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Some gastropods from the Upper Campanian of the Middle Vistula Valley, Central Poland

ABSTRACT: Fifty-three gastropod species are recognized in the Upper Campanian strata of the Middle Vistula Valley, Central Poland. The gastropod assemblage comprises 26 genera, belonging to 19 families. The mesogastropods are the major constituent of the assemblage, and are associated with the archaeogastropods, neogastropods, and opisthobranchs. The whole gastropod assemblage reflects influences of the North Temperate Realm. From ecological point of view, herbivores and predators are the most common trophic elements within this assemblage, together with a subordinate occurrence of deposit- and suspension-feeders. Of the taxonomic recognitions, notable is the first finding of the genus *Palaeocypraea* in the Upper Cretaceous deposits of Poland.

INTRODUCTION

The collection of the late Professor R. KONGIEL, which was completed in 1946—1953 from the Upper Cretaceous strata exposed along the Middle Vistula Valley in Central Poland, is housed in the Museum of the Earth in Warsaw. The most important components of this collection are the belemnites which were monographed by Professor R. KONGIEL himself (KONGIEL 1962), as well as gastropods, bivalves, some ammonites and echinoids, all of which still remained undescribed.

The scope of this paper is to describe the Upper Campanian gastropods contained in the KONGIEL's collection, and then compare them with those occurring in the Maastrichtian strata of the region and monographed by the present author formerly (ABDEL-GAWAD 1986).

The previous report on the Campanian gastropods from the Middle Vistula Valley are really very scarce. Since POŻARYSKI (1938) listed the faunal content of the whole Upper Cretaceous members of this section, nobody was paying special attention to their gastropod content.

The gastropods studied from the KONGIEL's collection are preserved only as casts and/or internal molds with well impressed sculpture. Their state of preservation is thus identical with those yielded by the Maastrichtian strata of the region (see ABDEL-GAWAD 1986).

All the studied specimens are kept in the Museum of the Earth in Warsaw. Few specimens used for comparative reasons, and collected by the present author, are housed in the Institute of Geology, University of Warsaw.

STRATIGRAPHY

The stratigraphic age of the chalky deposits (opokas) which yielded the studied gastropod assemblage is Upper Campanian, as it is apparently documented by biostratigraphic zonation based on ammonites (POŻARYSKI 1938, BŁASZKIEWICZ 1980), belemnites (KONGIEL 1962), and supplemented by investigation of nannoplankton (GAŹDZICKA 1978) and foraminifers (PERYT 1980).

The investigated gastropods come from local lithostratigraphic horizons, lettered *p* through *t*, as distinguished by POŻARYSKI (1938; see the map of the region in ABDEL-GAWAD 1986, Text-fig. 1). A correlation of particular biozonal subdivisions is presented in the former paper (ABDEL-GAWAD 1986, p. 80, Table 2), to which the readers are referenced. The gastropod-bearing part of the section corresponds to the horizons β — γ of KONGIEL (1962), or Kg_3 — Kg_4 of BŁASZKIEWICZ (1980) who attributed them to the *Didymoceras donezianum* and *Nostoceras pozaryskii* ammonite zones (see ABDEL-GAWAD 1986, p. 80, Table 2).

SYSTEMATIC ACCOUNT

The terminology of the gastropod morphology generally follows the glossary presented by COX (1960) in the *Treatise on Invertebrate Paleontology, Part I (Gastropoda)*, and by SOHL (1960, 1964a; see also ABDEL-GAWAD 1986). Of fifty-three gastropod species (listed in Table 1), 25 are discussed in this

Table 1

Systematic list of the studied gastropods and their stratigraphic range in the Upper Senonian of the Middle Vistula Valley

Camp. — Campanian; Maastr. — Maastrichtian (after ABDEL-GAWAD 1986)

Gastropod species	Camp.	Maastr.
Order Archaeogastropoda:		
<i>Margarites laevis</i> (PUSCH)	+	+
<i>M. radiatulus</i> (FORBES)	+	
<i>Calliomphalus</i> (<i>C.</i>) <i>boimstrofensis</i> (GRIEPENKERL)	+	+
<i>C.</i> (<i>C.</i>) <i>rimosus rimosus</i> (BINKHORST)	+	
<i>C.</i> (<i>C.</i>) <i>dichotomus</i> (ALTH)	+	+
<i>C.</i> (<i>C.</i>) <i>inaequocostatus</i> (KAUNHOWEN)	+	+
<i>C.</i> (<i>Planolateralus</i>) <i>fructi</i> (G. MÜLLER)	+	+
<i>C.</i> (<i>P.</i>), cf. <i>fructi</i> (G. MÜLLER)	+	
<i>C.</i> (<i>P.</i>) <i>lueneburgensis</i> (WOLLEMANN)	+	
<i>C.</i> (<i>P.</i>) <i>quadricinctus</i> (J. MÜLLER)	+	+
<i>Gibbula</i> (<i>Colliculus</i>) <i>echinulata</i> (ALTH)	+	

Gastropod species	Camp.	Maastr.
Camp. — Campanian; Maastr. — Maastrichtian (after ABDEL-GAWAD 1986)		
<i>G. (C.) minima</i> (FAVRE)	+	
<i>Guildfordia acantochila</i> WEINZETTL	+	
<i>Trochacanthus tricarinatus tricarinatus</i> (ROEMER)	+	+
<i>T. tricarinatus monilifer</i> (GOLDFUSS)	+	+
Order Mesogastropoda:		
<i>Architectonica (Solariaxis) granulatocostata</i> (ALTH)	+	+
<i>A. (S.) depressa</i> (ALTH)	+	
<i>Turritella (Turritella) lineolata</i> ROEMER	+	
<i>T. (T.) aff. carinatostrata</i> KAUNHOWEN	+	
<i>Confusiscala decorata</i> (ROEMER)	+	
<i>Cerithium binodosum</i> ROEMER	+	+
<i>C. alternatum</i> BINKHORST	+	+
<i>C. lorioli</i> FAVRE	+	
<i>C. nagorzanyense</i> FAVRE	+	
<i>C. subimbricatum</i> G. MÜLLER	+	
<i>Aporrhais granulosa</i> (J. MÜLLER)	+	
<i>A. kneri</i> (FAVRE)	+	+
<i>Drepanocheilus substenoptera</i> (G. MÜLLER)	+	
<i>D. cf. substenoptera</i> (G. MÜLLER)	+	+
<i>D. calcaratus</i> (SOWERBY)	+	
<i>Helicaulax buchi</i> (v. MÜNSTER)	+	
<i>Columbellaria tuberculosa</i> (BINKHORST)	+	
<i>C. laevicostata</i> ABDEL-GAWAD	+	+
<i>Natica? cretacea</i> GOLDFUSS	+	+
<i>Gyrodes hoernesii</i> (FAVRE)	+	+
<i>Palaeocypraea</i> sp.	+	+
<i>Charonia (Sassia) tuberculosa</i> (KAUNHOWEN)	+	
<i>C. multicostata</i> (FAVRE)	+	+
Order Neogastropoda:		
<i>Bellifusus septemcostatus</i> (FAVRE)	+	
<i>Graphidula inconsequens</i> (KNER)	+	+
<i>G. procera</i> (KNER)	+	
<i>G. galiciana</i> (ALTH)	+	+
<i>G. cf. pilicata</i> (ROEMER)	+	
<i>Tudicla (Tudicla) carinata</i> (v. MÜNSTER)	+	
<i>T. (T.) cf. quadricostata</i> (J. MÜLLER)	+	+
<i>Pyropsis cf. costatus</i> (ROEMER)	+	
<i>Volutilithes nagorzanyensis</i> (FAVRE)	+	
<i>Turricula</i> sp.	+	
<i>Cancellaria similis</i> KAUNHOWEN	+	
Order Cephalaspidea:		
<i>Acteonina lineolata</i> (REUSS)	+	
<i>Avellana inversetriata</i> KNER	+	
<i>Avellana cf. inversetriata</i> KNER	+	+
<i>Avellana</i> sp.	+	

paper. The rest, which have wider stratigraphic range up to the topmost Maastrichtian, were discussed by the present author formerly (ABDEL-GAWAD 1986).

Subclass **Prosobranchia** MILNE-EDWARDS, 1848

Order **Archaeogastropoda** THIELE, 1925

Suborder **Trochina** COX & KNIGHT, 1960

Superfamily **Trochacea** RAFINÉSQUE, 1815

Family **Trochidae** RAFINÉSQUE, 1815

Subfamily **Margaritinae** STOLICZKA, 1868

Genus *Margarites* GRAY, 1847

Type species: *Trochus helycinus* FABRICIUS, 1780

Margarites radiatulus (FORBES, 1846)

(Pl. 1, Figs 9a-9b)

1888. *Margarita radiatula* FORB. sp.; E. HOLZAPFEL, p. 171, Pl. 17, Figs 7—9 (cum syn.).

v. 1897. *Margarita radiatula* FORBES sp., F. KAUNHOWEN, p. 27, Pl. 2, Fig. 9; Pl. 5, Figs 4, 4a.

MATERIAL: 3 specimens from Piotrawin.

REMARKS: The studied specimens are incomplete; however, they agree with those figured by HOLZAPFEL (1888) and KAUNHOWEN (1897) from the Campanian Greensand of Aachen and Vaals, and the Upper Maastrichtian of Kunrade, respectively.

AGE and DISTRIBUTION: Campanian of England and West Germany; Upper Campanian of the Middle Vistula Valley; Upper Maastrichtian of Kunrade, Limburg.

Subfamily **Angariinae** THIELE, 1924

Genus *Calliomphalus* COSSMANN, 1888

Type species: *Turbo squamulosus* LAMARCK, 1804; OD

Calliomphalus (*Calliomphalus*) *rimosus rimosus* (BINKHORST, 1861)

(Pl. 1, Figs 1a-1b)

1861. *Turbo rimosus*, Nobis; J. T. BINKHORST, p. 47, Pl. Va, Fig. 5a, b.

v. 1897. *Turbo* (*Solariella*) *rimosus*, BINKHORST; F. KAUNHOWEN, p. 31.

MATERIAL: 1 specimen from Piotrawin

REMARKS: The studied specimen has well preserved sculpture. The subspecies *rimosus granulatus* (KAUNHOWEN) differs from the studied subspecies by its granular sculpture (see ABDEL-GAWAD 1986).

AGE and DISTRIBUTION: Campanian-Maastrichtian of Lvov; Upper Campanian of the Middle Vistula Valley; the Maastrichtian stratotype.

Subgenus *Planolateralus* SOHL, 1960

Type species: *Calliomphalus argenteus* WADE, 1926; OD

Calliomphalus (*Planolateralus*) *lueneburgensis* (WOLLEMAN, 1902)

(Pl. 1, Figs 2—3)

1902. *Turbo lueneburgensis*; WOLLEMAN, Pl. 17, Figs 10 a-c.

MATERIAL: 1 specimen from Ciszycia Kolonia, 3 from Ciszycia Górna, and 3 from Piotrawin.

REMARKS: The studied specimens are incomplete but they possess well preserved sculpture, and coincide with those figured by WOLLEMAN (1902). The species resembles *C.* (*Planolateralus*)

fructi (G. MÜLLER) in its general form (see Pl. 1, Figs 4—5), but it differs in having a prominent spiral cord along the periphery (see Pl. 1, Figs 2—3).

AGE and DISTRIBUTION: Senonian of West Germany and Campanian of the Middle Vistula Valley.

Subfamily **Gibbulinae** STOLICZKA, 1868

Genus *Gibbula* RISSO, 1826

Type species: *Trochus magus* LINNAEUS, 1758; *SD* HERRMANNSEN, 1847

Subgenus *Colliculus* MONTEROSATO, 1888

Type species: *Trochus adansoni* PAYRAUDEAU, 1827, *SD* BUCQUOY, DAUTZENBERG & DOLLFUS, 1898

Gibbula (Colliculus) echinulata (ALTH, 1850)

(Pl. 1, Figs 7—8)

1850. *Trochus echinulatus* m.; A. ALTH, p. 216, Pl. 11, Fig. 10.

1869. *Trochus echinulatus*, ALTH; E. FAVRE, p. 68.

MATERIAL: 4 specimens from Ciszycza Kolonia.

REMARKS: The studied species can be distinguished from *Gibbula (Colliculus) reticulata* (PUSCH) by the presence of two distinct spiral lirae (ABDEL-GAWAD 1986).

AGE and DISTRIBUTION: Campanian-Maastrichtian of the Lvov area and Campanian of the Middle Vistula Valley.

Gibbula (Colliculus) minima (FAVRE, 1869)

(Pl. 1, Figs 6a-6b)

1869. *Pleurotomaria minima*; E. FAVRE, p. 53, Pl. 8, Fig. 18.

1974. *Gibbula minima* (FAVRE); M. A. BLANK, p. 129, Pl. 44, Fig. 7.

MATERIAL: 4 specimens from Ciszycza Kolonia.

REMARKS: The studied specimens agree with those figured by FAVRE (1869) and BLANK (1974) from the Campanian of Lvov and Donbass basin (USSR), respectively. The species can be recognized by its small size and characteristic ornamentation.

AGE and DISTRIBUTION: Campanian of Lvov and the Middle Vistula Valley; Lower Maastrichtian of the Donbass basin.

Family **Turbinidae** RAFINÉSQUE, 1815

Subfamily **Astraeinae** DAVIES, 1933

Genus *Guildfordia* GRAY, 1850

Type species: *Astralium triumphalus* PHILIPPI, 1841; *SD* FISCHER, 1873

Guildfordia acantochila WEINZETTL, 1884

(Pl. 1, Figs 10—11)

1893. *Guildfordia acantochila* WEINZ.; A. FRIC, p. 84, Text-fig. 74.

1898. *Guildfordia acantochila* WEINZ.; G. MÜLLER, p. 91, Pl. 12, Figs 15—16.

MATERIAL: 3 specimens from Ciszycza Kolonia.

REMARKS: The studied specimens are incomplete and their diagnostic spines are broken, but the remains of their bases are preserved as nodules (see Pl. 1, Figs 10—11). However, the trochoid

form and the ornamentation of the studied specimens agree with those figured by G. MÜLLER (1898) from the Senonian of West Germany.

AGE and DISTRIBUTION: Senonian of West Germany and Campanian of the Middle Vistula Valley.

Suborder Uncertain

Superfamily **Amberleyacea** WENZ, 1938

Family **Nododelphinulidae** COX, 1960

Genus *Trochacanthus* DACQUÉ, 1936

Type species: *Trochacanthus tuberculatocinctus* GOLDFUSS, 1844; *SD* WENZ, 1938

Trochacanthus tricarinatus monilifer (GOLDFUSS, 1844)

(Pl. 2, Fig. 11)

1986. *Trochacanthus tricarinatus monilifer* (GOLDFUSS); G. I. ABDEL-GAWAD, p. 95, Pl. 7, Figs 1—2 (*cum syn.*).

MATERIAL: 2 specimens from Piotrawin, 1 from Ciszycza Górna.

REMARKS: The studied specimens coincide with those described (ABDEL-GAWAD 1986) from the Maastrichtian of the study area. Moreover, the studied specimens have better ornamentation.

AGE and DISTRIBUTION: Upper Senonian of West Germany and of the Middle Vistula; Lower Maastrichtian of the Donbass basin.

Order **Mesogastropoda** THIELE, 1925

Superfamily **Solariacea** CHENU, 1859

Family **Solariidae** CHENU, 1859

Genus *Architectonica* BOLTEN in RÖDING, 1798

Type species: *Trochus perspectiva* LINNAEUS, 1758

Subgenus *Solariaxis* DALL, 1892

Type species: *Solarium elaborata* CONRAD

Architectonica (Solariaxis) depressa (ALTH, 1850)

(Pl. 2, Figs 1—3)

1850. *Solarium depressum*; A. ALTH, p. 218, Pl. 11, Fig. 14.

1896. *Solarium depressum*, ALTH; E. FAVRE, p. 70.

1898. *Solarium depressum*, ALTH, G. MÜLLER, p. 94, Pl. 13, Fig. 18.

MATERIAL: 6 specimens from Ciszycza Kolonia, 1 from Ciszycza Górna, and 4 from Piotrawin.

REMARKS: The studied specimens agree with those described by ALTH (1850). The species is characterized by its depressed form and the presence of diagnostic ornamentation along the adapical suture.

AGE and DISTRIBUTION: Senonian of West Germany, Upper Senonian of the Lvov area and Campanian of the Middle Vistula Valley.

Superfamily **Turritellacea** CLARK, 1851

Family **Turritellidae** CLARK, 1851

Genus *Turritella* LAMARCK, 1799

Type species: *Turbo terebra* LINNAEUS, 1758

Subgenus *Turritella* LAMARCK, 1799

Turritella (Turritella) lineolata ROEMER, 1841
(Pl. 2, Figs 4—5)

1841. *Turritella lineolata*; F. A. ROEMER, p. 80, Pl. 11, Fig. 24.

(1850). *Turritella lineolata* RÖMER; H. B. GEINITZ, p. 124.

1891. *Turritella lineolata* A. F. RÖMER; J. BÖHM, p. 65, Pl. 2, Fig. 22.

MATERIAL: 3 specimens from Ciszycza Kolonia.

REMARKS: The species can be distinguished from *Turritella multilineata* (J. MÜLLER) by the outline of whorls and ornamentation. It is ornamented with fine and numerous spiral lines, and with one distinct spiral cord near the abapical suture.

AGE and DISTRIBUTION: Senonian of West Germany and Campanian of the Middle Vistula Valley.

Turritella (Turritella) aff. carinatostriata KAUNHOWEN, 1898

MATERIAL: One specimen from Piotrawin.

REMARKS: The studied specimen is an incomplete external mold; it shows a close similarity in ornamentation to that of *Turritella carinatostriata* KAUNHOWEN (1897, p. 46, Pl. 6, Fig. 1), which was described from the Maastrichtian stratotype.

Superfamily *Cerithiacea* FLEMING, 1828

Family *Cerithiidae* FLEMING, 1828

Subfamily *Cerithiinae* FLEMING, 1828

Genus *Cerithium* BRUGUIÈRE, 1789

Type species: *Cerithium adansoni* BRUGUIÈRE, 1789

Cerithium alternatum BINKHORST, 1861

(Pl. 2, Figs 8—9)

1861. *Cerithium alternatum*, Nobis; J. T. BINKHORST, p. 25, Pl. 1, Figs 4a, b.

MATERIAL: 8 specimens from Piotrawin.

REMARKS: The species can be differentiated from other Cretaceous cerithiids by its ornamentation, which is mainly alternation of coarse and finer spiral nodes along with spiral lines. The studied specimens are incomplete, but they have well preserved sculpture.

AGE and DISTRIBUTION: Campanian of Lvov and the Upper Campanian of the Middle Vistula Valley.

Cerithium lorioli FAVRE, 1869

1869. *Cerithium lorioli*; E. FAVRE, p. 36, Pl. 7, Fig. 10.

MATERIAL: One specimen from Ciszycza Górna.

REMARKS: The species can be differentiated from *Cerithium nagorzanyense* FAVRE by its ornamentation, which consists of numerous spiral cords crossed by axial lines. Fine nodes are developed at points of intersections of axial and spiral elements.

AGE and DISTRIBUTION: Campanian of Lvov and of the Middle Vistula Valley.

Cerithium nagorzanyense FAVRE, 1869
(Pl. 2, Fig. 10)

1869. *Cerithium nagorzanyense*; E. FAVRE, p. 37, Pl. 7, Fig. 11.

MATERIAL: 2 specimens from Pawlowice and 1 from Ciszycza Kolonia.

REMARKS: The shell is ornamented with six smooth spiral cords. The areas between these cords are crossed by axial lines. The basal part of whorls is smooth.

AGE and DISTRIBUTION: Campanian of Lvov and of the Middle Vistula Valley.

Cerithium subimbricatum G. MÜLLER, 1898
(Pl. 2, Figs 6—7)

1898. *Cerithium subimbricatum* n. sp.; G. MÜLLER, p. 107, Pl. 14, Fig. 9.

MATERIAL: 2 specimens from Piotrawin.

REMARKS: The studied specimens are incomplete and compressed. However, their ornamentation agrees with that of the specimen figured by G. MÜLLER (1898).

AGE and DISTRIBUTION: Lower Senonian of West Germany and the Upper Campanian of the Middle Vistula Valley.

Superfamily **Strombacea** SWAINSON, 1840
Family **Aporrhaidae** ADAMS, 1858
Genus *Aporrhais* da COSTA, 1778
Type species: *Strombus pespelecani* LINNAEUS, 1766

Aporrhais kneri (FAVRE, 1869)
(Pl. 3, Figs 5—7)

(1850). *Strombus bicarinatus*; H. B. GEINITZ, p. 136, Pl. 9, Fig. 4 (non *Pterocera bicarinata* DESH. 1842).

1852. *Strombus ovatus*? MÜNST.; R. KNER, p. 15, Pl. 16, Fig. 10.

1869. *Pterocera kneri*; E. FAVRE, p. 73, Pl. 9, Fig. 17.

1898. *Aporrhais ovata* MÜNST., sp.; G. MÜLLER, p. 116, Pl. 15, Figs 6—8.

1974. *Aporrhais bicarinatus* (GEINITZ); M. A. BLANK, p. 136, Pl. 46, Figs 4, 10.

REMARKS: The author agrees with FAVRE (1869) in considering the specimens described by GEINITZ (1850) as a synonymy of *Aporrhais kneri* (FAVRE). The studied specimens as well as those figured by GEINITZ (1850), FAVRE (1869), and BLANK (1974) are quite different from "*Pterocera*" *bicarinata* DESH. as figured by d'ORBIGNY (1842).

AGE and DISTRIBUTION: Lower Senonian of West Germany; Campanian of the Donbass basin, the Lvov area, and of the Middle Vistula Valley.

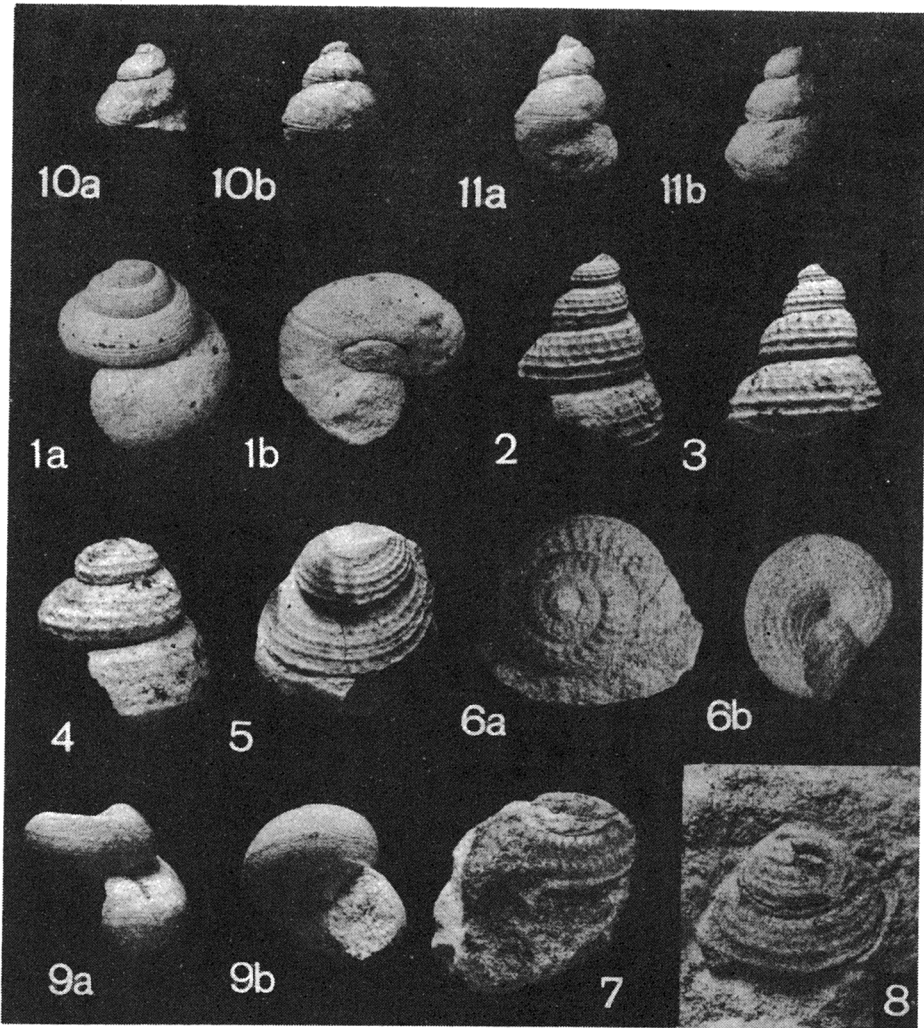
Genus *Drepanocheilus* MEEK, 1864
Type species: *Rostellaria americana* EVANS & SHUMARD, 1857; *OD* (= *D. evansi*
COSSMANN, 1904)

Drepanocheilus calcaratus (SOWERBY, 1822)
(Pl. 3, Figs 1—3)

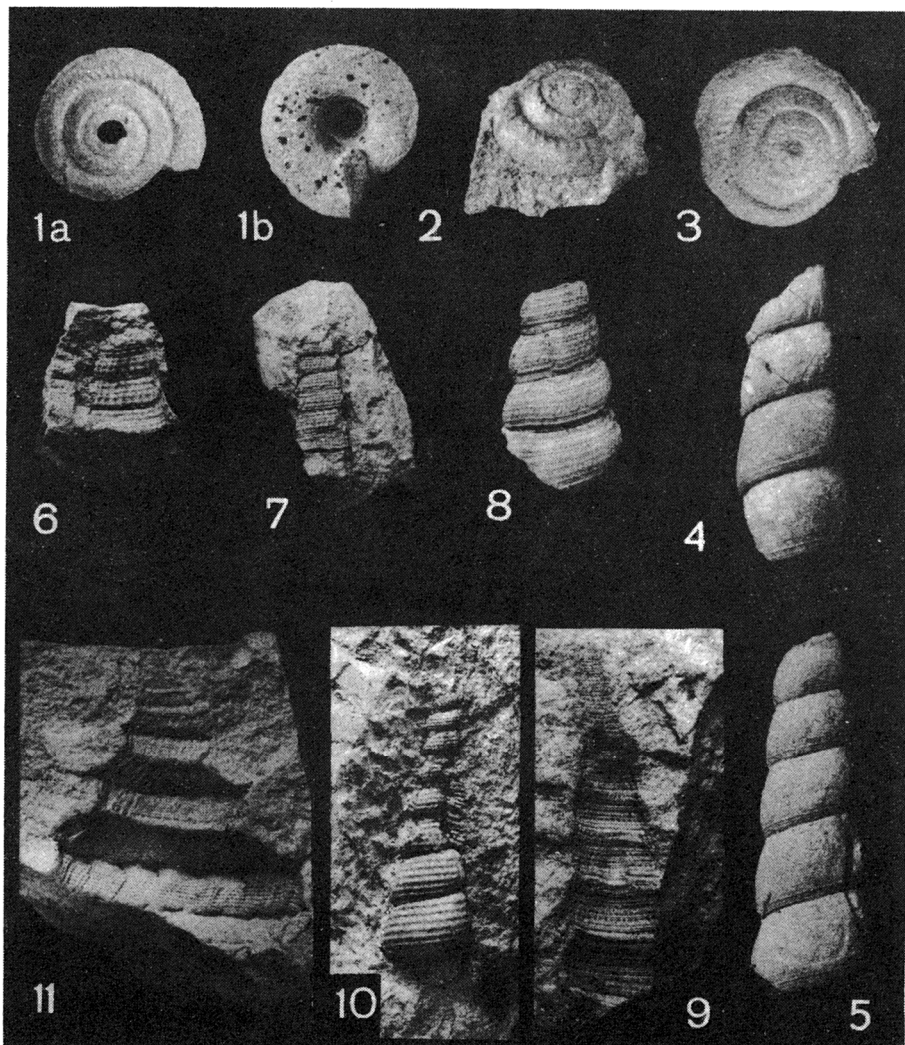
1842. *Rostellaria calcarata* SOWERBY; A. d'ORBIGNY, pp. 285—286, Pl. 207, Figs 3—4.

non 1874. *Rostellaria calcarata* SOW.; H. B. GEINITZ, p. 170, Pl. 30, Fig. 13.

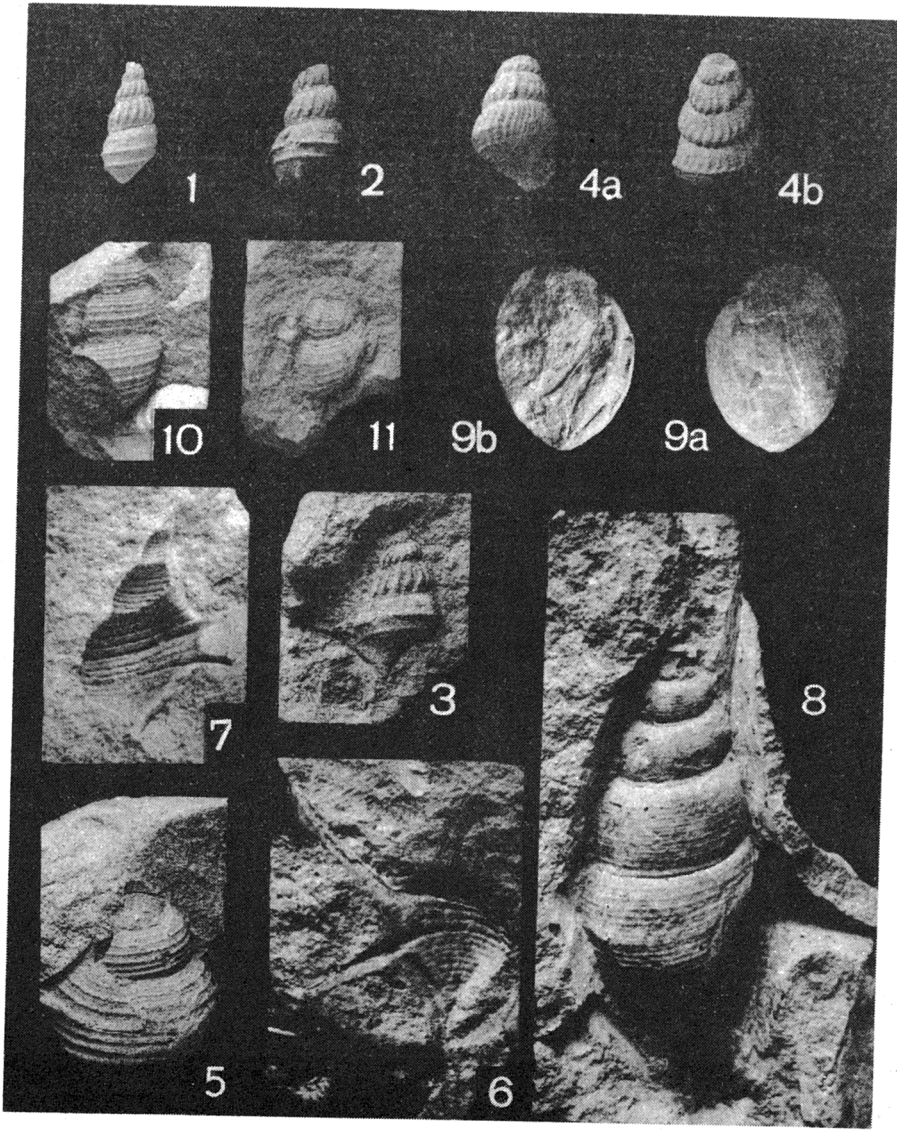
MATERIAL: 6 specimens from Ciszycza Kolonia.



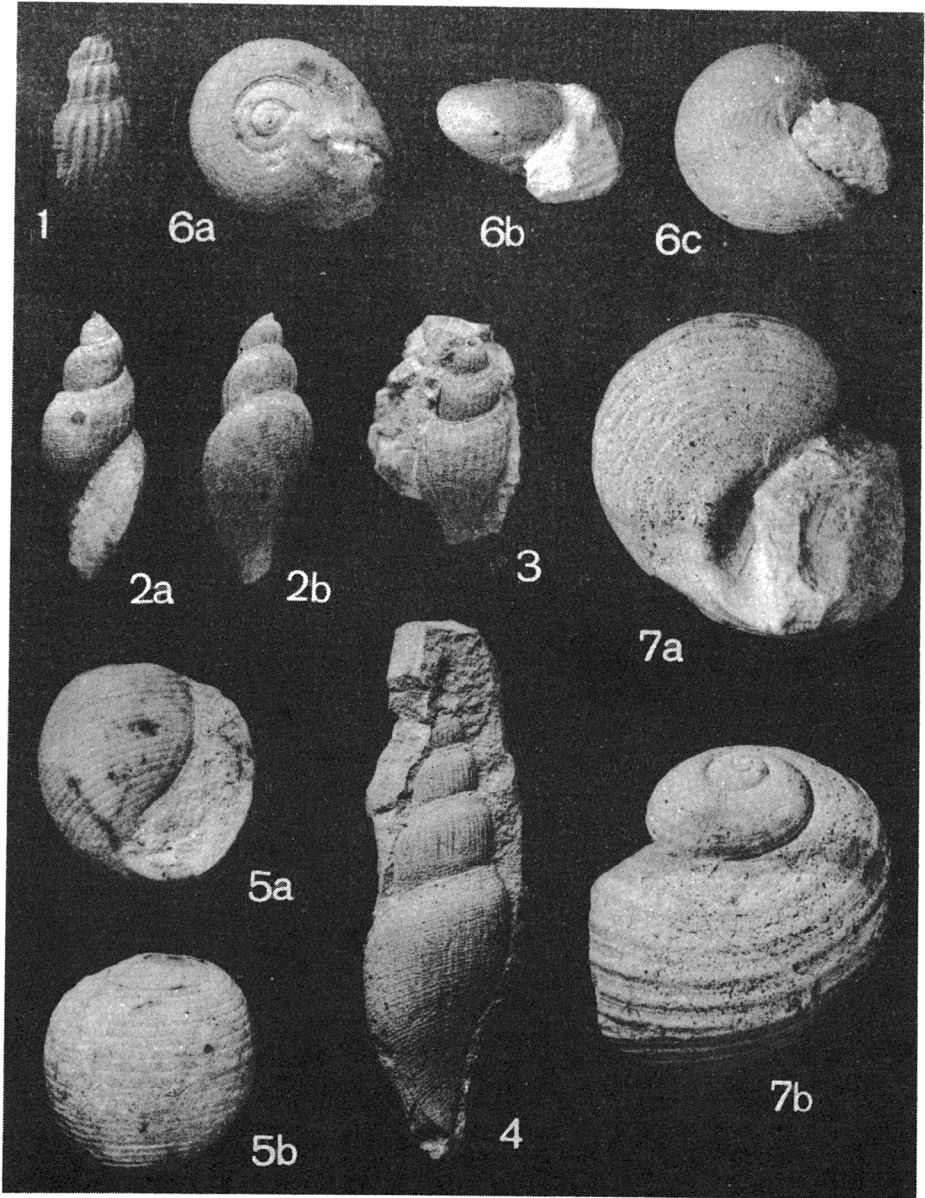
- 1 — *Calliomphalus (Calliomphalus) rimosus rimosus* (BINKHORST); Piotrawin; 1a oblique side view, 1b oblique basal view, $\times 2$
- 2-3 — *Calliomphalus (Planolateralus) lueneburgensis* (WOLLEMAN); Piotrawin; abapertural views, $\times 1$
- 4 — *Calliomphalus (Planolateralus) fructi* (G. MÜLLER); Piotrawin; incomplete abapertural view, $\times 2$
- 5 — *Calliomphalus (Planolateralus) cf. fructi* (G. MÜLLER); Piotrawin; incomplete side view, $\times 1$
- 6 — *Gibbula minima* (FAYRE); Ciszycza Kolonia; 6a apical view, 6b basal view, $\times 3$
- 7-8 — *Gibbula echinulata* (ALTH); Ciszycza Kolonia; incomplete side views, $\times 1.5$
- 9 — *Margarites radiatulus* (FORBES); Ciszycza Kolonia; 9a, 9b incomplete side and basal views, $\times 1$
- 10-11 — *Guildfordia acantochila* WEINZETTL; Ciszycza Kolonia; 10a, 11a apertural views, 10b, 11b abapertural views, $\times 1$



- 1-3 — *Architectonica (Solariaxis) depressa* (ALTH); Ciszycia Kolonia; 1a, 2, 3 apical views, 1b basal view, $\times 2$
- 4-5 — *Turritella (Turritella) lineolata* ROEMER; Ciszycia Kolonia; incomplete side views, $\times 1$
- 6-7 — *Cerithium subimbricatum* (G. MÜLLER); Piotrawin; incomplete side views, $\times 2$
- 8-9 — *Cerithium alternatum* BINKHORST; Piotrawin; 8 incomplete side view, 9 mold showing the sculpture, $\times 1$
- 10 — *Cerithium nagorzanyense* FAVRE; Ciszycia Kolonia; side view; $\times 1$
- 11 — *Trochacanthus tricarinatus monilifer* (GOLDFUSS); Piotrawin; mold showing the sculpture, $\times 1$



- 1-3 — *Drepanocheilus calcaratus* (SOWERBY); Ciszycia Kolonia; 1-3 incomplete abapertural views, $\times 1$
- 4 — *Drepanocheilus* cf. *substenoptera* (G. MÜLLER); Piotrawin, 4a, 4b incomplete apertural and abapertural views, $\times 1$
- 5-7 — *Aporrhais kneri* (FAVRE); Ciszycia Kolonia; 5 incomplete abapertural view, 6 mold showing the sculpture, 7 abapertural view showing the expanded canals, $\times 1$
- 8 — *Helicaulax buchi* (v. MÜNSTER); Ciszycia Kolonia; apertural view, $\times 1$
- 9 — *Palaeocypraea* sp.; Ciszycia Kolonia; 9a apertural view, 9b abapertural view, $\times 1$
- 10 — *Charonia multicostata* (FAVRE); Piotrawin; incomplete side view, $\times 1$
- 11 — *Charonia* (*Sassia*) *tuberculosa* (KAUNHOWEN); Piotrawin; abapertural view, $\times 1$



- 1 — *Volutilithes nagorzanyensis* (FAVRE); Ciszycza Kolonia; incomplete side view, $\times 1$
 2-3 — *Graphidula galiciana* (ALTH); Ciszycza Kolonia; 2a apertural view, 2b, 3 abapertural views, $\times 1$
 4 — *Graphidula procera* (KNER); Ciszycza Kolonia; abapertural view, $\times 1$
 5 — *Avellana* cf. *inversestriata* KNER; Piotrawin; 5a apertural view, 5b abapertural view, $\times 1$
 6 — *Avellana* sp.; Piotrawin; 6a apical view, 6b apertural view, 6c basal view, $\times 1$
 7 — *Pyropsis* cf. *costatus*; (ROEMER) Józefów; 7a oblique apertural view, 7b abapertural view, $\times 1$

REMARKS: The species differs from *Drepanocheilus substenoptera* (G. MÜLLER) by ornamentation of the last whorl where it has well developed two carinae. The axial elements are restricted to the spire and they do not extend to the last whorl.

AGE and DISTRIBUTION: Albion of England, Senonian of West Germany, and Upper Campanian of the Middle Vistula Valley.

Drepanocheilus cf. *substenoptera* (G. MÜLLER, 1898)
(Pl. 3, Fig. 4)

MATERIAL: One specimen from Piotrawin.

REMARKS: The specimen is similar in general form to the specimens of *Drepanocheilus substenoptera* (G. MÜLLER) from the Campanian—Maastrichtian of the study area (see ABDEL-GAWAD 1986), but it has numerous and closely spaced axial costae.

Genus *Helicaulax* GABB, 1868

Type species: *Rostellaria ornata* d'ORBIGNY, 1843; *SD* COSSMANN, 1904

Helicaulax buchi (v. MÜNSTER, 1841)
(Pl. 3, Fig. 8)

1841. *Chenopus Buchii* v. MÜNSTER; A. GOLDFUSS, p. 17, Pl. 170, Fig. 4.
non 1869. *Aporrhais Buchi*, MÜNSTER sp.; E. FAVRE, p. 74, Pl. 9, Figs 18—19.
1874. *Rostellaria Buchi* MÜN. sp.; H. B. GEINITZ, p. 171, Pl. 30, Fig. 14.
1898. *Aporrhais Buchii* MÜNST. sp.; G. MÜLLER, p. 111, Pl. 15, Figs 6—8.
(1938). *Aporrhais Buchii* MÜNST. sp.; W. POZARYSKI, p. 24.
1974. *Aporrhais buchi* (MÜNSTER); M. A. BLANK, p. 138, Pl. 46, Figs 1—2.

MATERIAL: 3 specimens from Ciszycia Kolonia, 1 from Pawłowska Wola, and 1 from Piotrawin.

REMARKS: The shell of the studied species carries the main diagnostic features of the genus *Helicaulax* GABB; particularly the aperture, its anterior and posterior canals, and its outer lip expanded spire-like.

The species can be distinguished from other Cretaceous ones, such as *H. granulata* (SOWERBY) and *H. pozaryskii* ABDEL-GAWAD, by shell ornamentation. The shell is ornamented with spiral lines alternated with spiral threads and the last whorl has a prominent carina.

AGE and DISTRIBUTION: Senonian of West Germany; Campanian of the Donbass basin and of the Middle Vistula Valley.

Superfamily Cypraeacea
Family Cypraeidae
Subfamily Cypraeinae

Genus *Palaeocypraea* SCHILDER, 1928

Type species: *Cypraeacites spiratus* SCHLOTHEIM, 1820

Palaeocypraea sp.
(Pl. 3, Figs 9a-9b)

MATERIAL: One specimen from Ciszycia Kolonia.

MEASUREMENTS: Height 2.38 cm, width 1.75 cm.

DESCRIPTION: Shell is ovate and involute. The spire is compressed and protrudes a little; the body whorl almost completely enfolds the preceding ones. Aperture is narrow. Shell smooth with growth lines.

REMARKS: The specimen is preserved as a cast, with badly preserved aperture. However, it carries the diagnostic features of the genus *Palaeocypraea* SCHILDER, particularly in the involute form. The studied specimen resembles in general form that of *Palaeocypraea limburgensis* KAUNHOWEN as described by KAUNHOWEN (1897, specially Fig. 1). The genus *Palaeocypraea* is first recorded in the Cretaceous of Poland.

Order **Neogastropoda** WENZ, 1938

Superfamily **Buccinacea**

Family **Vasidae**

Genus *Tudicla* BOLTEN in RÖDING, 1798

Type species: *Murex spirillus* LINNAEUS, 1758

Subgenus *Tudicla* BOLTEN in RÖDING, 1798

Tudicla cf. *quadricostata* (J. MÜLLER, 1859)

MATERIAL: One specimen from Ciszycza Górna.

REMARKS: The specimen is preserved as an external mold, and it is characterized by the presence of four carinae, three of which are more distinct. The general form of the studied specimen resembles that of *Tudicla quadricarinata* (J. MÜLLER) as figured by HOLZAPFEL (1888, p. 108, Pl. 11, Figs 14—15), but it differs in the number of carinae.

Genus *Pyropsis* CONRAD, 1860

Type species: *Tudicla (Pyropsis) perlata* CONRAD, 1860; *M*

Pyropsis cf. *costatus* (ROEMER, 1841)

(Pl. 4, Figs 7a-7b)

MATERIAL: One specimen from Józefów.

REMARKS: The studied specimen resembles in outline that of "*Rapa*" *costata* ROEMER as figured by GEINITZ (1874, p. 173, Pl. 30, Figs 19—21), but it differs in having smooth spiral cords and by the absence of axial elements.

Family **Fasciolaridae**

Subfamily **Fasciolarinae**

Genus *Graphidula* STEPHENSON, 1941

Type species: *Graphidula terebiformis* STEPHENSON, 1941; *OD*

Graphidula galiciana (ALTH, 1850)

(Pl. 4, Figs 2—3)

1850. *Fusus galicianus* m; A. ALTH, p. 223, Pl. 11, Fig. 23.

1869. *Fusus Galicianus*, ALTH; E. FAVRE, p. 84, Pl. 10, Fig. 8.

MATERIAL: 3 specimens from Ciszycza Kolonia.

REMARKS: The species is closely similar to *Graphidula procera* (KNER), but it differs in having more developed axial cords.

AGE and DISTRIBUTION: Campanian of the Lvov area and of the Middle Vistula Valley.

Family **Volutidae**

Subfamily **Volutinae**

Genus *Volutilithes* SWAINSON, 1829

Type species: *Voluta muricinus* LAMARCK, 1802

Volutilithes nagorzanyensis (FAVRE, 1869)

(Pl. 4, Fig. 1)

1869. *Voluta nagorzanyensis*; E. FAVRE, p. 93, Pl. 10, Fig. 20.

MATERIAL: One specimen from Ciszycia Kolonia.

REMARKS: The species can be differentiated from *Volutilithes kneri* (FAVRE) by ornamentation. The shell is ornamented with axial costae which are crossed by spiral elements, more developed on the adapical part of the whorls.

AGE and DISTRIBUTION: Campanian of the Lvov area of the Middle Vistula Valley.

Subclass **Opisthobranchia** MILNE-EDWARDS, 1848

Order **Cephalaspidea** FISCHER, 1883

Superfamily **Acteoninacea**

Family **Ringiculidae**

Genus *Avellana* d'ORBIGNY, 1842

Type species: *Auricula incrassata* SOWERBY, 1817

Avellana cf. *inversestriata* KNER, 1852

(Pl. 4, Figs 5a-5b)

MATERIAL: One specimen from Piotrawin.

REMARKS: The studied specimen shows a similarity in general form with that of *Avellana inversestriata* KNER (see ABDEL-GAWAD 1986, p. 126, Pl. 24, Fig. 9) but it differs in ornamentation of the body whorl.

Avellana sp.

(Pl. 4, Figs 6a-6b)

MATERIAL: One specimen from Piotrawin.

REMARKS: The studied specimen is a compressed cast, but still in a good state of preservation. Aperture outer lip is thick, with a collar, and aperture inner lip is callused. Other apertural features are blurred by rock matrix.

DISCUSSION

The Campanian opokas and marls of the Middle Vistula Valley yield 53 gastropod species, belonging to 26 genera of 19 families. The gastropod assemblage is dominated by the Mesogastropoda (12 genera), together with the Neogastropoda (7 genera) and the Archaeogastropoda (5 genera). The Opisthobranchia are represented here in a minor quantity (2 genera).

Generally, the above characters of the collected gastropods are similar to those of Maastrichtian age of the study area (ABDEL-GAWAD 1986). Moreover, 23 species of these Campanian gastropods survived to the end of the Maastrichtian (see Table 1).

The studied gastropods belong to the North European Province. Such genera as *Trochacanthus*, *Columbellaria*, *Confusiscala* and others (ABDEL-GAWAD

1986) are endemic to the North European Province, while *Calliomphalus*, *Bellifusus*, *Euthriofusus*, *Graphidula* and *Cancellaria* are the Euramerican genera. The rest of the studied genera are world-wide, as exemplified by *Architectonica*, *Turritella*, *Cerithium*, *Aporrhais*, *Drepanocheilus*, and *Helicaulax*.

The North European Province includes the Russian Platform (Lvov, Donbass and peri-Caspian basins), Central Poland and NW Europe (KAUFFMAN 1973). The Upper Senonian gastropods of the Russian Platform were monographed by KNER (1850, 1852), ALTH (1850), PLACHETKO (1863), FAVRE (1869), ROGALA (1911), BLANK (1974), and PLAMADIALA (1982). Both the Middle Vistula Valley and the Russian areas are sharing in 24 Campanian gastropod species. Moreover, the studied gastropods and those from the Campanian of Germany and Limburg (see GOLDFUSS 1833-1844, J. MÜLLER 1847-1851, HOLZAPFEL 1888, G. MÜLLER 1898) are sharing in 29 species. The recent data on the gastropods reported from the Lower Maastrichtian Chalk of the Isle of Rügen (KUTSCHER 1984) show a great similarity with those described from the Campanian-Maastrichtian of the study area. All the species figured by KUTSCHER (1984) are recorded in the studied assemblage.

The Campanian gastropods of the North American Province (Coffee Sand of Mississippi; see SOHL 1964b) as well as those of the Senonian of the Pacific Province (POPENOE 1983; POPENOE & SAUL 1987; POPENOE & al. 1987; SAUL 1983, 1988a, b, 1989) are sharing with those from the Middle Vistula Valley in world-wide and Euramerican genera (ABDEL-GAWAD 1986; SOHL 1964a, 1971).

The Campanian gastropods of the study area in the Middle Vistula Valley are dominated by the herbivorous trochids and cerithiids along with such predators as naticids, volutids, vasids and fasciolariiids. Other trophic groups, represented by deposit-feeding aporrhais and suspension-feeding turritellids, are of subordinate occurrence.

The community rich with these gastropods together with the associated bivalves, cephalopods and echinoids may reflect a shallow shelf environment prevailed during Late Campanian to Late Maastrichtian times over the area of the present-day Middle Vistula Valley. Such marine environment was of normal salinity, with light enough to grow seagrasses and algae, and also with a firm substrate.

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