BARBARA STUDENCKA

BIVALVES FROM THE BADENIAN (MIDDLE MIOCENE) MARINE SANDY FACIES OF SOUTHERN POLAND

(Plates 1—18)

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Taxonomic studies of Bivalvia from the sandy facies of the Klimontów area (Holy Cross Mts.) of southern Poland indicate 99 species, 19 of which have previously not been reported from the Polish Miocene. Following species have previously not been known from the Miocen: *Barbatia* (*Calloarca*) *modioliformis* and *Montilora* (*M.*) *elegans* (both Eocene), *Callista* (*C.*) *sobrina* (Oligocene), and *Cerullia ovoides* (Pliocene). *Pododesmus* (*Monia*) *squamus* and *Gregariella coralliophaga* are noticed for the first time in the fossil state. Twenty two species are revised and their taxonomic position are shifted. Two species: *Chlamys* (*Flexopecten*) *rybnicensis* and *Cardium* (*Trachycardium*) *rybnicensis* previously considered as endemic are here claimed to represent ontogenic stages of *Chlamys* (*Flexopecten*) *scissus* and *Laevicardium* (*L.*) *dingdense* respectively.

Key words: Bivalvia, taxonomy, Badenian, Poland.

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MAŁŻE FACJI PIASZCZYSTEJ BADENU POŁUDNIOWEJ POLSKI

Streszczenie. — Praca zawiera rezultaty badań nad środkowomioceńskimi (badeńskimi) małżami z zapadliska przedkarpackiego. Materiał pochodzi z czterech odsłonięć facji piaszczystej badenu położonych w obrębie południowego obrzeżenia Gór Świętokrzyskich: Nawodzic, Rybnicy (2 odsłonięcia) i Świniar. Wśród 99 opisanych gatunków małżów występowanie 19 gatunków stwierdzono po raz pierwszy w osadach miocenu Polski, zaś 6 gatunków nie było dotychczas znanych z osadów miocenu. Szczegółowo przedyskutowano pozycję taksonomiczną opisanych gatunków i podano ich zasięgi stratygraficzne.

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INTRODUCTION

This paper presents the results of taxonomic studies of Badenian (Middle Miocene) bivalves from the sandy deposits of the Carpathian Foredeep. The material was collected from four outcrops along the southern slopes of the Holy Cross Mts: Nawodzice, Rybnica (2 outcrops) and Świniary.

This paper is the first monograph of the molluscs from Rybnica and Nawodzice, although an abundant fossil fauna was known to occur in this area (SAMSONOWICZ 1917). However, subsequent authors have discussed mainly the geological age of the sediments of these localities (SAMSONOWICZ 1930, 1933; KOWALEWSKI 1918, 1930, 1950, 1958; ŁUCZKOWSKA 1961; BAŁUK and RADWAŃSKI 1968; HOFFMANN 1970; STUDENCKI 1973; SZUBZDA 1973). But bryozoans were described by MALECKI (1962) and decapod crustaceans by FÖRSTER (1979) from Nawodzice, and a few bivalve and gastropod species from Rybnica were included by FRIEDBERG (1911—1928; 1934—1936) in his monograph on Polish Miocene bivalves.

The sand-pit in Świniary has drawn the attention of many geologists (RADWAŃSKI 1973, with references) though the only paleontological paper concerns the pectinids (KRACH 1967).

This work, which forms part of a Ph. D. thesis (STUDENCKA 1981) was started in 1973 at the Institute of Geology, Warsaw University and continued at the Museum of the Earth, Polish Academy of Sciences, Warsaw.

The collection of bivalves from Rybnica and Nawodzice is housed in the Museum of the Earth (abbr. MZ), Warsaw, under the numbers MZ VIII Mł — 1584 to 1864.

The work was carried out under the supervision of Professor ANDRZEJ RADWAŃSKI (Institute of Geology, Warsaw University) who suggested the research topic. The author is grateful to the late Professor WILHELM KRACH (Institute of Geological Sciences, Polish Academy of Sciences, Cracow) for advice and suggestions and for making available W. FRIEDBERG's collection of molluscs. Sincere thanks are due to Dr. WACŁAW BALUK (Institute of Geology, Warsaw University), Dr. GWIDON JAKUBOWSKI (Museum of the Earth, Warsaw), Dr. KLARA G. BAGDASARJAN (Georgian Academy of Sciences, Tbilisi) and Dr. SERGEY W. POPOV (Soviet Academy of Sciences, Moscow) for helpful discussion on Miocene stratigraphy, and to Dr. ANTONI HOFFMAN (Columbia University), Dr. MAREK NARKIEWICZ (Geological Institute, Warsaw) and WIESŁAW STUDENCKI M. Sc. (Museum of the Earth, Warsaw) for reviewing and improving both the Polish and English versions of the manuscript. The text was translated into English and typed by WIESŁAW STUDENCKI, Dr. ROLAND GOLDRING (Department of Geology, University of Reading) kindly improved the English of the general part. The author is also indebted to Dr. GWIDON JAKUBOWSKI and JADWIGA ZWIERZ M. Sc. (Geological Institute, Warsaw) for making available collections of Tertiary molluscs as well as to WOJCIECH PRZYBYSZEWSKI M. Sc. for donating his collection of bivalves from Świniary. The Directory of the Museum of the Earth is kindly acknowledged for providing research facilities. The photographs were taken by Mrs KRYSTYNA BORUTA, BARBARA DROZD M. Sc., Mrs KRYSTYNA ZIELIŃSKA (all from Institute of Geology, Warsaw University) and Mr LESZEK DWORNIK (Museum of the Earth, Warsaw).

MATERIAL

The bivalves described in this paper were collected at three outcrops of the Badenian sands: Nawodzice, Rybnica 1 and Rybnica 2 by the author between 1970 and 1975 and by W. STUDENCKI between 1970 and 1972. The material collected includes in addition: foraminifers, polychaetes, bryozoans, ostracodes, cirripedes, crabs, lobsters, chitons, gastropods, echinoids, starfishes and fish (teeth, otoliths and bones). Bivalves and gastropods are the most common groups. The bivalve material comprises about 600 complete shells and some 13,000 separated valves which were assigned to 101 species belonging to 78 genera and 42 families.

The preservation state is very good. The shells are mostly disarticulated but fragmented valves are scarce except for those crushed by compaction. The sculpture is generally well preserved although traces of mechanical abrasion are frequent.

Two layers in Nawodzice and Rybnica 2 contain assemblages preserved in life position: layer 1 in Rybnica 2 with numerous *Lucinoma borealis* and layer 1 in Nawodzice with *Circomphalus orientalis* and *Panopea menardi*. In both the shells are extremely well preserved, even with fossilized ligament and traces of original pigmentation.

The species, and their stratigraphic ranges, from Nawodzice and Rybnica are listed in Table 1 which includes species found by earlier authors but not during the present investigations.

Table 1

Compiled list of bivalve species from the Badenian sandy deposits in Rybnica and Nawodzice, based on papers of Friedberg (1934-36, 1938), Kowalewski (1950), Bałuk and Radwański (1968), collections of Samsonowicz (1929) and Kowalewski (1931), and the present author's collections *

	Species	Present author's 1970–1975			Friedberg 1934-36 Rybnica 2	Friedberg 1938 Rybnica 2	Samsonowicz 1929 Rybnica**	Kowalewski 1931 Rybnica**	Kowalewski 1950 Rybnica**	Bałuk and Radwański 1968 Nawodzice	Stratigraphic range								
											Eocene	Oligocene		Miocene			Pliocene		Recent
		Nawodzice	Rybnica 1	Rybnica 2								Early	Late	Early	Middle	Late	Early	Late	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	*Nucula (Nucula) nucleus* (Linné)	+	+	+	+	+	+	+	+	+									
2	*Nucula (Nucula) nitidosa* Winckworth	+	+	+															
3	*Nuculana (Saccella) fragilis* (Chemnitz)	+	+	+	+	+	+		+										
4	*Barbatia (Barbatia) barbata* (Linné)		+	+			+		+										
5	*Barbatia (Barbatia) polymorpha* (Mayer)		+						+										
6	*Barbatia (Acar) clathrata* (Defrance)		+						+										
7	*Barbatia (Acar) bohemica* (Reuss)			+															
8	*Barbatia (Calloarca) modioliformis* (Deshayes)			+															
9	*Anadara (Anadara) diluvii* (Lamarck)	+		+					+										
10	*Striarca lactea* (Linné)		+	+					+										
11	*Glycymeris (Glycymeris) deshayesi* (Mayer)	+	+	+			+	+	+	+									
12	*Septifer (Septifer) oblitus* (Michelotti)		+																
13	*Musculus (Musculus) biformis* (Reuss)	+		+															
14	*Musculus (Musculus) conditus* (Mayer)		+	+					+										
15	*Gregariella coralliophaga* (Chemnitz)			+															
16	*Modiolaria hoernesi* Reuss								+										
17	*Modiolula phaseolina* (Philippi)	+	+	+															
18	*Modiolula volhynica* (Eichwald)	+	+	+															
19	*Pinna* cf. *brocchi* d'Orbigny							+											
20	*Isognomon (Isognomon) ciscaucasicus* Davidaschvili		+																
21	*Palliolum (Delectopecten) vitreum* (Gmelin)		+																
22	*Chlamys (Aequipecten) malvinae* (du Bois)		+	+															
23	*Chlamys (Aequipecten) scabrella* (Lamarck)		+	+	+	+	+	+	+										
24	*Chlamys (Aequipecten)* aff. *zenonis* Cowper-Reed		+	+															
25	*Chlamys (Flexopecten) scissus* (Favre)		+	+	+	+	+	+	+										
26	*Pecten (Flabelipecten)* cf. *besseri* Andrzejowski		+																
27	*Pecten (Flabellipecten) subarcuatus* Tournouër		+																
28	*Plicatula (Plicatula) striata* Defrance		+	+															
29	*Plicatula mytilina* Philippi								+										
30	*Pododesmus (Heteranomia) squamulus* (Linné)		+	+															
31	*Pododesmus (Monia) squamus* (Gmelin)			+															
32	*Neopycnodonte navicularis* (Brocchi)		+	+	+	+	+	+											
33	*Cubitostrea digitalina* (Eichwald em. du Bois)	+	+	+			+	+	+	+									
34	*Ostrea (Crassostrea) gryphoides* Schlotheim				+														
35	*Ctena (Ctena) decussata* (da Costa)	+	+	+			+	+	+	+									
36	*Loripes dujardini* Deshayes								+										
37	*Parvilucina (Microloripes) dentata* (Defrance)	+	+	+		+	+	+	+	+									
38	*Myrtea (Myrtea) spinifera* (Montagu)			+															
39	*Lucinoma borealis* (Linné)	+	+	+	+	+	+	+	+	+									
40	*Montilora (Montilora) elegans* (Defrance)			+															
41	*Miltha incrassata* Dubois							+											
42	*Anodontia (Loripinus) fragilis* (Philippi)	+																	
43	*Thyasira (Thyasira) flexuosa* (Montagu)	+	+	+															
44	*Chama (Psilopus) gryphoides* (Linne)	+	+	+			+		+	+									
45	*Scacchia (Scacchia) degrangei* (Cossmann and Peyrot)	+																	
46	*Bornia (Bornia) deltoidea* Wood	+	+				+	+											
47	*Kellya sebetia* da Costa								+	+									
48	*Lasaeokellya cestasensis* (Cossmann and Peyrot)	+	+																
49	*Montacuta substriata* (Montagu)			+															
50	*Cerullia ovoides* (Cerulli-Irelli)	+																	
51	*Cyclocardia (Scalaricardita) scalaris* (Sowerby)	+	+	+	+	+			+										
52	*Astarte (Astarte) radiata* Nyst and Westendorp		+	+															
53	*Tridonta (Nicania) waeli* (Glibert)		+	+	+	+													

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
54	*Crassatella concentrica* Dujardin								+										
55	*Crassatella* sp.			+															
56	*Acanthocardia (Acanthocardia) paucicostata* (Sowerby)	+	+	+		+	+		+										
57	*Acanthocardia (Acanthocardia) turonica* (Hörnes)	+	+	+	+	+	+	+	+	+									
58	*Parvicardium minimum* (Philippi)		+	+															
59	*Plagiocardium (Papillicardium) sonense* (Cossmann)	+	+	+															
60	*Laevicardium (Laevicardium) dingdense* (Lehmann)	+	+	+	+	+	+	+	+	+									
61	*Cerastoderma obsoleta* (Eichwald)	+	+	+															
62	*Cerastoderma praeplicata* (Hilber)	+	+	+				+	+	+									
63	*Cerastoderma plicata* (Eichwald)	+							+										
64	*Limnocardium holubicense* Hilber								+	+									
65	*Mactra (Sarmatimactra) eichwaldi* Laskarew			+															
66	*Lutraria (Lutraria) lutraria* Linné	+	+					+											
67	*Eastonia rugosa* Helbling		+	+															
68	*Ervilia podolica* (Eichwald)		+	+															
69	*Ervilia pusilla* (Philippi)	+	+	+	+	+	+	+	+	+									
70	*Cultellus (Cultellus) tenuis* (Philippi)			+															
71	*Ensis ensis* (Linné)		+	+			+	+											
72	*Ensis rollei* Hörnes	+		+	+	+			+	+									
73	*Tellina (Moerella) donacina* Linné	+		+															
74	*Tellina (Oudardia) compressa* Brocchi	+		+															
75	*Tellina (Peronaea)* cf. *planata* Lamarck			+															
76	*Gastrana fragilis* (Linné)	+	+	+	+			+	+	+									
77	*Donax (Paradonax) transversa* Deshayes			+	+		+	+											
78	*Donax (Paradonax) intermedia* Hörnes			+															
79	*Donax sallomacensis* Cossmann and Peyrot								+										
80	*Abra (Syndosmya) alba* (Wood)			+															
81	*Solecurtus* sp.	+																	
82	*Congeria sandbergeri* Andrussov	+																	
83	*Alveinus nitidus* (Reuss)	+	+	+															
84	*Coralliophaga (Coralliophaga) litophagella* (Lamarck)			+	+														
85	*Coralliophaga (Coralliophaga) transilvanica* Hörnes		+																
86	*Glossus (Glossus) humanus* (Linné)	+	+	+	+	+	+	+	+										
87	*Venus (Ventricoloidea) multilamella* Lamarck		+	+	+	+	+		+										
88	*Venus (Ventricoloidea) libella* de Rayneval, Van den Hecke and Ponzi	+	+	+															
89	*Circomphalus subplicatus* (d'Orbigny)	+	+	+	+	+	+	+	+	+									
90	*Gouldia (Gouldia) minima* (Montagu)		+	+					+										
91	*Pitar (Pitar) rudis* Poli			+															
92	*Callista (Callista) italica* (Defrance)	+	+	+	+	+	+	+	+	+									
93	*Callista (Callista) sobrina* (Conrad)			+				+											
94	*Pelecyora (Cordiopsis) islandicoides* (Lamarck)	+	+		+	+													
95	*Tapes (Tapes) vitalianus* (d'Orbigny)	+																	
96	*Irus (Irus) irus* (Linné)	+	+	+						+									
97	*Timoclea (Timoclea) sobieskii* (Hilber)	+	+	+															
98	*Petricola (Rupellaria) lithophaga* Retzius		+																
99	*Corbula (Varicorbula) gibba* (Olivi)	+	+	+	+		+	+	+	+									
100	*Gastrochaena (Gastrochaena) lata* (Dollfus and Dautzenberg)			+															
101	*Hiatella (Hiatella) arctica* (Linné)	+	+	+				+											
102	*Panopea (Panopea) menardi* (Deshayes)	+	+					+	+	+									
103	*Pholas* sp.	+	+																
104	*Zirfaea* sp.		+																
105	*?Zirlona* sp.			+															
106	*Martesia* sp.	+		+															
107	*Penitella* sp.		+																
108	*Jouannetia (Jouannetia) semicaudata* des Moulins	+	+	+															
109	*Thracia (Thracia) ventricosa* Philippi			+															
110	*Asthenothaerus desmoulinsi* (Cossmann and Peyrot)	+																	
111	*Clavagella* sp.	+		+						+									

* The species not found by the present author are listed with their original names; their stratigraphic ranges are ommitted.

** Both the collections are housed in the Museum of the Geological Institute, Warsaw. Preservation of fossils and remarks made by collectors on labels suggest that the specimens were gathered from two outcrops, i.e. Rybnica 1 and Rybnica 2.

*** The location of the outcrop with fossils remains unknown due to inaccurate data given by Kowalewski (1950). His collection has been lost during the time.

Some additional material from Świniary included here was collected between 1970 and 1975 by W. Przybyszewski. There, only calcitic shells of *Neopycnodonte navicularis*, *Podesmus* (*H.*) *squamulus* and *Chlamys* (*F.*) *scissa* are preserved; all aragonitic shells having been diagenetically leached. The oysters and scallops are extremely well preserved, frequently with valves joined.

GEOLOGICAL SETTING

The outcrops which yield the abundant bivalve material are situated in the eastern part of the so-called Raków—Klimontów Shore (fig. 1), south of Klimontów. The Badenian stage is represented in this area by sandy to gravelly sediments laid down under littoral to shallow neritic conditions (RADWAŃSKI 1973). The sediments now occur as isolated patches (fig. 2) due to post-Miocene erosion and outcrops represent only portion of the whole Badenian sequence. The succession at Nawodzice and Rybnica is shown in fig. 3:

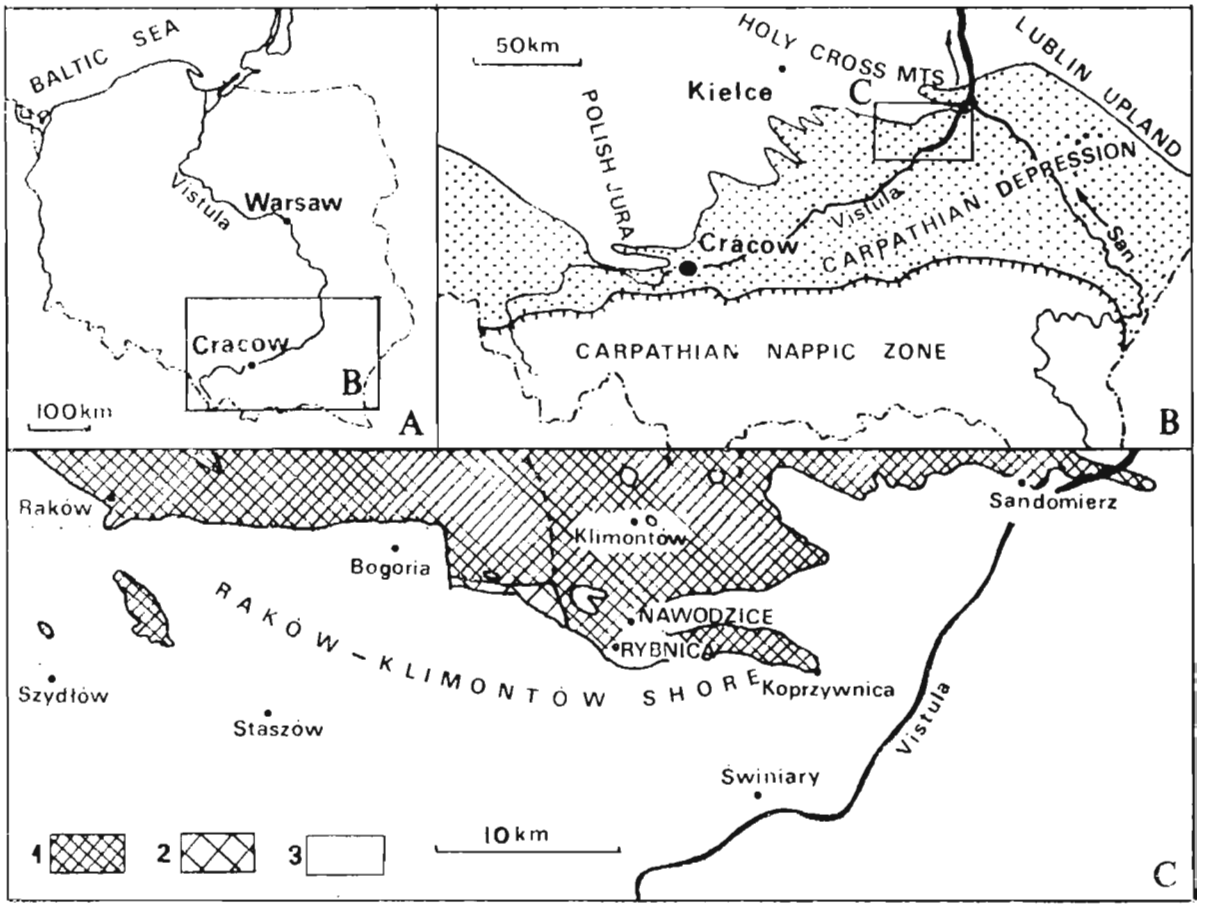

Fig. 1

A — General map of Poland (rectangled is the area presented in B). B — Extent of the Miocene deposits in southern Poland (rectangled is the area presented in C). C — Geological sketch-map depicting the occurrence of the Miocene deposits on the southern slopes of the Holy Cross Mts along the Raków—Klimontów paleoshore (after Radwański 1973): 1 — Cambrian, 2 — Devonian, 3 — Miocene.

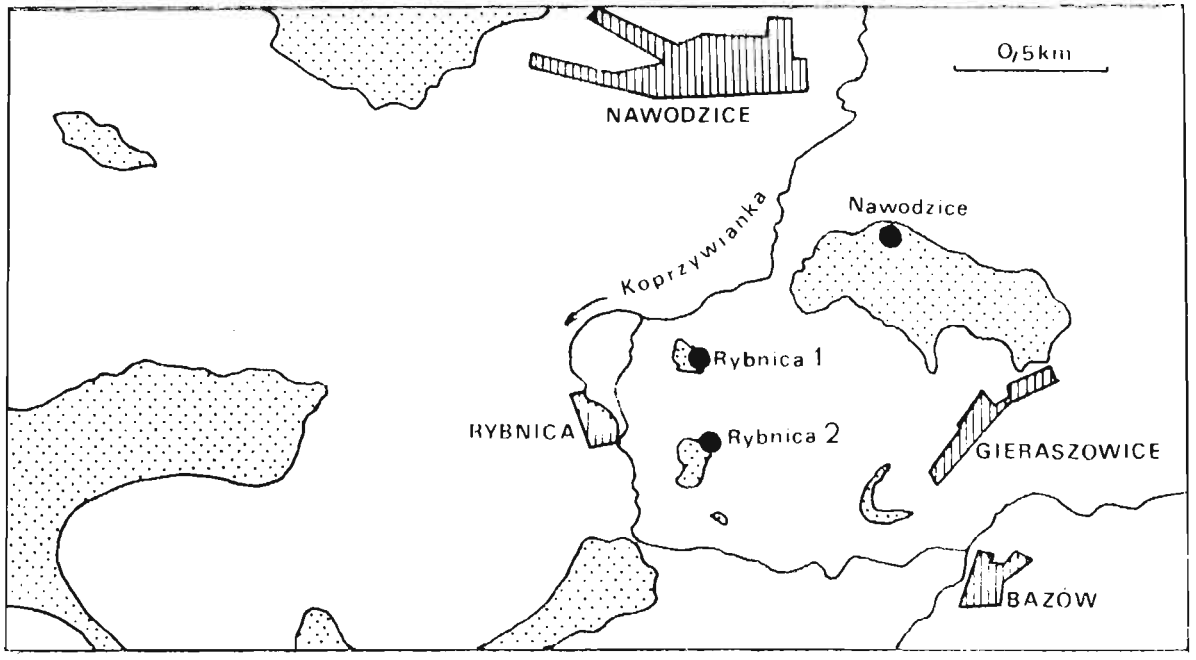

Fig. 2
Locality map of the outcrops at Nawodzice and Rybnica. Stippled are patches of Miocene deposits.

Nawodzice

1. Fine grained, unstratified quartz sand with abundant fauna (frequently in life position) described (HOFFMAN and SZUBZDA 1976) as *Circomphalus* assemblage. Thickness more than 1.5 m (bottom unexposed).
2. Fine-grained quartz sand, horizontally or diagonally stratified, locally cemented with calcium carbonate, alternating with thin gravel layers increasing in frequency higher in the section; gravels consist of pebbles of Cambrian quartzite and small branching calcareous red algae. An abundant and diverse fauna occurs in the sand as alternating auto- and allochtonous assemblages (BAŁUK and RADWAŃSKI 1968). Thickness ca. 4.0 m.
3. A unit of four layers composed of gravel and calcareous red algae, alternating with thin layers of fine-grained sand. The gravel layers are 0.15—0.30 m thick while the sand layers are 0.05—0.10 m thick. Proportion of gravel varies from layer to layer. The lowermost gravel layer is composed almost entirely of pebbles and cobbles of Cambrian quartzite and Devonian limestone (up to 20 cm in diameter), the fragments of red algae being smaller than 1 cm in diameter. The second gravel layer consists almost entirely of large, spheroidal rhodoliths (up to 10 cm in diameter) in a sandy-gravel matrix. The third and fourth layers are of gravel and rhodoliths in even proportions. Total thickness of unit ca. 1.0 m.
4. Thin-bedded organodetrital limestone. Thickness 0.10—0.15 m (top is truncated by erosion).

Rybnica 1

1. Fine-grained, yellow, unfossiliferous, unstratified quartz sand. Thickness ca. 6.0 m (HOFFMANN 1970).
2. Fine-grained, white quartz sand, horizontally or diagonally stratified; occasional pebbles of Cambrian quartzite. An abundant and diverse fauna occurs in this unit as alternating auto- and allochtonous assemblages. Thickness ca. 1.5. m.
3. A sandy-gravel unit with sparse fossils. A gravel layer 0.10—0.15 m thick containing pebbles and cobbles up to 15 cm in diameter occurs at the base. Thickness of unit varies from 0.30—0.60 m.

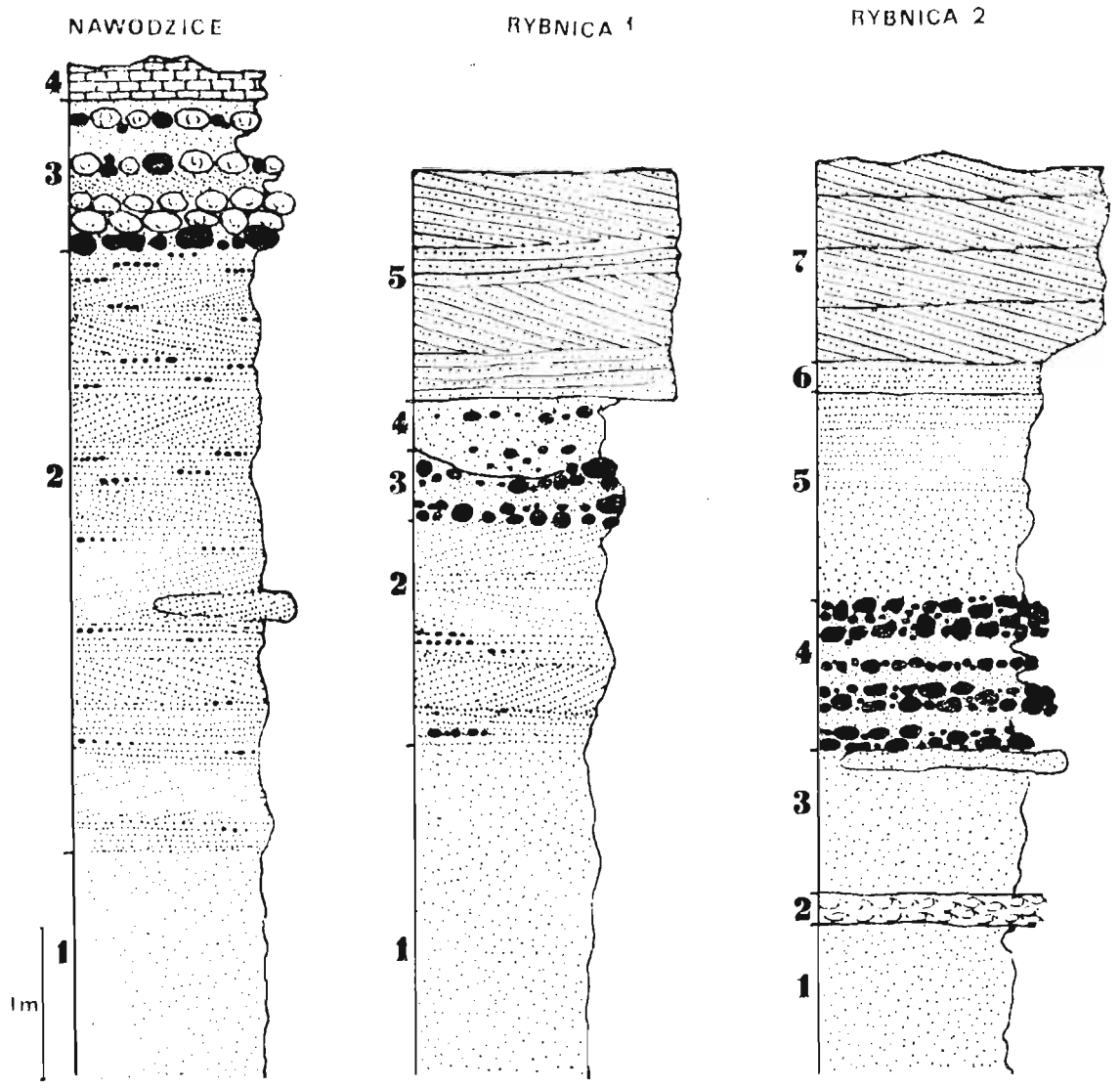

Fig. 3
Profiles of the outcrops at Nawodzice and Rybnica 1 and 2 (for explanations see the text).

4. A layer of coarse, well rounded shell detritus mixed with fine-grained quartz sand and sparse, small pebbles of Cambrian quartzite. Thickness varies from 0.05—0.40 m.
5. A unit of horizontally or diagonally stratified and partly cemented sands, containing abundant shell detritus. The increase in degree of cementation is related to a decrease in the amount of shell detritus. Thickness ca. 1.5 m.

Rybnica 2

1. Fine-grained, white, unstratified quartz sand with well preserved fauna (in life position) described (HOFFMAN and SZUBZDA 1976) as *Lucinoma* assemblage. Thickness more than 1.0 m (bottom unexposed).
2. Oyster layer. Thickness 0.2 m.
3. Fine-grained, yellow, unstratified quartz sand, locally cemented with calcium carbonate, with abundant and diverse fauna described (HOFFMAN and SZUBZDA 1976) as *Glossus* assemblage. Thickness 0.9 m.

4. A unit of four gravel layers alternating with fine-grained, unstratified sand layers. The gravel layers are 0.5—0.25 m thick while the sand layers are 0.05—0.15 m thick. An abundant and diverse fauna occurs in the sands as well as in the gravels. Total thickness of the unit ca. 1.0 m.
5. Fine-grained, white quartz sand, horizontally stratified in its upper part, with abundant fauna. Thickness 1.4 m.
6. Coarse-grained calcareous red algal sand, horizontally stratified, with sparse fossils. Thickness 0.2 m.
7. Diagonally stratified, calcareous red algal sandstones, with an abundant fauna. Shells together with rhodoliths 5—7 cm in diameter, occur in bottom part of unit; top erosionally truncated. Exposed thickness 1.3 m.

Profiles of the Miocene deposits outcropping in the Świniary are already published (RADWAŃSKI 1973, with reference).

SYSTEMATIC DESCRIPTIONS

The terminology and systematic arrangement of bivalves adapted in this paper follow those applied in the Treatise on Invertebrate Paleontology, part N (MOORE 1969).

Abbreviations used:

L — length of the valve
H — height of the valve
A — apical angle

Class **Bivalvia** LINNÉ, 1758
Subclass **Palaeotaxodonta** KOROBKOV, 1954
Order **Nuculoida** DALL, 1889
Superfamily **Nuculacea** GRAY, 1824
Family **Nuculidae** GRAY, 1824
Genus *Nucula* LAMARCK, 1799
Subgenus *Nucula* (*Nucula*) LAMARCK, 1799
Nucula (*Nucula*) *nucleus* (LINNÉ, 1758)
(pl. 1: 1a—b)

part. 1930. *Nucula nucleus* L.; KOWALEWSKI, 85.
1934. *Nucula nucleus* (LINNÉ); SCHENCK, 18—21, pl. 1: 8, pl. 3: 2, pl. 4: 4a—b, pl 5: 1—1a.
1935. *Nucula nucleus* (LINNÉ); SCHENCK, 258—261, text-fig. 1.
part. 1936. *Nucula nucleus* L.; FRIEDBERG, 159—161, pl. 27: 4—6 *non* pl. 27: 1—3.
part. 1938. *Nucula nucleus* L.; FRIEDBERG, 3.
1942. *Nucula* (*Nucula*) *nucleus* (LINNÉ); IJSPERT, 23, pl. 1: 4.
1945. *Nucula nucleus* LINNÉ, sp. 1758; GLIBERT, 12—16, pl. 1: 2a—b.
1954. *Nucula nucleus*; ALLEN, 471, pl. 1: 3.
1958. *Nucula* cf. *nitida* SOWERBY; SORGENFREI, 46, pl. 1: 4a—b.
1960. *Nucula* (*Nucula*) *nucleus* (LINNAEUS 1758); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 27, pl. 9: 4—5.
1965*a* *Nucula* (*s.s.*) *nucleus nucleus* (LINNÉ, 1758); GLIBERT and VAN de POEL, 12—13.
1970. *Nucula* (*Nucula*) *nucleus* (LINNAEUS); BAŁUK, pl. 2: 5—6.
1976. *Nucula* (*Nucula*) *nucleus* (L.); BRAMBILLA, 92, pl. 22: 1—2.
1977. *Nucula placentina* LAMARCK, 1819; JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 80—81 (*ex. syn.*), pl. 3: 10—11.
1979*a* *Nucula* (*Nucula*) *nucleus* (LINNAEUS, 1758); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 51, pl. 2: 1—2.

Material. — Nawodzice — 19 valves; Rybnica 1 — 98 shells, 282 valves — Rybnica 2—3 shells, 95 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml—1584	12.5	10.0

Description. — Shell is small-sized, solid, subtriangular in outline, equivalve, strongly inequilateral, with its posterior part accounting for 23% of the shell length. Beaks are small, weakly bent, opisthogyrate. Umbones do not project above the posterodorsal margin, the latter being distinctly convex in its middle part, concave beneath the beak, and straight below the furrow bordering the escutcheon. Anterodorsal margin is longer, somewhat arched, gently passing into regularly arched ventral margin. Lunule is long, narrow, smooth, poorly defined. Escutcheon is large, cordate, very well defined, ornamented only with concentric lines.

External surface shows fine radial striation and fine concentric lines increasingly conspicuous towards the ventral margin.

Ligament is internal, poorly developed. Resilifer is triangular in shape, with its ventral part directed anteriorly. Hinge consists of two branches, the anterior one being longer than the other. Specimens ranging from 7.2 to 15.0 mm in length have 18—23 teeth in the anterior row and 7—10 teeth in the posterior one.

Adductor muscle scars are distinct, subequal in size, the anterior one being rectangular and the posterior one rounded in shape. Median muscle scar is situated at an indistinct rise running from the beak towards the ventral margin. Central muscle scar is placed beneath the median muscle scar, while three punctiform scars (SCHENCK 1934) occur between the two and the anterior adductor muscle scar. Pallial line displays no sinus; it is parallel to the ventral margin, indistinct. Ventral margin is finely crenulated.

Remarks. — In a paper on Recent species of *Nucula*, ALLEN (1954) gave a method to distinguish among them on the basis of shell characteristics, soft-body anatomical investigations being useless for this purpose.

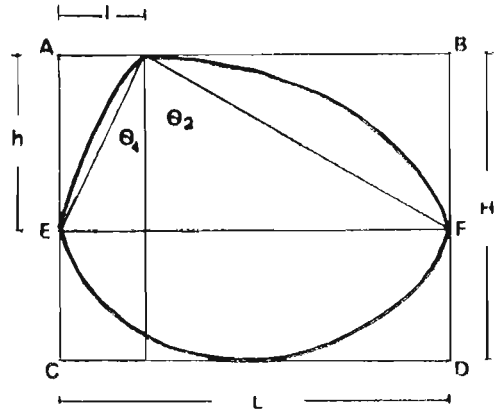

Fig. 4
Parameters of the *Nucula* shell measured in quantitative studies (for explanations see the text).

To this end shells are to be placed against ABCD net, with the EF line (=L) being parallel to the AB and CD axes (fig. 4). The height (H), length (L), posterior length (l) and distance of the EF line from the beak (h) should be measured with 0.1 mm accuracy. The angles Θ_1 and Θ_2 should then be calculated with 1' accuracy.

The present author measured 120 specimens and found that the specimens from Rybnica and Nawodzice, determined hitherto as *N. nucleus*, actually are attributable to two distinct species, namely *N. nucleus* LINNÉ and *N. nitidosa* WINCKWORTH, which differ from each other in the angle Θ_1.

Table 2

Shell measurements of
Nucula (*N.*) *nucleus* LINNÉ and *N.* (*N.*) *nitidosa* WINCKWORTH

	N	L	l	H	h	0_1	0_2
N. nucleus	20	9.0	2.1	7.2	4.2	26°26′	58°26′
N. nitidosa	100	6.7	1.1	5.6	3.6	17°05′	57°20′

Abbreviation according to ALLEN (1954).

Recent individuals of *N. nucleus* have shells with mat periostracum; they live up to 13 years and breed twice a year. On the other hand, individuals of *N. nitidosa* have glossy periostracum, sometimes with grey, radial bands; they live up to 12 years and breed once a year. The Polish Miocene specimens of *N. nucleus* and *N. nitidosa* were, all of them, erroneously assigned to *N. nucleus* because a non-diagnostic feature (viz. umbonal angle) was taken into account.

Stratigraphic range. — Early Miocene (GLIBERT 1945) — Recent.

Nucula (*Nucula*) *nitidosa* WINCKWORTH, 1930
(pl. 1: 3*a*—*b*)

1875. *Nucula nitida* var. *turgida*, MARSHALL; LECKENBY and MARSHALL, 391.
1850? *Nucula turgida*, S. WOOD, WOOD, 86—87, pl. 10: 7a—b.
1852? *Nucula Podolica* d'ORB.; d'ORBIGNY, 121, n° 2283.
1913? *Nucula Benoisti* nov sp.; COSSMANN and PEYROT, 91—92, pl. 5: 34—37.
1925. *Nucula nucleus* L.; KAUTSKY, 23, pl. 2: 11a—b, 12a—b.
1930. *Nucula nitidosa*; WINCKWORTH, 14.
1931. *Nucula turgida* MARSHALL, in LECKENBY and MARSHALL; WINCKWORTH, 280—281.
1935. *Nucula nitidosa* WICKWORTH; SCHENCK, 259, text-fig. 3.
part. 1936. *Nucula nucleus* L.; FRIEDBERG, 159—161, pl. 27: 1—3, *non* pl. 27: 4—6.
1953. *Nucula turgida* MARSHALL; ALLEN, 515—528, pl. 1: 1—3.
1954. *Nucula turgida*; ALLEN, 471, pl. 1: 4.
1958. *Nucula nucleus* (LINNÉ); SORGENFREI, 39, pl. 1: 1a—b.
1966. *Nucula turgida* LECKENBY and MARSHALL; TEBBLE, 27—28, pl. 1: b, d, text-figs 1, 14b.
1968. *Nucula nitidosa* WINCKWORTH; 1930; BOWDEN and HEPPEL, I, 100, 109.
1979*a*. *Nucula (Nucula) turgida* MARSHALL, in LECKENBY and MARSHALL, 1875; JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 51-52, pl. 2: 5, 6.

Material. — Nawodzice — 17 shells, 103 valves, Rybnica 1 — 157 shells, 663 valves, Rybnica 2 — 24 shells, ca 1000 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml—1585	6.5	5.5

Description. — Shells is small, triangular in outline, equivalve, strongly inequilateral, with its posterior part accounting for 16% of the shell length. Short posterodorsal margin is almost straight; longer anterodorsal margin is somewhat convex; regularly convex ventral margin is the longest one. Small opisthogyrate beaks slightly project above the posterodorsal margin. Lunule is lacking. Escutcheon is cordate, poorly defined.

External surface is ornamented with delicate concentric and radial lines. Concentric lines are weaker than in *N. nucleus* but more closely spaced. Ligament is amphidetic. Forms ranging from 9.3 to 20.0 mm in length have 18—28 teeth in the anterior row of the hinge and 5—13 teeth in the posterior one. The teeth on *N. nitidosa* are higher than those of *N. nucleus*.

Anterior adductor muscle scar is pear-shaped and larger than the posterior one, the latter being oval in shape. Median muscle scar and central muscle scar are also present as well as 3—5 punctiform scars set linearly close behind the anterior adductor muscle scar. Pallial line displays no sinus; it is irregularly convex and indistinct. Ventral margin is finely crenulated.

Remarks. — This species, described in detail by FORBES and HANLEY (1849) was for a long known as *N. nitida* SOWERBY, 1833. However, WINCKWORTH (1930) found that this name had been used by BROCCHI (1814) to describe *Arca nitida*. Therefore, he proposed a new name, *N. nitidosa* to replace *N. nitida*. Under the influence of MOORE (1931), WINCKWORTH (1931) claimed that *N. nitidosa* represents actually two distinct species which he proposed to call *N. moorei* and *N. turgida* MARSHALL in LECKENBY and MARSHALL, 1875, respectively, the latter name being an older synonym of *N. nitidosa* WINCKWORTH, 1930. According to ALLEN (1953), *N. moorei* WINCKWORTH should be treated as a younger synonym of *N. turgida* because the investigation of a large number of specimens of *N. turgida* and *N. moorei* did not demonstrate any differences at the specific level. BOWDEN and HEPPEL (1968) found subsequently that *N. turgida* MARSHALL, 1875, is a younger homonym of *N. turgida* GOULD, 1846; hence, the name *N. nitidosa* WINCKWORTH, 1930, should be restored.

The species *N. nitidosa* was first reported from the Polish Miocene by JAKUBOWSKI (1979a) under the name *N. turgida* MARSHALL, 1875.

The specimens from Podolia assigned by d'ORBIGNY (1852: 121, n° 2283) as *N. podolica* d'ORBIGNY, 1847, probably belong to *N. nitidosa*, but their inaccurate diagnosis make precise identification impossible. According to COSSMANN and PEYROT (1913), the specimens from Olesko mentioned by du BOIS de MONTPÉREUX (1831: 66—67, pl. 7: 35—36) under the name *N. margaritacea* LAM., but named as *N. podolica* by d'ORBIGNY (1847) are different from *N. nucleus*, to which they were erroneuously assigned by Polish geologists. *N. podolica* is also different from *N. benoisti* COSSMANN and PEYROT, 1913 (91—92, pl. 5: 34—37) from Aquitaine, but the only difference is in size, the specimens from Olesko being somewhat larger than the French ones.

The species *N. nitidosa* resembles very closely *N. trigonula* WOOD, 1840 (WOOD 1850, 86—87, pl. 10: 7a—b) from the Coralline Crag Formation of England. The latter has a convex, smooth shell, triangular in outline, with short, straight posterior margin. In fact, the differences between *N. trigonula* and *N. nitidosa* consists exclusively in the posterior margin being slightly convex in *N. nitidosa*. Possibly, the two forms are conspecific.

Stratigraphic range. — Middle Miocene (JAKUBOWSKI 1979*a*) — Recent.

Superfamily **Nuculanacea** ADAMS and ADAMS, 1858
Family **Nuculanidae** ADAMS and ADAMS, 1858
Genus *Nuculana* LINK, 1807
Subgenus *Nuculana* (*Saccella*) WOODRING, 1925
Nuculana (*Saccella*) *fragilis* (CHEMNITZ, 1784)
(pl. 1: 2a—b, 5, 7—10)

1891. *Leda fragilis* CHEMNITZ, sp. (*Arca*); BUCQUOY *et al.*, 215—217, pl. 37: 26—31.

1898. *Leda fragilis* (Chemn.). et var.; SACCO, 53—55, pl. 11: 41—43, pl. 11: 44—45 [var. *deltoidea* RISSO,], pl. 11: 46—47 [var. *pseudolaevis* SACC.].

1907. *Leda fragilis* CHEMN. sp. et var.; CERULLI-IRELLI, 129, pl. 11: 49—51, pl. 12: 1—2 [var. *consanguinea* BELLARDI], pl. 12: 3 [var. *inflata* Seguenza], pl. 12: 4 [var. *Calatabianensis* SACCO], pl. 12: 5 [var. *inflata* SEGUENZA].

1913. *Leda* (*Lembulus*) *fragilis* (CHEMN.); COSSMANN and PEYROT, 107—108, pl. 5: 65—68.
1913. *Leda* (*Lembulus*) *biali* nov. sp.: COSSMANN and PEYROT, 108—110, pl. 5: 61—64.
1913? *Nuculana fragilis* CHEMNITZ, sp. *(Arca)*; DOLLFUS and DAUTZENBERG, 373—376, pl. 33: 40—46.
1930. *Leda fragilis* CHEMN.; KOWALEWSKI, 88.
1930. *Leda fragilis* var. *consanguinea* BELL.; PARTINI, 35, pl. 3: 6—7.
1930. *Leda fragilis* var. *lamellosa* SEG.; PARTINI, 35, pl. 3: 8—9.
1933. *Leda fragilis* CHEMN.; FRIEDBERG, 27 (*cum syn.*).
1933. *Leda fragilis* CHEMN., var. *silesiaca mihi*; FRIEDBERG, 28—29, pl. 1: 10—11.
1936. *Leda* (*Lembulus*) *fragilis* CHEMNITZ et var.; BOGSCH, 33—34, pl. 2: 27—28, pl. 2: 29 [n. var. *gracilis*].
1936. *Leda fragilis* CHEMN.; FRIEDBERG, 163—164, pl. 27: 14—18.
1938. *Leda fragilis* L.; FRIEDBERG, 3.
1950. *Leda* (*Jupiteria*) *fragilis* CHEMN. et var.; MERKLIN, 56—57, pl. 1: 9—10, pl. 1: 11—13 [var. *raricostata* n. var.].
1955. *Leda fragilis* CHEMNITZ, 1784; MERKLIN and NEVESSKAJA, 26—27, pl. 1: 1—3.
1958. *Leda fragilis* (CHEMN.) var.; SENEŠ, 31—32, pl. 1: 1.
1959. *Leda* (*Ledina*) *fragilis* CHEMNITZ; ZHIZHCHENKO, 154—155, 3: 25—32.
1965*a*. *Nuculana* (*Saccella*) *biali* (COSSMANN et PEYROT, 1913); GLIBERT and VAN de POEL, 19.
1965*a*? *Nuculana* (*Saccella*) *delli* nov. sp.; GLIBERT and VAN de POEL, 20.
1965*a*. *Nuculana* (*Saccella*) *deltoidea* (RISSO, 1826); GLIBERT and VAN de POEL, 20—21.
1974. *Nuculana* (*Saccella*) *commutata* (PHILIPPI, 1884); MALATESTA, 12—13, pl. 2: 3.
1976. *Nuculana* (*Saccella*) *fragilis* (CHEMN.); BRAMBILLA, 93, pl. 22: 9—10.
1977. *Nuculana* (*Nuculana*) *fragilis* (CHEMNITZ, 1784); JAKUBOWSKI *in* JAKUBOWSKI and MUSIAŁ, 81—83, pl. 4: 1—8 text-pl. 2: 1—27.

Material. — Nawodzice — 1 shell; Rybnica 1—5 shells, 21 valves; Rybnica 2—26 shells, 1010 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml—1586/$_1$	12.0	7.0
MZ VIII Ml—1586/$_2$	10.5	7.2
MZ VIII Ml—1586/$_3$	10.5	6.2
MZ VIII Ml—1586/$_4$	10.0	6.0
MZ VIII Ml—1586/$_5$	9.5	5.2
MZ VIII Ml—1586/$_6$	8.5	5.5

Remarks.— The specimens from Nawodzice and Rybnica closely correspond to the descriptions and figures referred to in the synonymy.

The species *N.* (*S.*) *fragilis* displays a great intraspecific variability in shell shape and ornamentation. Flattened, band-like lamellae at the external surface of the shell may or may not run parallel to the ventral margin. In the latter case, they are more numerous in the central part of the shell than in its anterior and posterior parts. The width of the lamellae and their number, as well as depth and width of grooves inbetween are variable. This holds also for the shape of a sharp edge running posteriorly from the beak. In more convex, almost equilateral, and anterodorsally elongated forms the edge is straight and shorter than in forms less convex, more inequilateral, with longer posterior part. The latter forms have the edge concave in shape. On the other hand, a faint edge and a groove in the anterior part of the shell, running from the beak up to the part of the ventral margin close behind the anterior adductor muscle scar, may be either distinct, very weak, or entirely absent.

This variability stimulated establishment of many varieties and even differently named species. To present just one example, the following names were established for flattened, strongly transversally elongated forms, ornamented with concentric lamellae more numerous and more closely spaced than in typical *N.* (*S.*) *fragilis*: *Lembulus deltoideus* RISSO, 1826; *Leda consanguinea* BELLARDI, 1875; *Leda depressa* MONTEROSATO, 1877; *Lembulus castebianensis* SEGUENZA, 1877. As demonstrated by SACCO (1898) and DOLLFUS and DAUTZENBERG (1913), these various names refer to a single morphological variety of *N.* (*S.*) *fragilis*, namely var. *deltoidea*.

The species described by ZHIZHCHENKO (1959) and BAGDASARJAN (1970) under the name

Leda subfragilis R. HOERNES, 1875, bears concentric lamellae distinctly developed only in the posterior part of the shell but gradually disappearing anteriorly. In contrast, *N.* (*S.*) *fragilis*, has shell surface entirely covered with distinct lamellae. Another relative of the species under consideration is *L. prendeli* ANDRUSSOV, 1904, in which lamellae developed as thick fillets occur only in the posterior part of the shell.

The present author is of the opinion that the name *L. subfragilis* cannot be maintained at all, as R. HÖRNES (1875, 380, pl. 14: 17) stated clearly that the external surface of his specimens is entirely worn out (!). Those poorly preserved specimens cannot provide holotype for a new species. Any comparisons with *L. subfragilis* R. HÖRNES are therefore impossible, as no one knows how that species really looks like. Consequently, the specimens described by ZHIZHCHENKO (1959) and BAGDASARJAN (1970) as *L. subfragilis* should not keep that name.

The present author agrees with ZHIZHCHENKO (1959) who included the following varieties to the synonymy of *L. fragilis*: *elongata* ZHIZHCHENKO, 1936; *multicostulata* ZHIZHCHENKO, 1936; *raricostata* MERKLIN, 1950. All these varieties are interconnected by transitional forms and hence, their distinction is unnecessary.

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1913) — Recent.

Subclass **Pteriomorpha** BEURLEN, 1944
Order **Arcoida** STOLICZKA, 1871
Superfamily **Arcacea** LAMARCK, 1809
Family **Arcidae** LAMARCK, 1809
Subfamily **Arcinae** LAMARCK, 1809
Genus *Barbatia* GRAY, 1842
Subgenus *Barbatia* (*Barbatia*) GRAY, 1842
Barbatia (*Barbatia*) *barbata* (LINNÉ, 1758)
(pl. 1: 4, 6, 11, 12a—b)

1864. *Arca barbata* LINN.; HÖRNES, 327—329, p. 42: 6—11.
1891. *Arca barbata* LINNÉ; BUCQUOY *et al.*, 182—185, pl. 32: 1—5.
1898. *Barbatia barbata* (L.) et var.; SACCO, 12—14, pl. 2: 42—44, 44 bis, pl. 2: 47 [var. *elongata* (B. D. D.)].
1913. *Barbatia barbata* (LINNÉ) et var.; COSSMANN and PEYROT, 169—171, pl. 9: 1—2, pl. 9: 3—4 [var. *elongata* B. D. D.].
1913. *Arca* (*Barbatia*) *barbata* LINNÉ; DOLLFUS and DAUTZENBERG, 338—341, pl. 28: 16—28.
1933. *Arca* (*Barbatia*) *barbata* L., var. *Eichwaldi mihi*; FRIEDBERG, 33, pl. 1: 14.
1936. *Arca* (*Barbatia*) *barbata* L.; FRIEDBERG, 171—172, pl. 28: 8—11.
1936. *Arca* (*Barbatia*) *barbata* L. var. *Eichwaldi* Friedberg; Friedberg, 172—173, pl. 29: 2—3.
1960. *Barbatia* (*Barbatia*) *barbata* (LINNAEUS, 1758); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 58, pl. 18: 6—7.
1965. *Barbatia* (*Barbatia*) *barbata* (L.); RUGGIERI and GRECO, 53, pl. 10: 7.

Material. — Rybnica 1—35 valves; Rybnica 2—20 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml—1587/$_1$	75.0	40.0
MZ VIII Ml—1587/$_2$	26.5	11.0
MZ VIII Ml—1587/$_3$	26.0	15.7
MZ VIII Ml—1587/$_4$	14.0	7.0

Remarks. — The specimens under discussion are entirely consistent with the descriptions and figures referred to in the synonymy.

Among the specimens derived from the Middle Miocene of Podolia, FRIEDBERG (1933) distinguished the type form *B.* (*B.*) *barbata* as well as the variety *eichwaldi*, the latter being

characterized by its less conspicuous beaks, less convex shell, and more numerous ribs with regular beading on their surface. The abundant material from Rybnica as well as the specimens from Dr. G. JAKUBOWSKI's collection housed in the Museum of the Earth, Warsaw, allow to state, that var. *eichwaldi* is nothing more than a morphologic variety of highly variable species *B.* (*B.*) *barbata*. The present author is of the opinion that the features listed by FRIEDBERG (1933, 1936) cannot be considered as sufficient to treat var. *eichwaldi* as a distinct subspecies.

Bucquoy *et al.* (1891, 184, pl. 32: 6) distinguished var. *elongata* among the specimens of *B.* (*B.*) *barbata* from the Miocene of Algeria; it is very elongated and less asymmetrical than the type form. The elongation coefficient (L/H) equals 3.05 in var. *elongata*, while it does not

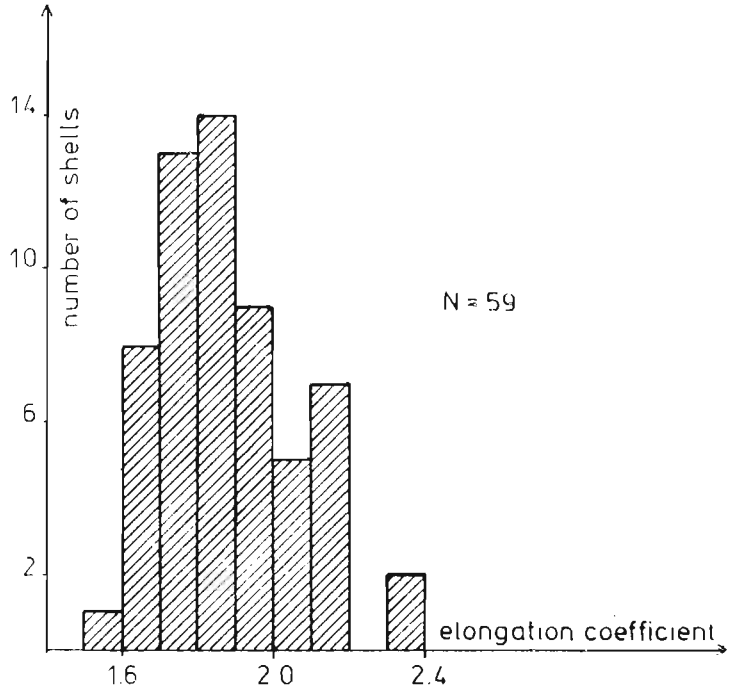

Fig. 5
Histogram of elongation coefficient (L/H) in *Barbatia* (*B.*) *barbata* from Rybnica.

exceed 2.4 in the longest specimens of *B.* (*B.*) *barbata* from Rybnica (fig. 5). According to DOLLFUS and DAUTZENBERG (1913), the specimen described by HÖRNES (1864, pl. 42: 10) as *Arca barbata*, should be determined as *B.* (*B.*) *barbata* var. *elongata* B. D. D. However, the coefficient L/H equals 2.21 in this specimen. Thus, is falls within the range of variability of the type form. Similarly, the specimens figured by COSSMANN and PEYROT (1913, pl. 9: 3—4) and SACCO (1898, pl. 2: 4) and assigned to *B.* (*B.*) *barbata* var. *elongata* should be attributed to *B.* (*B.*) *barbata* because their elongation coefficients equal 2.5 and 2.7, respectively. The actual taxonomic position of var. *elongata* B. D. D. remains still unclear. The lack of any comparative material does not allow the present author to decide whether var. *elongata* represents a distinct subspecies or only a morphologic variety.

Stratigraphic range. — Early Miocene (DOLLFUS and DAUTZENBERG 1913) — Recent.

Barbatia (*Barbatia*) *polymorpha* (MAYER, 1868)
(pl. 2: 1a—b)

part. 1913. *Barbatia* (*Obliquarca*) *polymorpha* MAYER; COSSMANN and PEYROT, 182—184, pl. 10: 7—9, 16.
part. 1913. *Arca* (*Barbatia*) *polymorpha* MAYER; DOLLFUS and DAUTZENBERG, 341—342, pl. 29: 1—16.
1965*a*. *Barbatia* (*s. s.*) *polymorpha* (MAYER, 1868); GLIBERT and VAN de POEL, 41.

Material. — Rybnica 1—2 valves; Rybnica 2—1 valve.

Dimensions (in mm):

	L	H
MZ VIII Ml—1588	10.0	5.0

Description. — Valve is small, slightly convex, oval in outline, transversally elongated, inequilateral, with its posterior part accounting for 75%—80% of the valve length. Short, convex anterior margin and somewhat longer, convex posterior margin gently pass into the ventral margin which bears a little sinus in its middle part. Small, acute, prosogyrate beaks slightly project above the dorsal margin. Distinct ridge runs posteroventrally from the beak, being sharp at the beginning, gradually rounded and indistinct further on. Shell is the most convex along the ridge.

Ornamentation consists of numerous ribs separated from one another with grooves equal in width. The ribs near the ridge and beyond it are higher and wider than the others, while grooves in this part of the valve are wider than the ribs. Concentric lines are irregular and variable in conspicuousness. When intersecting the ribs, concentric lines make irregular beading or even distinct scales on their surface, which is the case in the posterior part of the valve. Growth lines are clear.

Very low, trapezium-shaped cardinal area equals (at the basis) half the shell length. Ligament is amphidetic. Ligamental grooves are chevron-like, conspicuous only on the illustrated specimen. The tops of the chevrons are placed outside the shell. There are two ligamental grooves in the anterior part of the area, while they are three in number in the posterior part, the latter ones being twice longer than the former. Hinge margin is slightly arched. Anterior row includes 4 large, V-shaped teeth placed anteriorly, followed by 6 very small ones, nodular in shape. Posterior row begins with a series of 20 very small teeth followed by 6 very large and oblique ones.

Adductor muscle scars are oval in shape, equal in size, placed beneath the hinge. Posterior retractor muscle scar is rectangular in shape. Several small, orbicular anterior retractor muscle scars are situated in the anterior part of the shell. Pallial line displays no sinus; it occurs close to the smooth ventral margin.

Remarks. — The species *B.* (*B.*) *polymorpha* resembles young specimens of *B.* (*B.*) *barbata*. However, the former has less regular concentric lines and rib beading than the latter. In addition, *B.* (*B.*) *polymorpha* has an amphidetic ligament developed on trapezium-shaped area, which contrasts to the opisthodetic ligament on triangular area in *B.* (*B.*) *barbata*.

The species *Barbatia* (*B.*) *polymorpha* has previously not been mentioned from the Polish Miocene.

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1913) — Early Pliocene (DOLLFUS and DAUTZENBERG 1913).

Subgenus *Barbatia* (*Acar*) GRAY, 1857

Barbatia (*Acar*) *clathrata* (DEFRANCE, 1816)

(pl. 2: 2, 3a—b)

1936. *Arca* (*Barbatia*) *clathrata* DEFR, var. *acanthis* FONT.; FRIEDBERG, 174, pl. 29: 5 (*cum syn.*).

1950. *Arca clathrata* Defr. var. *acanthis* FONT.; KRACH, 297.

1960. *Barbatia* (*Acar*) *clathrata* var. *acanthis* (FONTANNES, 1881); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 59, pl. 18: 10, pl. 19: 1.

Material. — Rybnica 1—4 valves, 8 incomplete valves.

Dimensions (in mm):

	L	H
MZ VIII Ml—1589/$_1$	6.0	4.0
MZ VIII Ml—1589/$_2$	4.0	2.0

Remarks. — The specimens from Rybnica are entirely consistent with forms determined up to date as *B.* (*A.*) *clathrata* var. *acanthis*. To ascertain the taxonomic position of the name *acanthis* according to the requirements of the I. C. Z. N., Art. 45e, the present author investigated 750 specimens from Łychów Szlachecki (Roztocze, Poland) housed in the collection of Dr. G. JAKUBOWSKI, Museum of the Earth, Warsaw. One can observe transitional forms between the two endmembers of this variable species named *B.* (*A.*) *clathrata* (type forme) and *B.* (*A.*) *clathrata* var. *acanthis*. It became therefore clear that the latter should be treated as a morphologic variety but not as a subspecies. The shell of the type form is convex, short, with fine sculpture and poorly marked posteroventral angle. Flattened, elongated shells with coarse sculpture and distinct posteroventral angle represent the variety *acanthis*. A similar pattern of variation in *B.* (*A.*) *clathrata* was observed by COSSMANN and PEYROT (1913, 187—189, pl. 10: 10—13, 17—18) among the Early Miocene specimens from Aquitaine.

The species *Arca papillifera* HÖRNES, 1864, was erroneously included to the synonymy of *B.* (*A.*) *clathrata* by DOLLFUS and DAUTZENBERG (1913; 348). The specimens described by HÖRNES (1864, 338—339, pl. 44: 7a—d) resemble *B.* (*A.*) *clathrata* in outline and ornamentation, but the ligament is different in the two species. *A. papillifera* has a vertically striated triangular ligament area placed beneath the top of triangular cardinal area, as in *Striarca lactea*. In contrast, the triangular cardinal area of *B.* (*A.*) *clathrata* is very asymmetrical, horizontally striated in its anterior part, with shallow and closely spaced ligamental grooves being confined to the posterior part.

Stratigraphic range. — Early Miocene (DOLLFUS and DAUTZENBERG 1913) — Recent.

Barbatia (*Acar*) *bohemica* (REUSS, 1860)

(pl. 3: 1a—b)

1860. *Arca bohemica* m. nov. sp.; REUSS, 241—242, pl. 3: 13.
1898. *Arca tauroclathrata* SACC.; SACCO, 9, pl. 2: 13—16.
1913. *Barbatia bohemica* REUSS; COSSMANN and PEYROT, 185—187, pl. 9: 15—18, 33—37.
1913. *Arca* (*Acar*) *bohemica* REUSS et var.; DOLLFUS and DAUTZENBERG, 343—344, pl. 29: 17—29, pl. 29: 30—32 [var. *transversa* n. var.].
1965*a*. *Barbatia* (*Cucullaearca*) *bohemica* (REUSS, 1860); GLIBERT and VAN de POEL, 45—46.

Material. — Rybnica 2—1 left valve.

Dimensions (in mm):

	L	H
MZ VIII Ml—1590	12.0	7.5

Description. — Valve is oval in outline, slightly obliquely extending posteriorly, inequilateral, with its posterior part accounting for 67% of the valve length, very convex, particularly in its umbonal part which considerably projects above the straight dorsal margin. Beak is small, acute, strongly bent anteriorly.

External surface is ornamented with numerous, fine radial ribs variable in width, separated with narrower grooves. Thin, but variable in conspicuousness, concentric lines, covering the whole external surface interrupt the ribs. Distinct ridge reinforced by two strong ribs runs from the beak posteroventrally. The ridge is sharp near the beak but it becomes flattened posteroventrally. Shallow groove, distinct in the umbonal part, runs from the beak towards the middle part of the arched ventral margin. Growth lines are clear.

Cardinal area is triangular, very low and asymmetric. Ligament is opisthodetic. Posterior part of the cardinal area bears 8 very narrow, shallow ligamental grooves. Hinge margin is almost straight. Anterior branch of the hinge accounting for 1/3 of the hinge length, bears 8 oblique teeth. It is separated by a short interruption from the posterior one which bears 18 short teeth, vertical anteriorly while oblique posteriorly.

Adductor muscle scars are oval in shape, subequal, the posterior one being somewhat larger. Ovally elongated posterior retractor muscle scar is placed beneath the middle of the posterior part of the hinge margin. Pallial line shows no sinus; it is distinct, situated near the smooth ventral margin.

Remarks. — The specimen from Rybnica corresponds exactly to the description given by REUSS (1860).

The morphological variability of *B.* (*A.*) *bohemica* was illustrated by COSSMANN and PEYROT (1913) and DOLLFUS and DAUTZENBERG (1913). Specimens trapezoidal in outline, transversally elongated, with central hinge and angular connection of ventral margin with anterior and posterior margins were distinguished by DOLLFUS and DAUTZENBERG (1913) as the variety *transversa*.

The species *B.* (*A.*) *bohemica* resembles *Arca moriori* DESHAYES (1860, 874—875, pl. 65: 18—19) but differs from the latter in the ribs being less numerous, concentric lines being less densely spaced, and the teeth and ligament grooves being more numerous.

According to REUSS (1860), *B.* (*A.*) *bohemica* is similar to *Bathyarca pectunculoides* SCACCHI, 1834. It seems, however, impossible to find any similarity between the 17.5 mm long specimens of *B.* (*A.*) *bohemica* figured by REUSS (1860) or those from the Loire Basin reaching 60.0 mm in length on one hand, and *B. pectunculoides* which rarely attains 0.5 mm in length, on the other hand.

The species *B.* (*A.*) *bohemica* has previously not been mentioned from the Polish Miocene.

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1913) — Middle Miocene (DOLLFUS and DAUTZENBERG 1913).

Subgenus *Barbatia* (*Calloarca*) GRAY, 1857

Barbatia (*Calloarca*) *modioliformis* (DESHAYES, 1831)

(pl. 2: 4a—b)

1831. *Arca modioliformis* NOB.; DESHAYES, 214—215; 1837, pl. 32: 5—6.
1860. *Arca modioliformis* DESHAYES, 1831; DESHAYES, 896—897.
1887. *Arca* (section *Barbatia*) *modioliformis* DESH.; COSSMANN, 139.
1898. *Obliquarca postmodioliformis* SACC.; SACCO, 17, pl. 3: 17—19.
1965*a* *Barbatia* (*s. s.*) *modioliformis* (DESHAYES, 1829); GLIBERT and VAN de POEL, 41.

Material. — Rybnica 2—1 left valve.

Dimensions (in mm):

	L	H
MZ VIII MI—1591	8.3	4.0

Description. — The specific name of this form entirely corresponds to its shape: valve is obliquely elongated, strongly inequilateral, with its posterior part accounting for 80% of the valve length. Small but prominent beak is shifted anteriorly to form the narrow anterior part of the valve. Posterior part of the valve is very wide. Weak but very convex, rounded ridge runs posteroventrally from the beak. Anterior margin is short, very convex. Straight posterodorsal margin makes an obtuse angle with slightly arched posterior margin. Anterior part of the ventral margin is broken; it is thus not certain whether or not it bears the small

sinus characteristic of this species (DESHAYES 1824—1832). There is, however, a weak groove in the middle of the valve, to which a sinus on the ventral margin commonly corresponds.

External surface is ornamented with fine granulated ribs, 41 of which are distinct and densely spaced in the anterior and middle parts of the valve, while the remaining 5 ribs are weak and rarely spaced in the posterior one. Growth stages are indistinct.

Cardinal area is very low, triangular in shape. Ligament is opisthodetic; there are two deep ligamental grooves close to each other in the posterior part of the area. Hinge margin is nearly straight. Short, anterior row of the hinge bears 4 teeth perpendicular to the anterodorsal margin. The posterior row, separated from the former by a small interruption, begins with very fine teeth perpendicular to the posterodorsal margin; it ends with 5 large, very oblique teeth. Anterior adductor muscle scar is subORbicular in shape and smaller than the posterior one, rectangular in shape. Posterior retractor muscle scar is poorly defined. Pallial line shows no sinus; it is distant from the smooth ventral margin. Internal surface of the valve bears fine radial lines running from the beak down to the pallial line.

Remarks. — COSSMANN and PEYROT (1913) considered *Obliquarca postmodioliformis* SACCO, 1898, as a younger synonym of *Arca polymorpha* MAYER, 1868. Similarly, DOLLFUS and DAUTZENBERG (1913) included *O. postmodioliformis* to the synonymy of *B. polymorpha*. However, when describing the species *O. postmodioliformis*, SACCO (1898) emphasized that the erection of this species was permitted by comparative investigations with the specimens of *A. modioliformis* DESHAYES from the Eocene of the Paris Basin. Actually, both the species gradually pass into each other so that the Neogene forms attributable to *O. postmodioliformis* can be grouped around the species *A. modioliformis* (see SACCO 1898: 17). The present author is therefore of the opinion that the name *postmodioliformis* should be recognized as a younger synonym of *modioliformis*.

According to SACCO (1898) *A. polymorpha* described by MAYER (1868: 91) from the Miocene of Torino area should not be connected at all with *A. modioliformis* because the figures given by FONTANNES (1881, pl. 9: 12—16) present other forms.

The species *Barbatia* (*Barbatia*) *polymorpha* differs from *B.* (*C.*) *modioliformis* in its shorter posterior margin as well as in the lack of posteroventral elongation. Furthermore, the posterior ribs of *B* (*B.*) *polymorpha* are higher and wider than the remaining ones, being ornamented with irregular beading as a result of intersection with irregular concentric lines; whereas the posterior ribs of *B.* (*C.*) *modioliformis* are very narrow and indistinct, with fine granules on their surfaces, the whole shell surface being devoid of concentric lines. The trapezoidal cardinal area of *B.* (*B.*) *polymorpha* bears 3—4 bent, chevron-like ligamental grooves; in contrast, the low, triangular cardinal area of *B.* (*C*). *modioliformis* bears 2—3 straight ligamental grooves conspicuous only in the posterior part of the area. Finally, the anterior and posterior hinge branches are not separated from each other in *B.* (*B.*) *polymorpha*, which is the case in *B.* (*C.*) *modioliformis*.

The considered species *B.* (*C.*) *modioliformis* resembles also *B.* (*C.*) *marceauxiana* (DESHAYES, 1860) which differs, however, from the former in some details of hinge construction (DESHAYES 1860: 897—898). There are 2 or 3 deep ligamental grooves close to each other in the posterior part of cardinal area in *B.* (*C.*) *marceauxiana*, compared to 3—4 ligamental grooves in *B.* (*C.*) *modioliformis*. The latter has also, eventhough rarely, 1—2 additional grooves in the anterior part of cardinal area. The hinge margin is straight and devoid of teeth in its middle part in *B.* (*C.*) *modioliformis*, while it bears 2—3 irregular teeth beneath the beak in *B.* (*C.*) *marceauxiana*.

The species under discussion has previously not been mentioned from the Polish Miocene.

Stratigraphic range. — Early Eocene (GLIBERT and VAN de POEL 1965*a*) — Pliocene (SACCO 1898).

Subfamily **Anadarinae** REINHART, 1935
Genus *Anadara* GRAY, 1847
Subgenus *Anadara* (*Anadara*) GRAY, 1847
Anadara (*Anadara*) *diluvii* (LAMARCK, 1805)
(pl. 2: 5a—b)

1913. *Arca* (*Anadara*) *diluvii* LAMK.; COSSMANN and PEYROT, 149—151, pl. 8: 3—6, pl. 10: 53, 60.
1936. *Arca* (*Andara*) *diluvii* LAM. FRIEDBERG, 166—168, p. 27: 23—25, pl. 28: 1—3.
1942. *Arca* (*Arca*) *diluvii* LAMK. et var.; IJSPERT, 37—44, pl. 2: 1a—d, 6, pl. 2: 2a—c [var. *pertransversa* (SACCO)], pl. 2: 3a—c [var. *lateocostata* var. nov.].
part. 1945. *Arca* (*Arca*) *diluvii* LAMARCK, 1819, GLIBERT, 35—38, pl. 1: 12a—b.
1958. *Arca diluvii* LAMARCK; SORGENFREI, 63, pl. 3: 12a—c.
1960. *Anadara diluvii* (LAMARCK 1819); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 61, pl. 19: 9—10.
1963. *Anadara diluvii pertransversa* SACCO; TAVANI and TONGIORGI, 9, pl. 3: 2, 4—8.
1963. *Arca* (*A.*) *diluvii* LAMK.; VENZO and PELOSIO, 139—140, pl. 42: 6—8, pl. 42: 9 [f. *petransversa* SACCO].
1965*a*. *Anadara* (*s. s.*) *diluvii* (LAMARCK, 1805); GLIBERT and VAN de POEL, 53—54.
1973. *Anadara diluvii* LAMARCK, 1805; BÁLDI, 166, pl. 3: 1—2.
1974. *Anadara* (*Anadara*) *diluvii* (LAMARCK, 1805); MALATESTA, 21—22, pl. 1: 17a—b.
1976. *Anadara* (*Anadara*) *diluvii* (LK); BRAMBILLA, 94, pl. 22: 12—20.

Material. — Nawodzice — 1 right valve; Rybnica 2—1 left valve.
Dimensions (in mm):

	L	H
MZ VIII Ml—1592	6.0	3.5

Remarks. — The investigated specimens closely correspond to those referred to in the synonymy.

SACCO proposed the name *A. diluvii* var. *pertransversa* for specimens from northern Italy with obliquely elongated shell (SACCO 1898, 23, pl. 4: 19—21). TAVANI and TONGIORGI (1963) treated it as a distinct subspecies. According to IJSPERT (1942: 41—42) forms with length of the basis of cardinal area (a) being greater than valve height (b) belong to the variety *pertransversa*, while those with a $\leqslant$ b belong to the type form. The grooves are typically wider than the ribs in the variety *pertransversa*. IJSPERT (1942: 43—44) proposed also a new variety, *A. diluvii lateocostata*, characterized by its ribs being flattened and wider than the grooves.

The measurements of both a and b made by the present author on the investigated specimens showed the name *pertransversa* to be proper. However, with the relation of groove width to rib width taken into account, the investigated right valve turned out to be attributable to *pertransversa*, while the other one to *lateocostata*. The external surface of the former is ornamented with 35 ribs rectangular in cross-section, separated from one another with flattened grooves which are as wide as ribs in the middle part of the valve but wider than ribs and rarely spaced in the anterior and posterior parts. The other valve bears 30 flattened ribs separated from one another with grooves which are at least twice narrower than ribs.

In spite of the scarce material the present author's opinion is to not distinguish between the varieties *pertransversa* and *lateocostata*, as they were established after incompatible criteria.

Stratigraphic range. — Late Oligocene (BÁLDI 1973) — Recent.

Family **Noetiidae** STEWART, 1930
Subfamily **Striarcinae** MAC NEIL, 1938
Genus *Striarca* CONRAD, 1862
Striarca lactea (LINNÉ, 1758)
(pl. 2: 6a—b, 8a—b)

1850. *Arca lactea* LINNAEUS; WOOD, 77—79, pl. 10: 2a—b.
1864. *Arca lactea* Linn.; HÖRNES, 336—338, pl. 44: 6a—d.

1907. *Arca* (*Fossularca*) *lactea* L.; CERULLI-IRELLI, 113—114, pl. 8: 6—10.
1913. *Arca* (*Fossularca*) *lactea* LINNÉ; DOLLFUS and DAUTZENBERG, 334—347, pl. 39: 33—46.
1936. *Arca* (*Fossularca*) *lactea* L.; FRIEDBERG, 176—177, pl. 29: 7—10.
1945. *Arca* (*Arcopsis*) *lactea* LINNÉ, 1758; GLIBERT, 41—42, pl. 1: 10.
1950. *Arca lactea* L.; KRACH, 297, pl. 2: 3.
1960. *Arcopsis* (*Arcopsis*) *lactea* (LINNALUS 1758); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 59—60, pl. 19: 2.
1965*a*. *Striarca* (*Galactella*) *lactea* (LINNÉ, 1758); GLIBERT and VAN de POEL, 61—62.
1965. *Arcopsis* (*Arcopsis*) *lactea* (LINNÉ); NEVESSKAJA, 112, pl. 1: 4—7.
1974. *Striarca lactea* (LINNÉ, 1766); MALATESTA, 24—25, pl. 1: 10.
1976. *Striarca lactea* (L.); BRAMBILLA, 94—95, pl. 22: 23—24.

Material. — Rybnica 1—43 valves; Rybnica 2—70 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml—1593/$_1$	9.5	6.5
MZ VIII Ml—1593/$_2$	9.0	5.0

Remarks. — DOLLFUS and DAUTZENBERG (1913) gave exhaustive explanations concerning various names of this species and its varieties. The specimens under discussion are entirely consistent with the figures and descriptions referred to in the synonymy.

The variability of the specimens from Rybnica is moderate, related to the shell convexity. The more convex specimens have their cardinal area higher than the remaining ones, and ornamented with fine horizontal lines; in addition, the basis of their ligamental triangle is longer than in less convex specimens; their long, slightly arched hinge margin is devoid of teeth; the small, orthogyrate beaks which considerably project above the dorsal margin are shifted posteriorly, with the posterior part accounting for 67% of the shell length; and the ventral margin bears a weak sinus. In turn, the less convex specimens are more asymmetric, with their posterior part accounting for 75% of the shell length; and their hinge margin bears 9—11 small vertical teeth at the basis of the ligamental triangle.

Stratigraphic range. — Early Miocene (DOLLFUS and DAUTZENBERG 1913) — Recent.

Family **Glycymerididae** NEWTON, 1922
Subfamily **Glycymeridinae** NEWTON, 1922
Genus *Glycymeris* DA COSTA, 1778
Subgenus *Glycymeris* (*Glycymeris*) DA COSTA, 1778
Glycymeris (*Glycymeris*) *deshayesi* (MAYER, 1868)

(pl. 2: 7, 9a—b, 10)

1829. *Arca orbiculus* n.; EICHWALD, 288, pl. 5: 12.
1913. *Pectunculus* (*Axinea*) *deshayesi* MAYER; DOLLFUS and DAUTZENBERG, 354—357, pl. 31: 1—7.
1930. *Pectunculus pilosus* L.; KOWALEWSKI, 85 (*cum syn.*).
1933. *Pectunculus glycymeris* L., var. *pilosa* L.; FRIEDBERG, 37—39 (*cum syn.*).
1933. *Pectunculus pilosus* L.; KRACH, 78—86.
1936. *Pectunculus glycymeris* L. var. *pilosa* L.; FRIEDBERG, 180—183, pl. 25: 1—7, pl 26: 1.
1936. *Pectunculus bimaculatus* POLI; FRIEDBERG, 184, pl. 26: 2.
1942. *Glycymeris* (*Glycymeris*) *bimaculata* (POLI); IJSPERT, 49—53, text-fig. 10, pl. 3: 4a—b, 5, 6a—c.
1950. *Pectunculus glycymeris* L. var. *pilosa* L.; KRACH, 297, pl. 2: 5.
1954. *Pectunculus* (*Axinea*) *deshayesi* MAY.; KOROBKOV, pl. 52: 6, 7a—b, 8.
1956. *Glycymeris* (*Glycymeris*) *pilosa deshayesi* (MAYER, 1868); TEJKAL, 46—48, pl. 3: 14—19.
1956. *Pectunculus* (*Axinea*) *deshayesi* MAYER, 1868; GORECKIJ, 195—199, pl. 1: 1—3, pl. 2: 1—3.
1959. *Glycimeris* (*Glycimeris*) *pilosa deshayesi* C. MAYER-EYMAR 1868; ANDERSON, 83—87, pl. 13: 7a—c.
1960. *Pectunculus* (*Axinea*) *pilosa* var. *deshayesi* (MAYER, 1868); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 62, pl. 19: 13, pl. 20: 1, pl. 21: 1.

1962. *Glycymeris (G.) pilosa deshayesi* (MAYER, 1868); BÁLDI, 115—120, pl. 1: 4, pl. 2: 1—2, pl. 8: 9, pl. 9: 1—4, pl. 11: 4, 7—8.

1965*a*. *Glycymeris (s. s.) bimaculata deshayesi* (MAYER, 1868); GLIBERT and VAN de POEL, 81—82.

1976. *Glycymeris (Glycymeris) glycymeris* (L.); BRAMBILLA, 95—96, pl. 23: 3—4.

1977. *Glycymeris pilosa deshayesi* (MAYER, 1868); JAKUBOWSKI in JAKUBOWSKI and MUSIAL, 88—89, pl. 7: 1.

Material. — Nawodzice — 26 valves; Rybnica 1—4 shells, 149 valves; Rybnica 2—175 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml—1594/$_1$	58.5	59.4
MZ VIII Ml—1594/$_{21}$	42.0	38.7
MZ VIII Ml—1594/$_{16}$	26.0	27.2

Description. — Shell is massive, convex, suborbicular in outline, more or less asymmetrical because of elongation of the anteroventral or posteroventral parts. Small, acute, opisthogyrate beaks which considerably project above the arched dorsal margin are somewhat shifted posteriorly; the posterior part accounts for 48 %—49 % of the shell length. Lunule is lacking; escutcheon is very narrow, delimited by a deep groove. A weak groove runs from the beak towards the posterior margin. The groove confines the large, cordate corselet, the surface of which is ornamented with narrow ribs, weaker and less regularly arranged than at the remaining surface of the shell.

External surface of the shell is covered with faint, flattened, radially lineated ribs, separated from one another with very narrow grooves. Concentric lines intersecting the ribs are densely spaced. In large forms the concentric lines are undulated near the ventral margin. Small forms, up to 2.0 mm in height, bear only concentric ornamentation. The radial sculpture arises later in ontogeny as weak folds on the lateral parts of the valves. Some specimens show alternate, white and grey-bluish, concentric belts, variable in width. Growth lines are clear.

Cardinal area is large, triangular in shape, somewhat asymmetrical, with its posterior part longer than the anterior one. Ligament is external, amphidetic. There are 4—8 chevronlike ligamental grooves on the surface of cardinal area. However, in the early, postlarvar stage, the shell height being less than 1.0 mm, the ligament is internal, placed in a small, triangular ligamental socket in the hinge center. Hinge consists of 2—3 horizontal, thin, lamelliform teeth at either side of the resilifer. Shape of the cardinal area changes in ontogeny, its height increasing allometrically relative to the shell height. Consequently, growth rate of the central part of the hinge decreases or even the hinge height diminishes. The cardinal area may, therefore, entirely separate the anterior row of teeth from the posterior one, which is in fact the case in some large specimens. As a consequence, the teeth number in each row diminishes as well. Teeth are massive, vertically striped, projected above the hinge surface. They are straight or V-shaped, horizontal, oblique or vertical, depending upon their location along the hinge. The largest V-shaped teeth have their longer branch subparallel to the hinge axis. Teeth in the anterior row are somewhat longer and larger than those in the posterior row.

Adductor muscle scars are very distinct, placed at low buttresses. The posterior buttress is higher than the anterior one; it bears a small lappet which tends to cover a groove running towards the beak, along the interior margin of the posterior adductor muscle scar. Anterior adductor muscle scar is triangular in shape, its ventral side being rounded. It is larger from the oval-shaped posterior one. Anterior retractor muscle scar is very large and elongated, while the posterior one is smaller-sized and oval in shape. Pallial line shows no sinus; it is very distinct, placed near the strongly crenulated ventral margin.

Remarks. — The taxonomic position of the following names: *G. bimaculata* (POLI, 1795), *G. deshayesi* (MAYER, 1868), *G. glycymeris* (LINNÉ, 1758) and *G. pilosa* (LINNÉ, 1758) has been

long discussed; nevertheless, it still remains unsolved (see WOOD 1850, DOLLFUS and DAUTZENBERG 1913, BÁLDI 1962, GLIBERT and VAN de POEL 1965a).

There seems to be little doubt that the differences between the forms named by LINNÉ as *glycymeris* and *pilosa* are insufficient to treat them as distinct species (see WOOD 1850, FRIEDBERG 1933, 1936; KRACH 1933, BÁLDI 1962, MALATESTA 1963, 1974; GLIBERT and VAN de POEL 1965*a*, CAPROTTI 1972). However, there is no agreement as to which one of the two names should have the priority. KRACH (1933) and BÁLDI (1962) used the name *pilosa* while GLIBERT and VAN de POEL (1965*a*), CAPROTTI (1972) and MALATESTA (1974) preferred the name *glycymeris* and recognized the form *pilosa* for a subspecies; in turn, FRIEDBERG (1933, 1936) and MALATESTA (1963) distinguished the species *glycymeris* and its "varietas" *pilosa*. According to the priority rule, the name *glycymeris* should be applied for the species, as it was first published in 1758 (Syst. Nat. ed. X, n° 695), i.e. 9 years erlier than the name *pilosa* (Syst. Nat. ed. XII, n° 182).

On the other hand, HÖRNES (1864), HILBER (1882), and DOLLFUS and DAUTZENBERG (1913) presented an opinion contrasting to the one mentioned above. They treated the forms *glycymeris* and *pilosa* as two distinct species. Moreover, DOLLFUS and DAUTZENBERG (1913) claimed that these two names should refer only to the Recent species, while the Miocene forms should be distinguished under a separate name, namely *Pectunculus deshayesi* MAYER, 1868. This position was then accepted by KAUTSKY (1932), GORECKIJ (1956) and MERKLIN (1974), as well as by the present author. *G. deshayesi* has therefore been treated as the Miocene ancestor of *G. pilosa* (see GLIBERT 1945, ANDERSON 1959, BÁLDI 1962), or even of both *G. pilosa* and *G. bimaculata* POLI, 1785, which started to disjoin in the Pliocene (KAUTSKY 1932). However, BÁLDI (1962) and GLIBERT (1945) as well as GLIBERT and VAN de POEL (1965*a*) considered deshayesi as the subspecies of either *G. pilosa*, or *G. bimaculata*, respectively.

There is also a lot of confusion concerning the species *G. bimaculata*, particularly after the appearance of the paper by IJSPERT (1942) on the possibility of distinguishing among *G. pilosa* and *G. bimaculata* in fossil material. According to IJSPERT (1942), the shell of *G. pilosa* is oval-shaped (H>L), subequilateral, very convex, with large, opisthogyrate beaks and asymmetrical cardinal area. On the other hand, the shell of *G. bimaculata* is suborbicular in outline (H$\leqslant$L), equilateral, with small, orthogyrate beaks placed in the midline of cardinal area. However, KAUTSKY (1932) and BÁLDI (1962) demonstrated in a Miocene material that the features considered to be characteristic of *G. pilosa* and *G. bimaculata* are in fact mixed not only within a single population but even in a single individual. Similarly, KRACH (1933) assessed after biometrical investigations that shell asymmetry varies among the Miocene representatives of *Glycymeris*.

The long-established perplexity in distinction among fossil species of *Glycymeris* has resulted from the lack of any univocal criterions. On the basis of measurements of many shell parameters, BÁLDI (1962) proposed the way how to distinguish among the Oligocene and Miocene species of *Glycymeris*. Obviously, not all the features measured or counted, are stable and characteristic of a species (BÁLDI 1962). Some features are controlled by environmental factors, others vary in ontogeny.

The results of the measurements made on the specimens from Rybnica and Nawodzice are presented in Table 3. The results of BÁLDI's investigations are added for comparison. As it turns out, the length index and the length of the longest tooth in the anterior row increase in ontogeny, while the number of teeth and the slope of the longest tooth decrease. The only feature characteristic of the species appears to be the index of the length of cardinal area.

According to THOMAS (1975) the growth relationships between the height of cardinal area, the height of median hinge plate, and their sum against the shell height can be treated as diagnostic for particular species of *Glycymeris*. Below, a diagram is presented to show the allometry

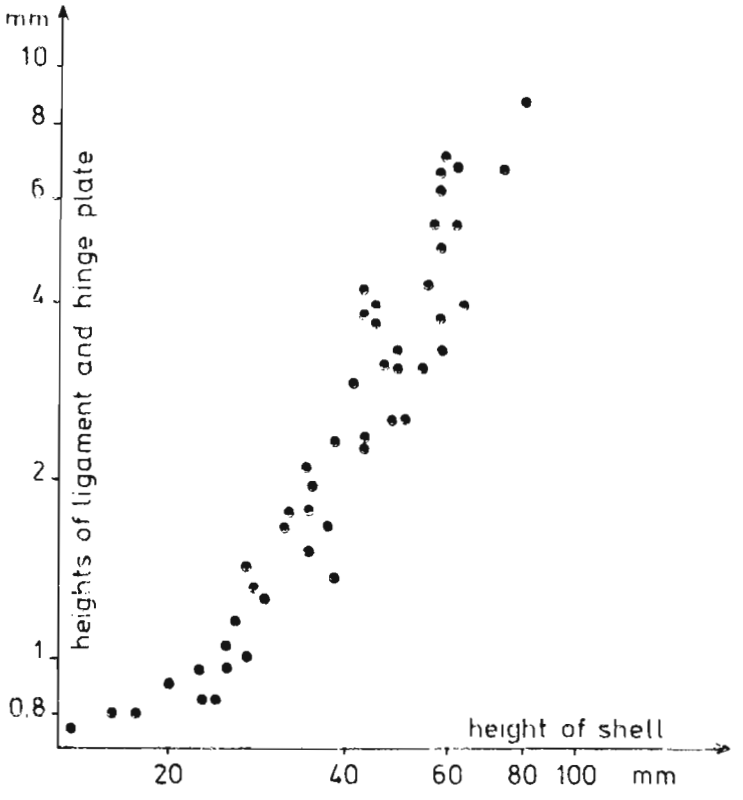

Fig. 6
Allometric growth of the cardinal area in *Glycymeris* (*G.*) *deshayesi*. Double logarithmic scale.

Table 3
Shell measurements of
Glycymeris (*G.*) *deshayesi* (MAYER)

	Rybnica 1		Rybnica 2		Nawodzice		Olesko (BÁLDI 1962)	
	N	M	N	M	N	M	N	M
Height D.u.v.	24	35.7	20	40.0	8	44.4	20	50.0
Length D. a. p.	24	37.8	20	40.1	8	45.0	20	48.1
Length index $\frac{\text{D. u. v.}}{\text{D. a. p.}}$	24	98.1	20	98.2	8	98.9	20	103.0
Convexity Conv.	24	14.9	20	15.8	8	16.8	20	16.1
Convexity index $\frac{\text{Conv.}}{\text{D. a. p.}} \times 100$	24	37.5	20	33.9	8	36.8	20	33.2
Index of the length of cardinal area $\frac{\text{Height of area}}{\text{Length of area}} \times 100$	20	16.3	20	16.2	8	19.0	20	19.4
Number of ligamental chevrons	12	4.5	20	6.0	5	4.2	20	3.8
Number of teeth in anterior row	24	8.8	20	6.7	8	7.5		6.0
Length of the longest tooth in the anterior row	24	2.6	20	3.5	8	3.5		3.5
Slope of the longest tooth in the anterior row	24	23.2	20	17.0	8	15.0		12.5

Abbreviations according to BÁLDI (1962)
N — number of specimens
M — mean value counted after BÁLDI's (1962) method

in growth of cardinal area in specimens of *Glycymeris* (*G.*) *deshayesi* from Nawodzice and Rybnica (fig. 6).

Stratigraphic range. — Early Miocene (DOLLFUS and DAUTZENBERG (1913) — Middle Miocene (BÁLDI 1962).

Order **Mytiloida** FÉRUSSAC, 1822
Superfamily **Mytilacea** RAFINESQUE, 1815
Family **Mytilidae** RAFINESQUE, 1815
Subfamily **Mytilinae** RAFINESQUE, 1815
Genus *Septifer* RECLUZ, 1848
Subgenus *Septifer* (*Septifer*) RECLUZ, 1848
Septifer (*Septifer*) *oblitus* (MICHELOTTI, 1847)

1867. *Mytilus* (*Septifer*) *oblitus* MICHT.; HÖRNES, 359, pl. 45: 10a—c.
1914. *Septifer Hoernesi nobis*; COSSMANN and PEYROT, 237.
1972. *Septifer oblitus* (MICHELOTTI, 1847); JAKUBOWSKI, 73—79, text—pl. 4: 1—23, pl. 4: 1—23 (*cum syn.*).

Material. — Rybnica 1—3 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml—1595	9.0	3.5

Remarks. — JAKUBOWSKI (1972) showed *S.* (*S.*) *oblitus* to be characterized by a wide intraspecific variability in shell shape and sculpture, hinge margin, and size of a flattened septum to which the anterior adductor muscle is fixed. The investigated specimens from Rybnica fall within the range of variability of *S.* (*S.*) *oblitus*.

The Viennese specimens figured by HÖRNES (1867) under the name *Mytilus* (*S.*) *oblitus* were considered by COSSMANN and PEYROT (1914) as representative of another species for which they introduced the name *S. hoernesi*. According to COSSMANN and PEYROT (1914), the differences between the species *oblitus* and *hoernesi* refer to the shell shape and the hinge construction, the shell of *S. hoernesi* being somewhat higher and more acute in the anterior part than it is in *S. oblitus*. The differences in hinge construction have not been pointed out by those authors. The present author agrees with TEJKAL (1956: 61) that *S. hoernesi* COSSMANN and PEYROT, 1914, is a younger synonym of *S. oblitus*.

The forms reported under the name of *S. saccoi* and *S. cornutus* from the Lower Miocene of Aquitaine presumably represent merely morphotypes of *S. oblitus*. The specimens named *S. saccoi nov. mut.* by COSSMANN and PEYROT (1914, 236—237, pl. 12: 8—11) differ from the holotype of *S. oblitus* in their less convex and elongated shell and in their ribs widening more abruptly towards the margins. The forms with horned beak, somewhat less elongated, less "modioliform" than *S. oblitus*, were described by COSSMANN and PEYROT (1914, 239—240, pl. 12: 12—13, 33—36) as *S. cornutus* COSSMANN, 1895.

The species *S.* (*S.*) *oblitus* is allied with *S.* (*S.*) *superbus* (HÖRNES, 1867). However, the latter is ornamented with rounded ribs, considerably wider than in the former. As the concentric lines are more rarely spaced in *S.* (*S.*) *superbus*, its rectangular nodules formed by intersection of ribs and concentric lines are distinctly larger than in *S.* (*S.*) *oblitus*. Furthermore, the dorsal margin along the whole length of the ligamental groove and the concave part of the ventral margin are smooth in *S.* (*S.*) *superbus*, while whole the internal margin is crenulated in *S. (S.) oblitus*.

Stratigraphic range. — Middle Miocene (TEJKAL 1956) — Early Pliocene (SACCO 1898).

Subfamily **Crenellinae** ADAMS and ADAMS, 1857
Genus *Gregariella* MONTEROSATO, 1883
Gregariella coralliophaga (CHEMNITZ, 1785)
(pl. 3: 5a—b)

1937. *Modiolaria* (*Gregariella*) *coralliophaga* CHEMNITZ; LAMY, 42—45.
1974. *Gregariella coralliophaga* (GMELIN, 1791); ABBOTT, 431, 5062.

Material. — Rybnica 2—2 valves.
Dimensions (in mm):

	L	H
MZ VIII MI—1598	10.5	6.5

Description. — Valve is small, irregularly rhomboidal in outline, very convex, inequilateral, with its posterior part accounting for 85% of the valve length. Small, prosogyrate beak considerably projects above the dorsal margin which makes an obtuse angle (140°) with the straight posterior margin. Short, convex anterior margin gently passes into the straight, oblique ventral margin, the posterior part of which is somewhat rounded and makes an acute angle with the posterior margin. Distinct, angular ridge runs posterodorsally from the beak. Beyond the ridge valve becomes flattened, this part being perpendicular to the plane of commissure.

External surface of the valve is ornamented with variably conspicuous concentric lines, some of which disappear on the ridge. The remaining concentric lines become very deep beyond the ridge to form concentric, imbricating lamellae. Middle part of the valve is devoid of radial ornamentation. Anterior part bears 18 ribs, while the posterior one 50 in number. Those posterior ribs that are placed anteriorly to the ridge are thin; the others thick and prominent. Small rectangles which are formed by intersection of the concentric lines with the ribs, are larger and more convex beyond the ridge than anteriorly to it. The number of ribs increases in ontogeny. Additional shorter ribs appear at the boundary of the anterior and middle parts of the valve; in the posterior part, additional ribs disperse in a fan-like manner from the ridge. Weak groove running from the beak towards the middle part of the ventral margin appears at the boundary of the middle and posterior parts. Growth stages are very clear.

Ligament is opisthodetic. Shallow ligamental groove approximates 2/3 of the dorsal margin in length; at the ventral side it is delimited by a distinct fillet. There are 2 very weak dysodont teeth at the upper part of the anterior margin.

Anterior adductor muscle scar is distinct, small, oval in shape, placed near the anteroventral connection of the valve. Posterior adductor muscle scar is less distinct, irregular in shape, elongated, parallel to the posterior margin. Pallial line is indistinct. Internal margin bears ribs confined to the areas where the external surface is sculptured, thus, leaving the middle part smooth.

Remarks. — The species *Musculus* (*Musculus*) *marmoratus* (FORBES, 1838) resembles the considered species *G. coralliophaga* in being rhomboidal in outline but less convex than the latter and also in its arched dorsal margin gently connecting with long, convex posterior margin. Distinct ridge running posterodorsally from the beak is rounded in *M.* (*M.*) *marmoratus* compared to angular in *G. coralliophaga*. The posterior bunch in *M.* (*M.*) *marmoratus* consists of 40—50 flattened, delicate ribs which are weaker than those in the anterior bunch. Posterior ribs are weaker and thinner in *M.* (*M.*) *marmoratus* than in *G. coralliophaga*.

G. coralliophaga is allied with *Modiolaria* (*Gregariella*) *neuveille* COSSMANN and PEYROT, 1914, which is more elongated than the former species, with its posteroventral angle being more acute. However, the similarity of these two forms is so striking that *M.* (*G.*) *neuveille* may be treated as a synonym of *G. coralliophaga*.

The species *G. coralliophaga* (CHEMNITZ) has previously not been mentioned from the Polish Miocene.

Stratigraphic range. — Middle Miocene (this paper) — Recent.

Genus *Musculus* RÖDING, 1798
Subgenus *Musculus* (*Musculus*) RÖDING, 1798
Musculus (*Musculus*) *conditus* (MAYER, 1853)

1867. *Modiola condita* MAYER; HÖRNES, 347—348, pl. 48: 3a—c.
1936. *Modiolaria* an *condita* MAYER; FRIEDBERG, 194—195, text-fig. 23.
1950. *Musculus* (*Musculus*) *conditus* MAYER; MERKLIN, 60—62, pl. 2:, 6—12.
1959. *Modiolus* (*Musculus*) *conditus* MAYER; ZHIZHCHENKO, 222, pl. 13: 5—8.
1972. *Musculus conditus* (MAYER, 1853); JAKUBOWSKI, 68—73, text-pl. 3: 1—34, pl. 3: 1—33.
1977. *Musculus conditus* (MAYER, 1853); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 89, pl. 5: 7—8.

Material. — Rybnica 1—1 shell, 11 valves; Rybnica 2—4 valves.

Dimensions (in mm):

	L	H
MZ VIII Mł—1596	5.0	4.0

Remarks. — The specimens of *M.* (*M.*) *conditus* from Rybnica are entirely consistent with those described by JAKUBOWSKI (1972) from Korytnica.

The species under consideration resembles very closely *M.* (*M.*) *sorgenfreii* ANDERSON, 1967 (ANDERSON 1967, 112—113, text-figs 4—5) from the Lower Miocene of Northern Germany; however, the two species are differently sculptured. The external surface of *M.* (*M.*) *sorgenfreii* bears radial ribs assembled into two bunches separated by a narrow, middle area of the valve, ornamented with delicate concentric lines. The anterior bunch consists of 15—17 ribs, 7—8 of which run from the beak to the anterior margin; the further from the beak begin the remaining ribs, the more posteriorly are they placed. The posterior bunch, with 23—25 flattened ribs beginning at the beak, is separated from the posterodorsal margin by a narrow area ornamented with oblique wrinkles. The concentric lines are distinct in grooves, while poorly marked on ribs.

In turn, the shell of *M.* (*M.*) *conditus* is sculptured with radial ribs beginning 1.0 mm away from the beak, the surface near the beak being smooth. The anterior bunch consists of 7—10 wide, smooth ribs separated from one another with very narrow grooves, the latter being ornamented with straight, rounded lines. The anterior bunch of ribs is separated from the posterior one by a very narrow median area covered with delicate concentric lines. The posterior bunch includes 26—28 ribs which are somewhat higher than those in the anterior bunch.

Another allied species is *M.* (*M.*) *caucasicus* (ZHIZHCHENKO, 1936). It has a small, slightly convex shell, oval in outline (ZHIZHCHENKO 1959, 224, pl. 13: 9). *M.* (*M.*) *caucasicus* differs from *M.* (*M.*) *conditus* in its beak being smaller and more anteriorly displaced. However, the similarity of these two forms is so striking that *M.* (*M.*) *caucasicus* was recognized by MERKLIN and NEVESSKAJA (1955: 98) as a synonym of *M.* (*M.*) *conditus*.

Stratigraphic range. — Middle Miocene (FRIEDBERG, 1936)

Musculus (*Musculus*) *biformis* (REUSS, 1860)
(pl. 3: 3a—b)

1831? *Modiola navicula* NOV.; du Bois de MONTPÉREUX, 68, pl. 7: 17—20.
1860. *Modiolaria biformis* m. n. sp.; REUSS, 239, pl. 4: 3.
1867. *Modiolaria biformis* REUSS; HÖRNES, 348—349, pl. 45: 4a—c.

1936. *Modiolaria biformis* REUSS; FRIEDBERG, 193—194, pl. 30: 6—9.
1950. *Modiolaria biformis* REUSS; KRACH, 298, pl. 2: 1.
1979*b*. *Musculus* (*Musculus*) *biformis* (REUSS, 1860); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 86, pl. 2: 17—19.

Material. — Nawodzice — 9 valves; Rybnica 2—1 shell, 23 valves.
Dimensions (in mm):

	L	H
MZ VIII MI-1597	5.0	2.5

Description. — Shell is small, irregularly oval in outline, posteroventrally elongated, inequilateral, with its posterior part accounting for 84% of the shell length. Small prosogyrate beaks prominently project above the straight dorsal margin. The latter gently passes into oblique, slightly convex posterior margin. Short, very convex anterior margin gently connects with long ventral margin which is slightly concave in its middle part. Ventral margin makes an acute angle with the posterior margin. Distinct, rounded ridge runs from the beak posteroventrally. It is bent dorsally near the beak and ventrally in the posterior part of the shell. Beyond the ridge shell flattens abruptly.

External surface is sculptured with delicate concentric lines and radial ribs. There are 8—10 flattened ribs in the anterior part of the valve and 50—60 in number in the posterior one, the middle part being devoid of ribs. Small, rectangular nodules are formed by intersection of the ribs with concentric lines. Ornamented part of the shell is light-grey or light-beige in colour, while the distinctly delimited smooth prodissoconch with straight ventral margin is white. Growth lines are clear.

Ligament is opisthodetic, placed in the shallow ligamental groove; the latter is somewhat shorter than the dorsal margin. There are several dysodont teeth beneath the beak. The whole internal margin, except for the middle part of the ventral margin, is crenulated, the largest internal ribs being placed along the posterior margin. Anterior adductor muscle scar is small, ovally elongated, while the posterior one is very large, oval in shape, elongated along the posterior margin.

Remarks. — The considered species *M.* (*M.*) *biformis* is allied with *M.* (*M.*) *marginatus* (EICHWALD, 1830), the difference consisting in the shell shape and sculpture. Because of an obtuse angle between its nearly straight dorsal margin and slightly convex posterior margin, the shell of *M.* (*M.*) *marginatus* flattens gradually beyond the ridge, the posterior area being thus large and triangular in outline. The ribs are wider in *M.* (*M.*) *marginatus* than in *M.* (*M.*) *biformis*; they are frequently bifurcated near the ventral margin, which is never the case in the latter species. The concentric lines are deeper and more distant one from another in *M.* (*M.*) *marginatus*, the rectangular nodules being thus larger than in *M.* (*M.*) *biformis*.

The same differences separate *M.* (*M.*) *biformis* from *M.* (*M.*) *sarmaticus* (GATUEV, 1916); in fact, the only basis for establishment of the latter species was its geological age which is considered by the present author as an obvious misunderstanding (see also FRIEDBERG 1936: 196, 198). Specimens from the Middle Miocene were thus assigned to *M.* (*M.*) *marginatus*, while forms from the Late Miocene were ascribed to *M.* (*M.*) *sarmaticus*. The only to express a different opinion was LASKAREW (1903, 58—59, pl. 1: 21—24) who established a new specific name, *submarginata*, for specimens from the Middle Miocene and followed HÖRNES (1867, 350, pl. 45: 6) in considering the name *marginatus* to be appropriate for the Late Miocene forms.

The species *M.* (*M.*) *biformis* differs also from *M.* (*M.*) *tarchanensis* (GATUEV, 1916), the latter form being ornamented with very wide ribs, sometimes bifurcated near the ventral margin, and grooves which are narrow near the beak, but become as wide as the ribs near the ventral margin.

FRIEDBERG (1936) supposed that the specimens from Szuszkowce described by du BOIS de MONTPÉREUX (1831, 68, pl. 7: 17—20) as *M. navicula* belong in fact to *M.* (*M.*) *biformis*;

however, the available description has been so short and the figures so vague that he could not state with certainty whether or not *M. navicula* is an older synonym of *M.* (*M.*) *biformis*.

Stratigraphic range. — Middle Miocene (FRIEDBERG 1936).

Subfamily **Modiolinae** KEEN, 1958
Genus *Modiolula* SACCO, 1898
Modiolula phaseolina (PHILIPPI, 1844)
(pl. 3: 2, 6a—b, 7a—b)

1881. *Modiola phaseolina* PHIL.; NYST, 164, 1878, pl. 17: 6a—d.
1907. *Modiola phaseolina* PHIL.; CERULLI-IRELLI, 104, pl. 7: 10.
1909. *Modiola phaseolina* PHIL.; CERULLI-IRELLI, 193, pl. 23: 10.
1950. *Modiolaria hoernesi* REUSS; KOWALEWSKI, 43.
1965. *Modiolus* (*Modiolula*) *phaseolinus* (PHILIPPI); NEVESSKAJA, 126—127, pl. 4: 12—19.
1966. *Modiolus phaseolinus* (PHILIPPI); TEBBLE, 45, text-fig. 22a—b, pl. 1: i.
1977. *Modiolula phaseolina* (PHILIPPI, 1844); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 89—91, text-pl. 5: 1—17, pl. 5: 9—10 (*cum syn.*).

Material. — Nawodzice — 3 valves; Rybnica 1—3 valves; Rybnica 2—78 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml-1599/$_1$	13.0	8.0
MZ VIII Ml-1599/$_2$	10.5	7.0
MZ VIII Ml-1599/$_3$	4.8	3.4

Remarks. — The specimens under study closely correspond to the descriptions and figures referred to in the synonymy.

The species *M. phaseolina* resembles *Modiolus hörnesi* REUSS, 1867, in its outline but differs from the latter in the hinge margin (REUSS 1867, 137—138, pl. 6: 2—4). The internal side of the dorsal and hinge margins is smooth in *M. hörnesi*, which contrasts to *M. phaseolina* having a dysodont hinge in form of oval, delicately lineated area placed beneath the beak, at a thickened edge of the shell. Dysodont teeth are more distinct in young specimens of *M. phaseolina* than in adult ones (pl. 3: 6b, 7b).

Ontogenetic changes in shell shape show the same pattern in *M. hörnesi* and *M. phaseolina*. Juveniles of both the species have long, regularly arched posterior margin making an obtuse angle (120°—140°) with the straight dorsal margin; this connection becomes more gentle in adults. During the shell growth, the small, prosogyrate beak becomes more swollen and more prominently projecting above the dorsal margin. The shell length and convexity increase in both the species faster than the shell height. It is thus obvious that the similarity of *M. hörnesi* and *M. phaseolina* makes it impossible to distinguish between them if preserved in form of casts and molds because the delicate but diagnostic details of the hinge are then never sufficiently distinct.

Although REUSS (1867) and NYST (1881) had already emphasized that *M. hörnesi* and *M. phaseolina* are distinguishable from each other only by hinge details, all the smooth forms of the subfamily Modiolinae from the Polish Miocene have been assigned to *M. hörnesi*, even though they are commonly preserved as casts and molds; this is the case in particular with the so-called *Modiola-Ervilia* layer (KRACH 1949, KOWALEWSKI 1950).

The species *M. phaseolina* was first described from the Polish Miocene (Monastyrz) by JAKUBOWSKI (1977).

Some of the Viennese specimens attributed by HÖRNES (1867, 347, pl. 45: 2a—c) to *Modiola*

hörnesi may actually belong to *M. phaseolina*, as HÖRNES himself mentioned a crenulated elevation beneath the beak.

Stratigraphic range. — Middle Miocene (GLIBERT 1945) — Recent.

Modiolula volhynica (EICHWALD, 1829)

(pl. 3: 8a—b)

1829. *Modiola volhynica*, n.; EICHWALD, 287, pl. 4: 17.
1853. *Modiola volhynica* EICHWALD, EICHWALD, 67—68, pl. 4: 16—17.
1867. *Modiola Letochae* HÖRN.; HÖRNES, 351—352, pl. 45: 7a—c.
part. 1867. *Modiola volhynica* EICHWALD,; HÖRNES, 352—353, *non* pl. 45: 8.
1903. *Modiola volhynica* EICHWALD; LASKAREW, 56—58, pl. 1: 25—28.
1903. *Modiola Letochae* M. HÖRN.; LASKAREW, 57.
1936. *Modiola volhynica* EICHW.; FRIEDBERG, 191—193, pl. 30: 1—5.
1959. *Modiolus incrassatus* d'ORBIGNY var. *buglovensis* GATUEV; ZHIZHCHENKO, 220—221, pl. 22: 23—24.
1974. *Modiolus buglovensis* GATUEW, 1916; VOLKOVA, 21, pl. 15: 5.
1974. *Modiolus incrassatus* ORBIGNY, 1844; VOLKOVA, 21—22, pl. 21: 1a—b, 2a—b.

Material. — Nawodzice — 20 valves; Rybnica 1—20 valves; Rybnica 2—2 valves.

Dimensions (in mm):

	L	H
MZ VIII MI-1600	4.5	2.8

Description. — Valve is small-sized, convex, oval to beanshaped in outline, inequilateral, with its posterior part accounting for 95% of the valve length. Shell shape undergoes changes in ontogeny. Specimens up to 1.5 mm long are oval in outline, relatively high ($H/L \approx 0.6$), with ventral and dorsal margins straight, the latter being twice shorter than the former. Dorsal margin makes an obtuse angle with the convex posterior margin. Larger specimens, up to 5.5 mm in length, are elongated, relatively low ($H/L \approx 0.4$—0.5), with straight dorsal margin approximating 2/3 of the ventral margin in length. The latter is somewhat concave or bears a deep sinus in its middle part. Weak groove runs from the small prosogyrate beak towards the sinus. Posterior margin is relatively shorter than in juveniles; it connects gently with the dorsal margin. Beak is more prominent and more strongly bent anteriorly than in juveniles, it does never project above the short, very convex anterior margin. Sharp ridge runs posteroventrally from the beak. If ventral margin is straight, the ridge is straight, too; if ventral margin bears a sinus, the ridge is arcuate, with convexity directed dorsally.

External surface of the valve is ornamented with very thin, densely spaced concentric lines. White, smooth pseudoprodissoconch distinctly contrasts with the rest of the shell which is beige in colour, with irregular white, radial belts. Growth lines are clear.

Ligament is internal, opisthodetic, placed in a shallow ligamental groove which equals half the dorsal margin in length. Several dysodont teeth (commonly 5 in number) are placed close beneath the beak; they are irregular in shape. The whole dorsal margin is crenulated, with thick notches.

Anterior adductor muscle scar is small, transversally elongated, without any dorsally limiting buttress. Posterior adductor muscle scar is very large; irregular in shape, placed very high. Pallial line shows no sinus; it is distinct, distant from the smooth ventral margin.

Remarks. — The Middle Miocene specimens from Zaleśce (Ukraine), indistinguishable from those described herein, were assigned by LASKAREW (1903: 57) to *Modiola letochae* HÖRNES. The main difference between *M. volhynica* and *M. letochae* is in colour of the external surface. Both the species are beige in colour, but *M. volhynica* has a white spot on the posteroventral part of the shell, while *M. letochae* has white, radial belts. In addition, the latter species has more regular and delicate concentric lines than the former. The present author is of the opinion

that the differences between *M. letochae* HÖRNES, 1867 and *M. volhynica* EICHWALD, 1829, are negligible and certainly do not reach the specific level.

The species *M. volhynica* is related to *Modiolus incrassatus* (d'ORBIGNY, 1844) [= *M. subincrassatus* d'ORBIGNY, 1847]. In 1847 d'ORBIGNY changed the name of his species because he discovered that DESHAYES (1830) had previously described other forms under the name *incrassatus*. This statement was later confirmed by d'ORBIGNY (1852, 121, n° 2386), but unfortunately it has been ignored by other authors. Consequently, specimens from Bulgaria, Austria and USSR have been identified as *M. incrassatus* d'ORBIGNY, 1844.

When describing the holotype of *Mytilus incrassatus*, d'ORBIGNY (1844, 477—478, pl. 5: 8—11) did not give any information on the hinge margin. Consequently, this species was variably treated. Some authors considered it to be synonymous with *M. volhynica*, others regarded it as a distinct species. For instance, EICHWALD (1853: 67—68) included *M. incrassatus* to the synonymy of *M. volhynica*; he stated that the crenulation of the anterior margin and the anterior part of the dorsal margin is conspicuous in small forms, but weak in larger ones (22.5 mm long). This statement was confirmed by HÖRNES (1867: 352—353) who described under the name *M. volhynica* shells with the crenulated hinge margin, but at the same time figured shells with smooth dorsal margin, with small dysodont teeth under the beak (HÖRNES 1867, pl. 45: 8).

HOERNES (1874, 43, pl. 2: 14—17) identified specimens from Kishyniev (wherefrom *M. incrassatus* had been originally described) as *M. volhynica* EICHW. var. *incrassata* d'ORB. The varietas *incrassata* differs from the type form in its thick, more convex shell. KOLESNIKOV (1935) objected to identify *Mytilus incrassatus* d'ORB. with *Modiola volhynica* EICHW. He distinguished between *M. incrassata* with smooth anterior margin and the anterior part of the dorsal margin and, on the other hand, *M. volhynica* with both the margins being finely crenulated. Surprisingly, however, KOLESNIKOV (1935) placed *M. volhynica* figured by HÖRNES (1867) with its crenulated anterior margin, in the synonymy of *M. incrassata* (d'ORB.). A similar error was committed by ŠVAGROVSKY (1971: 133—134) who accepted the distinction proposed by KOLESNIKOV (1935) but nevertheless, attributed specimens with crenulated anterior margin to *Modiolus* (*M.*) *incrassatus* (d'ORBIGNY, 1844).

The species *Mytilus* (*Mytilaster*) *minimus* POLI, 1795, from the Middle Miocene of the Loire Basin (DOLLFUS and DAUTZENBERG 1920, 381—382, pl. 38: 7—12) resembles *M. volhynica* in its ornamentation and hinge construction. However, it differs from the latter species in its shell being lower, with straight ventral margin, and with edge being less conspicuously bent.

Stratigraphic range. — Middle Miocene (LASKAREW 1903) — Late Miocene (FRIEDBERG 1936).

Order **Pterioida** NEWELL, 1965
Suborder **Pteriina** NEWELL, 1965
Superfamily **Pteriacea** GRAY, 1847
Family **Isognominidae** WOODRING, 1925
Genus *Isognomon* LIGHTFOOT, 1786
Subgenus *Isognomon* (*Isognomon*) LIGHTFOOT, 1786
Isognomon (*Isognomon*) *ciscaucasicus* (DAVITASCHVILI, 1932)

1959. *Perna ciscaucasica* DAVITASCHVILI; ZHIZHCHENKO, 232, pl. 13: 17—20.
1965. *Isognomon ciscaucasica* (DAVITASCHVILI), 1932; BAGDASARJAN, 69—71, pl. 1: 10—14.
part. 1972. *Isognomon radiatus* (HÖRNES, 1870); JAKUBOWSKI, 58—63, text-pl. 1: 1—24, pl. 1: 1—24, *non* pl. 1: 25.

Material. — Rybnica 1—1 left valve.
Dimensions (in mm):

	L	H
MZ VIII Ml-1601	1.5	2.0

Description. — Valve is small, slightly convex, triangular in outline, strongly inequilateral, with its posterior part accounting for 87% of the valve length. Oval-shaped pseudoprodissoconch with central beak is distinctly distinguished. Small, opisthogyrate beak slightly projects above the straight dorsal margin which makes an obtuse angle with the arched posterior margin; the latter, in turn, gently passes into the more strongly arched ventral margin. Very short anterodorsal margin makes an acute angle (ca 60°) with the slightly concave anterior margin. Distinct ridge runs anteroventrally from the beak, which results in an elongation of the valve. Valve becomes abruptly flattened toward the anterior margin.

The external surface is covered with fine concentric lines.

Ligament is opisthodetic, multivincular. The first, triangular resilifer (re 1) is placed at the low, triangular cardinal area, beyond the beak.

Hinge in the left valve: small AII is placed at the anterior part of the straight hinge margin, while narrow, lamelliform PII occurs at its posterior part; there is a shallow socket above AII; three vertical, very weak, provincular teeth of taxodont type occur at the lower part of the hinge margin, between AII and re 1.

Pallial line and adductor muscle scars are indiscernible.

Remarks. — JAKUBOWSKI (1972) considered *I. ciscaucasicus* (DAVITASCHWILI, 1932) to be a younger synonym of *I. radiatus* (HÖRNES, 1867) in spite of distinct differences in ornamentation and shell shape between the holotypes of both these species. In the present author's opinion, JAKUBOWSKI (1972) erroneously interpreted the lack of sculpture on the majority of this specimens as caused by poor preservation state and abrasion of the shell surfaces. The figures (JAKUBOWSKI 1972, pl. 1: 1—25) show, indeed, well preserved specimens with even their pseudoprodissoconch being sometimes visible. Undoubtedly, a vast majority of those specimens belong to *I. ciscaucasicus*.

Stratigraphic range. — Middle Miocene (JAKUBOWSKI 1972) — Late Miocene (ZHIZHCHENKO 1959).

Family **Pectinidae** RAFINESQUE, 1815
Genus *Palliolum* MONTEROSATO, 1884
Subgenus *Palliolum* (*Delectopecten*) STEWART, 1830
Palliolum (*Delectopecten*) *vitreum* (GMELIN, 1791)

1897*a*. *Palliolum* cf. *vitreum* (CHEMN.); SACCO, 45.
1954. *Palliolum vitreum* CHEMN.; KOROBKOV, 192, pl. 74: 11.
1977. *Palliolum* (*Delectopecten*) cf. *vitreus* (GMELIN, 1791); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 92—94, pl. 6: 6—7 (*cum syn.*).

Material. — Rybnica 1—1 left valve.

Dimensions (in mm):

	L	H
MZ VIII Ml-1602	1.6	1.8

Description. — Valve is small, fragile, transparent, suborbicular in outline. Small, slightly projected orthogyrate beak is situated at the midlength of the cardinal margin. Anterior ear is large, ended with a right angle, while the posterior one is not marked off the disc.

The whole external surface is covered with fine, densely spaced radial lines intersected by concentric lines. The latter become more distinct toward the ventral margin, where they are ornamented with small nodules looking like beads on a string. The concentric lines are more closely spaced at the posterior ear than at the rest of the valve. Growth lines are clear. Ventral margin is smooth.

Remarks. — The investigated specimen from Rybnica is indistinguishable from shells of the deep-water Recent species *Chlamys* (*Delectopecten*) *vitrea* recorded by TEBBLE (1966) off northern Scotland.

The species *P.* (*D.*) *vitreum* resembles *P.* (*D.*) *simile* (LASKEY, 1811) [= *Pecten exilis* EICHWALD, 1850], the shell of which is almost smooth, ornamented only with very fine concentric lines, without any beading typical of *P.* (*D.*) *vitreum*. The radial lines are considerably less prominent in *P.* (*D.*) *simile* than in *P.* (*D.*) *vitreum*, and conspicuous only under the microscope. The posterior ear is large and distinctly marked off the disc in *P.* (*D.*) *simile*. The large, triangular byssal notch in the right valve is smooth in *P.* (*D.*) *simile*, while provided with ctenoidal teeth in *P.* (*D.*) *vitreum*.

Stratigraphic range. — Middle Miocene (JAKUBOWSKI 1977) — Recent.

Genus *Chlamys* RÖDING, 1798
Subgenus *Chlamys* (*Aequipecten*) FISCHER, 1886
Chlamys (*Aequipecten*) *malvinae* (du BOIS de MONTPÉREUX, 1831)

(pl. 4: 5, 7, 10a—b)

1831. *Pecten Malvinae* Nov.; du BOIS de MONTPÉREUX, 71—72, pl. 8: 2—3.
1831. *Pecten flavus*, Nov.; du BOIS de MONTPÉREUX, 72, pl. 8: 7.
1831. *Pecten rectangulus*, Nov.; du BOIS de MONTPÉREUX, 72, pl. 8: 10—11.
1831. *Pecten pulchellinus*, Nov.; du BOIS de MONTPÉREUX, 70, pl. 8: 8.
part. 1850. *Pecten scabriolus* m.; EICHWALD, 49, pl. 4: 6, *non* pl. 4: 4—5.
part. 1853. *Pecten scabriolus* m.; EICHWALD, 63—66, pl. 4: 6.
1867. *Pecten Malvinae* DUBOIS; HÖRNES, 414—415, pl. 64: 5a—c.
1897*a*. *Aequipecten Malvinae* (DUB.); SACCO, 16.
1897*a*. *Aequipecten Malvinae* var. *acuticostulata* SACC.; SACCO, 16, pl. 3: 36—40.
1907. *Pecten flavus* DUB. +*P. Neumayri* HILB.; FRIEDBERG, 34—35, Pl. 2: 9.
1907. *Pecten flavus* DUB.; FRIEDBERG, 32—33, pl. 3: 1a—c.
1907. *Pecten flavus* var. *rectangulus* DUB.; FRIEDBERG, 33—34, pl. 3: 2.
1920. *Pecten* (*Aequipecten*) *seniensis* LAMARCK var. *assimilata* MILLET; DOLLFUS and DAUTZENBERG, 416, pl. 37: 20.
1936. *Chlamys* (*Aequipecten*) *Malvinae* DUB.; FRIEDBERG, 228—230, pl. 38: 8—11.
1939. *Chlamys Malvinae* DUBOIS; ROGER, 144—146, pl. 18: 2—6.
1956. *Chlamys* (*Aequipecten*) *malvinae malvinae* (DUBOIS, 1831); TEJKAL, 54—55, pl. 5: 8.
1956. *Chlamys* (*Aequipecten*) *malvinae* (DUBOIS), 1851, EAMES and COX, 57.
1960. *Chlamys malvinae* (DUBOIS); CSEPREGHY-MEZNERICS, 27—28, pl. 18: 14—19.
1960. *Chlamys flava* (DUBOIS); CSEPREGHY-MEZNERICS, 29, pl. 19: 7—8.
1960? *Chlamys diaphana* (DUBOIS); CSEPREGHY-MEZNERICS, 29—30, pl. 19: 16—17.
1963. *Chlamys malvinae* (DUBOIS); VENZO and PELOSIO, 151—152, pl. 51: 4—4a.
1965*b*. *Lyropecten* (*Aequipecten*) *malvinae* (DUBOIS de MONTPÉREUX, 1851); GLIBERT and VAN de POEL, 26.
1979*b*. *Chlamys* (*Aequipecten*) *flava* (du BOIS de MONTPÉREUX, 1831); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 88, pl. 4: 1—2 (*cum syn.*).

Material. — Rybnica 1—12 valves; Rybnica 2—12 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1603/$_1$	13.6	13.8
MZ VIII Ml-1603/$_2$	8.0	8.2
MZ VIII Ml-1603/$_3$	6.8	7.6

Description. — Shell is equivalve, slightly convex, suborbicular in outline, equilateral. Small, weakly prosogyrate beak slightly projects above the hinge margin, the latter being somewhat concave in the right valve but straight in the left valve. Apical angle ranges from 85° to 101°, no regular relationship being observed between this angle, shell size, and rib number (see Table 4).

Table 4
Shell measurements of *Chlamys* (*Aequipecten*) *malvinae* du Bois de Montpéreux

	Length	Height	Apical angle	Rib number
Left valve	5.1	5.6	85	34
	5.6	5.8	88	36
	6.6	7.2	88	40
	7.4	7.4	93	29
	14.5	15.0	101	36
Right valve	6.1	6.1	98	41
	7.4	7.0	90	42
	9.3	9.5	92	36
	13.5	13.4	101	38
	15.3	16.2	89	40

Ears are medium-sized. Anterior ear in the right valve is ornamented with 7—8 ribs, the thickest and most prominently scaled one being placed near the hinge margin. The weakest rib is that one located at the suture of the ear and disc; it is separated from the remaining ribs by a triangular, flattened fasciola, covered with fine, densely spaced concentric lines. Byssal notch is not very deep. There are 5 ctenoidal teeth at the prolongation of the ctenolium. Anterior ear in the left valve is smaller than in the right one, ornamented with 10 ribs with scales formed at the intersection of ribs and distinct concentric lines. Posterior ears in both the valves are smaller than the anterior ones. They are ornamented with 7 ribs each and ended with a right angle.

External surface of the disc is covered with triangular, rounded, very distinct ribs. The ribs are similar in both the valves, ranging from 29 to 42 in number. Growth stages are fairly distinct from one another.

Hinge is of isodont type, with the following formula:

RV c.c.AIII — c.c.PIII
r
c.c.AI — c.c.PI

LV c.c.AIV — c.c.PIV
r
c.c.AII — c.c.PII

(c.c. — cardinal crus; A — anterior; P — posterior; I, II — inferior; III, IV — superior)

Cardinal crura are distinct in both the valves. They are placed to the both sides of the triangular resilifer, the latter being divided by two lamelliform projections into three triangular parts. The biggest part, the median one, gives place for the attachment of the fibrous, elastic portion of the resilium.

Hinge in the right valve: c.c.AI is somewhat arched, more distinct than the straight c.c.AIII which is almost parallel to the hinge margin; c.c.PI and c.c.PIII are straight, equal in length.

Hinge in the left valve: c.c.AII is oblique, approximating half the length of c.c.AIV which is straight, parallel to the hinge margin; c.c.PII is oblique, approximating 2/3 of the straight c.c.PIV in length; anterior auricular crus is distinct.

Pallial line shows no sinus; it is distant from the ventral margin. Adductor muscle scar is large, oval in shape, indistinct. Internal ribs extend far inside the shell.

Remarks. — The specimens from Rybnica and from FRIEDBERG's collection (from Szuszkowce among others, which is the type locality) as well as the figures given by the authors referred to in the synonymy have permitted the investigations of the ontogenetic changes in ornamentation in *Ch. malvinae*. The following developmental stages have been distinguished:
1st stage — up to 3—4 mm in shell height: shell is smooth;
2nd stage — up to 6—7 mm in shell height: 29—42 triangular ribs appear;
3rd stage — up to 22 mm in shell height: concentric ornamentation appears, at first in form of densely spaced, fine lines, V-shaped in grooves, while weaker, rounded, sometimes scaled on the ribs; shells being more than 10 mm high show straight, rarely spaced concentric lines, conspicuous only in grooves, while the ribs are smooth and more rounded than at the earlier stages;
4th stage — up to 40 mm in shell height: ribs divide each into a fascicle of 3 to (rarely) 4 riblets, the median of which is the highest; concentric ornamentation is very prominent due to the scales on the ribs;
5th stage — over 45 mm in shell height: scaly riblets arise in interrib grooves.

Shells of the stage 3 have been attributed by the majority of authors to *Ch. flava*, while shell of the stages 4 and 5 have been assigned to *Ch. malvinae*. The presence or absence of riblets in grooves between the ribs has been considered as the criterion to distinguish between these two species. According to this definition, *Ch. flava* could never be larger than 24 mm in shell height. HÖRNES (1867), as well as FRIEDBERG (1936) stated that some ribs near the ventral margin become flattened in the largest specimens of *Ch. flava*, being suggestive of a tendency to bifurcation: the other ribs become subdivided each into the initial fascicle. The same authors stated in their descriptions of *Ch. malvinae* that the secondary ornamentation (i.e. riblets) appears close to the midheight of the shell; whereas the largest specimens described by HÖRNES (1867) are 46.0 mm high, those described by FRIEDBERG (1936) achieve 60.0 mm in height.

TEJKAL (1956) considered *Ch. flava* to be a subspecies of *Ch. malvinae* because of the variability in ornamentation, rib number (28 to 42), and apical angle (82° to 110°). According to TEJKAL, any secondary radial ornamentation is lacking in the subspecies *flava*, the adults of the latter being smaller-sized than the adults of *malvinae*. TEJKAL's collection, derived from the sandy sediments of Kimberk (Czechoslovakia), included 171 specimens up to 16 mm high assigned to *Ch. malvinae flava*, and 3 specimens 25 mm high, with riblets close to the ventral margin, attributed to *Ch. malvinae malvinae*.

The present author is of the opinion that the absence of secondary ornamentation and the smaller shell size are juvenile features. There is therefore little doubt that *Ch. flava* represents the immature form of *Ch. malvinae* (du BOIS). According to I.C.Z.N. art. 24a, the latter name should be retained.

The present author disagrees with WOOD (1850: 35—37) who claimed that *Ch.* (*A.*) *malvinae*, and possibly the other species of *Pecten* established by du BOIS de MONTPÉREUX (1831), namely *flavus*, *pulchellinus* and *rectangulus*, are younger synonymes of *Ch.* (*A.*) *opercularis* (LINNÉ, 1758). The specimens figured by WOOD (1850, pl. 6: 2a—c) as *P. opercularis* have 19—22 triangular ribs each, separated with very narrow, plane grooves; while the shell of *Ch.* (*A.*) *malvinae* bears 29—42 rounded ribs. The rib sculpture, as figured by WOOD in *P. opercularis*, also makes a difference from *Ch.* (*A.*) *malvinae*, but it closely resembles the sculpture of immature individuals of *Ch.* (*A.*) *scabrella* LAMARCK, 1819. Hence, HÖRNES (1867: 414) was undoubtedly mistaken when having included *P. opercularis* from WOOD's paper in the synonymy of *Ch.* (*A.*) *malvinae*.

Stratigraphic range. — Early Miocene (EAMES and COX 1956) — Middle Miocene (ROGER 1939).

Chlamys (*Aequipecten*) *scabrella* (LAMARCK, 1819)

(pl. 3: 9, pl. 4: 1a—b, 2a—b, 3a—b, 4a—b, 6a—b)

1882. *Pecten Niedźwiedzkii* HILBER, *nova forma*; HILBER, 25, pl. 3: 1—2.
1882. *Pecten Lomnicki* HILBER, *nova forma*; HILBER, 25, pl. 3: 3.
1897*b*. *Aequipecten* (an *Argopecten*) *scabrellus* (LK.) et var.; SACCO, 24—28, pl. 8: 1—6, pl. 8: 12 var. [*planoundulata* SACC.], pl. 8: 13—14 [var. *planolaevis* SACC.], pl. 8: 26—32 [var. *taurolaevis* SACC.], pl. 8: 33—36 [var. *tautogibbula* SACC.].
1907. *Chlamys* (*Aequipecten*) *scabrella* LK. sp.; CERULLI-IRELLI, 92—93, pl. 5: 17—18.
1907. *Pecten Romanii* n. sp.; FRIEDBERG, 27—29, text-fig. 6, pl. 2: 2a—b.
1910. *Aequipecten scabrellus* LAM. et var.; SCHAFFER, 33—34, pl. 15: 9—12, pl. 15: 13—16 [var. *Bollenensis* MAY.], pl. 15: 17—19, pl. 16: 1 [var. *taurolaevis* SACCO], pl. 16: 2—3 [var. *inflata* SCHAFF.].
1914. *Chlamys* (*Aequipecten*) *scabrella* (LAMARCK); var. *girondica* nov. var.; COSSMANN and PEYROT, 320—322, pl. 17: 18—21.
1914. *Chlamys* (*Aequipecten*) *liberata* nov. sp.; COSSMANN and PEYROT, 326—328, pl. 17: 14—17.
1920. *Pecten* (*Aequipecten*) *seniensis* LAMARCK; DOLLFUS and DAUTZENBERG, 411—417, pl. 27: 8—20.
1932. *Chlamys seniensis* LAM. var. *Lomnickii* HILB.; FRIEDBERG, 52, pl. 3: 2.
1936. *Pecten* (*Aequipecten*) *seniensis* Lam. et var.; FRIEDBERG, 220—225, pl. 37: 3, pl. 37: 9—10 [var. *Niedźwiedzki* HILB.], pl. 37: 5—8 [var. *Łomnickii* HILB.], pl. 37: 4 [var. *bollenensis* MAY.].
1938. *Chlamys seniensis* LAM.; FRIEDBERG, 10.
1939. *Chlamys scabrella* LAMARCK; ROGER, 104—107, pl. 12: 8, 9, 9a, 10, 10a, pl. 13: 3—12.
1945. *Pecten* (*Aequipecten*) *seniensis* LAMARCK, 1819; GLIBERT, 72—73, pl. 36: 6.
1950. *Pecten* (*Aequipecten*) *scabrellus* LAMARCK; HEERING, 13, pl. 1: 21, pl. 2: 24, 27, 28, 30.
1957. *Chlamys scabrella* (LAM.) var. *lomnickii* (HILB.); KRACH, 345, pl. 49: 4—5.
1959. *Chlamys* (*Aequipecten*) *seniensis* (LAMARCK, 1819); ANDERSON, 98—99, pl. 14: 8a—b.
1960. *Chlamys scabrella* (LAMARCK) et subspecies; CSEPREGHY-MEZNERICS, 20—21, pl. 12: 2—20, pl. 14: 3—15 [*Ch. s. lomnickii* (HILBER)], pl. 14: 16—21 [*Ch. s. niedźwiedzkii* (HILBER)].
1962. *Chlamys scabrella* LK.; BONI and SACCHI VIALLI, 98—109, pl. 13: 4, 8, 9, 11, 18.
1963. *Chlamys scabrella* (LAMARCK); TAVANI and TONGIORGI, 16, pl. 6: 4, pl. 7: 3, pl. 9: 6, pl. 10: 1, 3—6, pl. 11: 2.
1972. *Chlamys* (*Argopecten*) *seniensis* (LAMARCK), 1819, CAPROTTI, 59, pl. 1: 3.
1974. *Chlamys* (*Aequipecten*) *seniensis* (LAMARCK, 1819); MALATESTA, 47—48, pl. 3: 6a—b.
1976. *Chlamys* (*Aequipecten*) *seniensis* (LK.); BRAMBILLA, 100, pl. 25: 3—4.
1977. *Chlamys* (*Aequipecten*) *scabrella* (LAMARCK, 1819); JAKUBOWSKI *in* JAKUBOWSKI and MUSIAŁ, 95, pl. 8: 1—4.
1979*a*. *Chlamys* (*Aequipecten*) *scabrella scabrella* (LAMARCK, 1819); JAKUBOWSKI *in* JAKUBOWSKI and MUSIAŁ, 55, pl. 3: 2.

Material. — Rybnica 1—39 valves; Rybnica 2—1 shell, 32 valves.

Dimensions (in mm):

	L	H	A
MZ VIII Ml-1604/$_1$	38.5	36.0	108°
MZ VIII Ml-1604/$_2$	27.5	26.0	103°
MZ VIII Ml-1604/$_3$	25.0	24.5	101°
MZ VIII Ml-1604/$_4$	23.0	23.0	107°
MZ VIII Ml-1604/$_5$	16.5	15.5	108°
MZ VIII Ml-1604/$_6$	9.0	10.0	91°

Description. — Shell is inequivalve, the right valve being more convex than the left one. Valves are inequilateral, their somewhat concave posterodorsal margin is longer than the straight anterodorsal margin. Small, orthogyrate beak slightly projects above the hinge margin which is straight in the left valve, while somewhat concave in the right one. In small forms, the beak is weakly prosogyrate. Apical angle ranges from 91° in smaller forms up to 109° in large forms, but commonly equals 98°—100°. There are 5 riblets and small triangular fasciola at the anterior ear of the right valve. Both the fasciola and the ribletes are ornamented with densely spaced concentric lines forming fine scales on the riblets. Four ctenoidal teeth are placed in a shallow, triangular byssal notch; the ctenolium is very distinct. Posterior ear of the right valve is somewhat concave at the base. It is ornamented with 8 riblets bearing scales; however, the latter are

weaker than those on the riblets at the anterior ear. Anterior ear of the left valve bears 6 riblets, two of which, placed close to the suture line of the ear and disc, are covered with distinct, densely spaced scales. Posterior ear of the left valve, smaller and less concave at the base than the anterior one, is ornamented with 5—6 weak riblets.

External surface of the disc in sculptured with 14—18 rounded ribs and 2—7 delicate riblets placed near the dorsal margin. Rounded grooves are as wide as the ribs. Concentric lamellae in the grooves are straight or bent toward the ventral margin. They are more closely spaced on the ribs than in the grooves. The tops of the ribs are smooth or ornamented each with one row of scales sloping toward the ventral margin (pl. 4: 3b). Some 15 mm from the beak, at a certain growth stage, three rows of scales appear on the ribs. Another row of scales appears some 20 mm from the beak, at a further growth stage. In some specimens, subsequent rows of scales appear due to a modification of the outline of concentric lamellae, without any specified relation to the growth stages. The ribs become almost rectangular in cross section when the secondary ornamentation appears on their surface (pl. 4: 4b) which takes place earlier on the right valve than on the left one. Large specimens, 37—40 mm high, have ribs each with 7 rows of scales near the ventral margin (pl. 4: 6b), the lateral rows being very weak. In such a large specimens, additional riblets appear in grooves near the ventral margin. The first two additional riblets are placed close to the main ribs, the third one appears in the middle of the groove. Growth stages are very distinct.

In the right valve hinge consists of two pairs of cardinal crura; c.c.AI and c.c.PI are very oblique, their length being equal to 1/3 of the ear length; c.c.AIII and c.c.PIII are straight, parallel to the hinge margin, and almost as long as the latter.

In the left valve the hinge consists also of two pairs of cardinal crura; c.c.AII and c.c.PII are very oblique, subparallel to the margin of the resilifer, their length being equal to 1/4 of the ear length; somewhat oblique c.c.AIV and straight c.c.PIV are subequal to the ears in length.

There are two distinct anterior auricular crura and a weaker posterior auricular crus on the left valve, while the right valve bears only the posterior auricular crus. Adductor muscle scar is large, oval in shape, and very distinct.

Remarks. — Discussions on variability of *Chlamys scabrella* (LAMARCK) and on establishment of its type form are everlasting. DOLLFUS and DAUTZENBERG (1912) claimed that the two specific names *seniensis* and *scabrellus* were applied undoubtedly to two forms of a single species which should be named, according to the priority rule, *seniensis*, as this name had been mentioned by LAMARCK at the first place (LAMARCK 1819, 182—183, n° 20). The name *scabrella* however, is more widespread and refers to the form found more frequently, which was the base for BONI (1935), ROGER (1939), and BONI and SACCHI VIALLI (1962) to recognize it for valid.

HILBER (1882) described from the Polish Miocene two new species, *P. lomnickii* and *P. niedźwiedzkii*. DOLLFUS and DAUTZENBERG (1912) doubted whether these species are really independent and considered them to be morphological forms of *P. scabrellus*.

The present author's opinion is that two species *P. lomnickii* HILBER and *P. niedźwiedzkii* HILBER represent in fact subsequent stages in the ontogeny of *Ch.* (*A.*) *scabrella*. *P. lomnickii*, characterized by weak concentric ornamentation and secondary riblets near the ventral margin, is here considered to present juvenile stages. *P. niedźwiedzkii*, in turn, is characterized by distinct concentric ornamentation (scales on ribs) and secondary ribs beginning in the middle of the valve height. It is noteworthy that specimens identified as *Ch. s.* var. *lomnickii* have never been larger than ca 20 mm in height, while specimens attributed to *Ch. s.* var. *niedźwiedzkii* have been 35 mm — 40 mm high, but never less than ca 20 mm (!). These morphologic varieties of *Ch.* (*A.*) *scabrella* were raised by some authors to the subspecific level (CSEPREGHY-MEZNERICS 1960, JAKUBOWSKI 1977).

Stratigraphic range. — Early Miocene (DOLLFUS and DAUTZENBERG 1912) — Pliocene (ROGER 1939).

Chlamys (*Aequipecten*) aff. *zenonis* COWPER-REED, 1935
(pl. 4: 11)

1939? *Chlamys zenonis* COWPER-REED; ROGER, 133—135, pl. 16: 3—5.

Material. — Rybnica 1—5 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1605	13.0	13.0

Description. — Valve is slightly convex, suborbicular in outline, slightly inequilateral; posterodorsal margin is longer than the anterodorsal one. Small, orthogyrate beak is placed at the midlength of the straight hinge margin. The ears are preserved only on the left valve; the anterior one is provided with indentation at its base, while the posterior is ended perpendicularly.

External surface of the valve is covered with 20 narrow, triangular ribs, one of which, placed near the suture of the ear and disc, is narrower than the others. Grooves are wider than the ribs, sculptured with straight lamellae which are spaced more sparsely than on the ribs. Distinct scales are formed on the ribs by the ventrally bent lamellae. At the rib base weak slates, parallel to the ribs, are formed. Anterior ear is scultpured with 6 ribs, the upper three of which are wider, more sparsely spaced, and bear weaker scales than the remaining ribs. Posterior ear is covered with 5 ribs; the width of the grooves in between decreases towards the hinge margin. Concentric lamellae are distinct on both the ears. Scales on the ears are more prominent than those on the disc surface. The internal surface of the ears is partly damaged. Preserved are: cardinal crura c.c.AIV and c.c.PIV, one posterior auricular crus and two anterior auricular crura.

Remarks. — The investigated specimens from Rybnica are almost entirely consistent with the Pliocene species *Ch. zenonis* presented by ROGER (1939), except for the ornamentation of the ears. The specimens from Syria, described by ROGER (1939), as well as those from the Pliocene of the Cyprus described by COWPER-REED (1935; *fide* ROGER 1939) have their ears sculptured with 8—10 delicate ribs each, except for the anterior ear in the right valve bearing 5 coarser ribs.

The specimens from Rybnica resemble *Ch.* (*A.*) *radians* NYST, 1939, in the number, shape and ornamentation of the ribs, but differ from the latter in shape of posterior ear, number of ribs on the posterior ear (5 instead of 8—10, respectively), as well as in absence of fine, oblique lines on the marginal part of the valve.

The form under discussion is also similar to *Ch.* (*A.*) *opercularis* (LINNÉ 1758), especially to its variety *lateocostata* MONTEROSATO, the shell of which, however, shows more rectangular ribs, covered with scales weaker than in the former species. Furthermore, *Ch.* (*A.*) *opercularis* has its posterior ear in the left valve oblique and nearly twice shorter than the anterior ear, the surface of the former being covered with densely spaced, fine riblets; while the specimens from Rybnica have their ears subequal, straight, sculptured each with 5 wide ribs.

Stratigraphic range. — Middle Miocene (this paper).

Subgenus *Chlamys* (*Flexopecten*) SACCO, 1897

Chlamys (*Flexopecten*) *scissus* (FAVRE, 1869)
(pl. 4: 8—9, pl. 5: 1a—b, 2—4, 5a—b, 6—10, pl. 6: 1—2, 5—6, 9—10)

1869. *Pecten scissus* E. FAVRE; FAVRE, 152, pl. 13: 9.
1882. *Pecten scissus* E. FAVRE; HILBER, 21, pl. 2: 11—15.
1882. *Pecten scissoides* HILBER, *nova forma*; HILBER, 21, pl. 2: 19—20.
1882. *Pecten sub-scissus* HILBER, *nova forma*; HILBER, 21, pl. 2: 21.

1882. *Pecten Wulkae* HILBER, *nova forma*; HILBER, 22, pl. 2: 24—26.
1882. *Pecten Wulkae-formis* HILBER, *nova forma*; HILBER, 22, pl. 2: 27.
1882.? *Pecten posthumus* HILBER, *nova forma*; HILBER, 22, pl. 2: 33.
1882. *Pecten* (*Chlamys*) *Wolfi* HILBER, *nova forma*; HILBER, 28, pl. 3: 14—15.
1882. *Pecten* (*Pseudoamussium*) *resurrectus* HILBER, *nova forma*; HILBER, 29—30, pl. 3: 18.
1882. *Pecten* (*Pseudoamussium*) *Richthofeni* HILBER, *nova forma*; HILBER, 30, pl. 3: 19, pl. 4: 1.
part. 1902. *Pecten Neumayri* HILB.; SIMIONESCU, 10—11, pl. 1: 5.
1932. *Chlamys* (*Flexopecten*) aff. *flexuosa* POLI var. *plioparvula* SACCO; FRIEDBERG, 55, pl. 3: 7—8.
1932. *Chlamys* (*Flexopecten*) *scissa* FAVRE et var.; FRIEDBERG, 55—57 [var. *Wulkae*, var. *wulkaeformis*].
1932. *Chlamys* (*Flexopecten*) *resurrecta* HILB.; FRIEDBERG, 57.
1936. *Chlamys* (*Flexopecten*) *rybnicensis* FRIEDB.; FRIEDBERG, 235—236, pl. 39: 11—15.
1936. *Chlamys* (*Flexopecten*) *scissa* FAVRE et var.; FRIEDBERG, 236—240, pl. 39: 16—20, pl. 40: 1—2, pl. 40: 3—5 [var. *Wulkae* HILB.], pl. 40: 6 [var. *wulkaeformis* HILB.].
1936. *Chlamys* (*Flexopecten*) *Wolfi* HILB.; FRIEDBERG, 246—247, pl. 41: 5—8, pl. 42: 1.
1938. *Chlamys rybnicensis* FRIEDB.; FRIEDBERG, 11.
1938. *Chlamys scissa* FAVRE var. *Wulkae* HILB.; FRIEDBERG, 12.
1939. *Chlamys Wolfi* HILBER; ROGER, 193—194, pl. 19: 21—22, 22a.
1939. *Chlamys scissa* FAVRE; ROGER, 187—189, pl. 19: 7—16.
1939. *Chlamys rybnicensis* FRIEDBERG; ROGER, 199—200, text-fig. 100.
part. 1945. *Pecten* (*Pallium*) *lilli* PUSCH [=*P. lamai* NYST]; GLIBERT, 73—77, pl. 5: 1a—j.
1957. *Chlamys scissa* FAVRE et var.; KRACH, 330—335, pl. 45: 1—4 [var. *richthofeni* (HILB.)], pl. 45: 5—7, 9, pl. 46: 1, pl. 49: 3 [var. *wulkae* (HILB.)].
1960. *Chlamys scissa* (FAVRE) et subspecies; CSEPREGHY-MEZNERICS, 34, pl. 32: 8, pl. 35: 1—6 [*Ch. s. scissa* FAVRE], pl. 35: 7—9 [*Ch. s. wulkae* HILBER].
1960. *Chlamys* (*Manupecten*) *lilli* var. *scissa* (FAVRE 1869); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 72, pl. 25: 4—5.
1960. *Chlamys* (*Manupecten*) *wolfi* (HILBER 1882); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 72, pl. 25: 6.
1962. *Chlamys scissa* (FAVRE) et var.; WOŹNY, 292, pl. 1: 2—3, pl. 1: 1 [var. *richthofeni* (HILB.)].
1967. *Chlamys scissa* (FAVRE) et subspecies; KRACH, 216—219, pl. 6: 13—17 [*Ch. s. scissa* (FAVRE)], pl. 6: 10—12, 18—19 [*Ch. s. wulkae* (HILB.)], pl. 6: 20—21, pl. 7: 8—11 [*Ch. s. resurrecta* (HILB.)], pl 7: 1—7 [*Ch. s. richthofeni* (HILB.)], pl. 7: 15—16 [*Ch. s. wolfi* (HILB.)].
1977. *Pseudamussium scissa wulkae* (HILBER, 1882); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 92, pl. 7: 2—6.
part. 1979*b*. *Chlamys* (*Chlamys*) *kneri* (HILBER, 1882); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 87—88, pl. 3: 8—12, 14—15.

Material. — Rybnica 1—38 valves; Rybnica 2—130 valves; Świniary — 70 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml-1606/$_1$	43.5	43.0
MZ VIII Ml-1606/$_2$	41.0	40.0
MZ VIII Ml-1606/$_3$	31.0	33.0
MZ VIII Ml-1606/$_4$	29.0	31.0
MZ VIII Ml-1606/$_5$	17.0	16.5
MZ VIII Ml-1606/$_6$	16.5	16.5
MZ VIII Ml-1606/$_7$	13.0	13.5
MZ VIII Ml-1606/$_8$	13.0	13.0
MZ VIII Ml-1606/$_9$	12.6	13.0
MZ VIII Ml-1606/$_{10}$	11.0	11.5
MZ VIII Ml-1606/$_{11}$	10.8	11.0
MZ VIII Ml-1606/$_{12}$	10.0	10.5
MZ VIII Ml-1606/$_{13}$	9.5	10.0
MZ VIII Ml-1606/$_{14}$	8.2	8.6
MZ VIII Ml-1606/$_{15}$	7.5	8.0
MZ VIII Ml-1606/$_{16}$	7.0	7.2
MZ VIII Ml-1606/$_{17}$	6.8	7.0
MZ VIII Ml-1606/$_{18}$	6.5	7.0

Remarks. — The abundant and well preserved material from Rybnica supplemented with material from Świniary (coll. W. J. PRZYBYSZEWSKI) has allowed to recognize the species *Chlamys* (*Flexopecten*) *rybnicensis* FRIEDBERG, 1936 for immature stages of *Ch.* (*F.*) *scissus* (FAVRE, 1869). In fact, the observed variation in apical angle (90°—120°) and ornamentation much exceeds the range given by FRIEDBERG (1936) in the diagnosis of *Ch.* (*F.*) *rybnicensis*. It concerns the number and width of radial ribs, as well as the conspicuousness of concentric ornamentation. Thus, the following species established by HILBER (1882) should be treated as morphological varieties of *Chlamys* (*F.*) *scissus*, connected with transitional forms: *Pecten scissoides*, *P. resurrecta*, *P. richthofeni*, *P. wulkae*, *P. wulkaeformis*, and *P. wolfi*.

A similar, but not identical, pattern of variability in *Ch.* (*F.*) *scissus* was described by GLIBERT (1945), KRACH (1957, 1967, 1968) and WOŹNY (1962); nevertheless, KRACH (1967) considered the particular morphotypes as distinct subspecies of *Ch.* (*F.*) *scissus*.

Still another pattern of ornamentation variability was described by SIMIONESCU (1902) who demonstrated that 3 out of Hilber's forms, i.e. *P. wolfi*, *P. neumayri*, and *P. kneri*, are in fact morphotypes of a single species which should be named, according to SIMIONESCU, *P. neumayri*. JAKUBOWSKI (1977) confirmed that conclusions, but proposed, for unknown reasons, the name *Ch. kneri* instead of *Ch. neumayri*.

A continuous variation in ornamentation, the interrelationships among various shell parameters being constant, has also been reported in other species of the subgenus *Flexopecten*, e.g. *Ch.* (*F.*) *tigerinus* (MÜLLER, 1776), *Ch.* (*F.*) *flexuous* (POLI, 1795) and *Ch.* (*F.*) *islandicus* (MÜLLER, 1776) (see GLIBERT 1945, KRACH 1967), and also in various species of the Recent Pacific counterpart of *Flexopecten*, namely the subgenus *Swiftopecten* HERTLEIN, 1936 (SINELNIKOVA 1975).

Stratigraphic range. — Middle Miocene (FRIEDBERG 1936) — Late Miocene (GLIBERT 1945).

Genus *Pecten* MÜLLER, 1776
Subgenus *Pecten* (*Flabellipecten*) SACCO, 1897
Pecten (*Flabellipecten*) *subarcuatus* TOURNOUËR, 1874
(pl. 3: 4a—b)

1879. *Pecten Styriacus* HILB.; HILBER, 40—41, pl. 6: 13—15.
1920. *Pecten subarcuatus* TOURNOUËR; DOLLFUS and DAUTZENBERG, 401—403, pl. 36: 1—6.
1928. *Pecten subarcuatus* TOURN. var. *styriaca* HILBER; KAUTSKY, 248—249, pl. 7: 10.
1943. *Pecten Fuchsi* FONT.; STRAUSZ and SZALAI, 121, pl. 1: 38, 40, 43.
1954. *Pecten subarcuatus styriacus* HILBER; CSEPREGHY-MEZNERICS, 71, pl. 9: 14—15.
1960. *Pecten fuchsi styriacus* HILBER; CSEPREGHY-MEZNERICS, 11, pl. 3: 5, 12.
1965*b*. *Pecten* (*s. s.*) *subarcuatus styriacus* HILBER, 1879; GLIBERT and VAN de POEL, 21.

Material. — Rybnica 1—1 left valve.
Dimensions (in mm):

	L	H
MZ VIII Mł-1608	10.0	10.0

Description. — Valve is small, concave, almost orbicular in outline. Small, orthogyrate beak is placed before the valve midline and slightly projects above the straight hinge margin. Apical angle equals 100°. Ears are subequal, the anterior one, ended perpendicularly, being somewhat smaller than the posterior which is cut obliquely.

External surface is ornamented with 21 smooth, triangular, rounded ribs, separated from one another with wider, flattened grooves. Three marginal ribs are weaker and narrower than the others. The ears are devoid of ribs. Growth stages are distinct.

Hinge is of isodont-type. Only upper cardinal crura, i.e. c.c.AIV and c.c.PIV, are distinct, because of poor preservation state. They have form of straight lamellae, parallel to the cardinal margin, their length approximating 3/4 of the ears in length. Auricular crura are distinct, the posterior one being somewhat longer than the anterior. Pallial line shows no sinus; it is distant from the costate ventral margin. Adductor muscle scar is indistinct.

Remarks. — The species under discussion shares many features in common with immature individuals of *P.* (*F.*) *besseri* Andrzejowski, 1830. It differs from the latter in its smaller apical angle (100° and 130°, respectively), less rounded ribs, and ornamentation characteristics. The external surface of the left valve is ornamented with 20—21 ribs in *P.* (*F.*) *besseri*, covered with densely spaced concentric lamellae which are arched on the ribs as well as in the grooves towards the ventral margin (FRIEDBERG 1907, 36—39, pl. 3: 3—5). The left valve of *P.* (*F.*) *subarcuatus* is covered with 16—21 ribs; its concentric ornamentation is weaker than in *P.* (*F.*) *besseri*, or it is lacking at all (CSEPREGHY-MEZNERICS 1960). The similarity of these two species is striking enough to explain many mistakes in identification of small individuals of *P.* (*F.*) *subarcuatus* and *P.* (*F.*) *besseri*.

For example, some specimens without concentric ornamentation derived from the Viennese collection assembled by M. HÖRNES (1867: 404—406) and attributed by him to *P. besseri* belong, according to SIEBER (1955), to *P. subarcuatus styriacus* (HILBER, 1879). DOLLFUS and DAUTZENBERG (1920: 401—403) included the specimens from Podhorce, which HILBER (1882, 30—31, pl. 4: 3—4) had identified as *P. besseri*, to the synonymy of *P. subarcuatus*.

The form *P. besseri* illustrated by DEPERET and ROMAN (1910, 121, text-fig. 52) is, according to KAUTSKY (1928: 248—249), indistinguishable from *P. subarcuatus* var. *styriaca*. The latter is, in KAUTSKY's opinion, an intermediate form between *P.* (*F.*) *fuchsi* FONTANNES, 1878, which it resembles in its outline, and *P.* (*F.*) *subarcuatus*, with which it shares the beak shape and valve convexity. The similarity of *P.* (*F.*) *fuchsi* to *P.* (*F.*) *subarcuatus* is so striking, that IVOLAS and PEYROT (1900) treated them as a single species, named *P. subarcuatus*, according to priority rule. *P.* (*F.*) *fuchsi* was considered by TOURNOUËR (*fide* IVOLAS and PEYROT 1900: 183) as a Redonian (Late Miocene) variety of *P. subarcuatus*. DOLLFUS and DAUTZENBERG (1920: 401—403) in turn, claimed that *P. fuchsi* described by DEPERET and ROMAN (1907, pl. 1: 7, 10) doubtlessy represent *P. subarcuatus*.

The investigated specimen of *P. subarcuatus* from Rybnica is entirely consistent with the specimen figured by DOLLFUS and DAUTZENBERG (1920, pl. 36: 3), while the remaining specimens from Pontlevoy (DOLLFUS and DAUTZENBERG 1920, pl. 36: 1—2, 4) are more flabelliform in shape, of the same apical angle, due to their concave dorsal margins. The same features make a difference between the specimen of *P.* (*F.*) *subarcuatus* from Rybnica and *P. styriaca* HILBER, 1879, as described from St. Florian, Austria (HILBER 1879, 40—41, pl. 6: 13—15).

Stratigraphic range. — Middle Miocene (DOLLFUS and DAUTZENBERG 1920) — Late Miocene (IVOLAS and PEYROT 1900).

Family **Plicatulidae** WATSON, 1930
Genus *Plicatula* LAMARCK, 1801
Subgenus *Plicatula* (*Plicatula*) LAMARCK, 1801
Plicatula (*Plicatula*) *striata* DEFRANCE, 1825
(pl. 7: 1a—b, 4)

1914. *Plicatula ruperella* DUJARDIN; COSSMANN and PEYROT, 374—375, pl. 18: 23, pl. 20: 9—13.
1920. *Plicatula striata* DEFRANCE; DOLLFUS and DAUTZENBERG, 458—459, pl. 40: 3—10.
1936. *Plicatula ruperella* DUJ.; FRIEDBERG, 206—207, pl. 31: 8—14.
1965*b*. *Plicatula striata* DEFRANCE, 1826; GLIBERT and VAN de POEL, 46.

Material. — Rybnica 1—23 left valves; Rybnica 2—1 left valve.
Dimensions (in mm):

	L	H
MZ VIII MI-1609/$_1$	10.0	14.0
MZ VIII MI-1609/$_2$	6.5	8.0

Remarks. — The investigations of COUFFON (1903, *fide* DOLLFUS and DAUTZENBERG 1920) and SACCO (1898) allowed DOLLFUS and DAUTZENBERG (1920) to recognize the following specific names for synonymous: *Plicatula miocaenica* MICHELOTTI, 1847; *P. striata* DEFRANCE, 1825; *P. rugulosa* MILLET, 1854; and *P. rupercila* DUJARDIN, 1835. According to priority rule, the species should be named *P. striata*.

The specimens from Rybnica closely correspond to the figures and descriptions referred to in the synonymy.

The left valve changes in shape during ontogeny. Juvenile valve is suborbicular in outline, with short dorsal margin, above which small, acute beaks project. Adult valve, in turn, is rather flattened, oval-shaped (height > length), slightly posteroventrally elongated, with small, opisthogyrate beak which does not project above the short and straight dorsal margin. The hinge also changes during ontogeny; it consists of two very narrow and projecting crura, which are transversally furrowed on the internal side of the triangular resilifer. Crura are strongly divergent in juveniles (pl. 7: 4) while nearly parallel to each other and perpendicular to the dorsal margin in adults (pl. 7: 1a). Two ridges simulating the second pair of crura are placed near the resilifer, being parallel to its edge. Small specimens have these ridges nearly as prominent as the proper crura.

The species *P.* (*P.*) *striata* is allied with *P.* (*P.*) *mytilina* (PHILIPPI, 1836) from which it differs in shell sculpture. The external surface of the shell of *P.* (*P.*) *mytilina* is ornamented with irregular concentric lamellae and irregular radial folds, the number of which increases during ontogeny. Valves 7.0 mm high are ornamented with 6—8 folds each, beginning at the midheight (see FRIEDBERG 1936: 207—208), while valves 13.0 mm high are covered with 15—18 folds each. Small specimens of *P.* (*P.*) *mytilina* have their concentric lamellae distinctly imbricated near the ventral margin, the lamellae forming tubules in some larger specimens (see HÖRNES 1867, pl. 67: 5). In turn, the external surface of the shell of *P.* (*P.*) *striata* is finely granulated and sculptured with distinct, narrow, radial ribs; the ribs are scaled by intersection with irregular concentric lamellae.

Stratigraphic range. — Early Miocene (DOLLFUS and DAUTZENBERG 1920) — Middle Miocene (FRIEDBERG 1936).

Superfamily **Anomiacea** RAFINESQUE, 1815
Family **Anomiidae** RAFINESQUE, 1815
Genus *Pododesmus* PHILIPPI, 1837
Subgenus *Pododesmus* (*Heteranomia*) WINCKWORTH, 1922
Pododesmus (*Heteranomia*) *squamulus* (LINNÉ, 1758)
(pl. 6: 3—4, 7)

1850. *Anomia aculeata* MÜLLER; WOOD, 2—3, pl. 1: 2a—b.
1881. *Anomia ephippium*, LIN., et var.; NYST, 142—143; 1878, pl. 10: 3a—l.
1882. [*Anomia ephippium* LINNÉ] var. *squamula* LINNÉ; BUCQUOY *et al.*, 37—39, pl. 9: 4—7.
1897*a*. *A.*[*nomia*] *ephippium* var. *squamula* L. (an juv.); SACCO, 32, pl. 10: 3—4.
1922. [*Heteranomia*] *squamula*, L. 1758 = *A. aculeata*, MÜLLER; WINCKWORTH, 33—34, pl. 1: 5—7, 12.
1957*b*. *Heteranomia squamula* LINNÉ, sp. 1758; GLIBERT, 34, pl. 1: 16.
1962. *Anomia aculeata* GMELIN; MERRILL, 131—138, pl. 14: 1—6.
1972. *Anomia ephippium rugulosostriata* BRONN, 1831; JAKUBOWSKI, 63—67, text-pl. 2: 1—27, pl. 2: 1—27.

1977. *Anomia ephippium rugulosastriata* BRONN, 1831; JAKUBOWSKI, in JAKUBOWSKI and MUSIAŁ, 96—97, text-pl. 5: 18—35, pl. 6: 8—12.

1977. *Pododesmus* (*Heteranomia*) *squamulus* (LINNÉ, 1758); MARASTI and RAFFI, 24.

1979*a*. *Pododesmus* (*Heteranomia*) *squamula* (LINNAEUS, 1758); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 55, pl. 3: 4—6.

1979*b*. *Pododesmus* (*Heteranomia*) *squamula* (LINNAEUS, 1758); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 90, pl. 5: 4—9.

Material. — Rybnica 1—34 left valves, 2 right valves; Rybnica 2—132 left valves, 21 right valves.

Dimensions (in mm):

	L	H
MZ VIII Mł-1610/$_1$	7.5	5.0
MZ VIII Mł-1610/$_2$	6.2	6.5
MZ VIII Mł-1610/$_3$	5.5	5.0

Description. — Shell is small, fragile, transparent, inequivalve. Right valve is smaller than the left one; it is oval in outline, tranversally elongated, flattened, with small, suborbicular byssal aperture. Left valve, serving as an operculum, is variable in outline. The specimens from Rybnica are commonly oval, posteroventrally elongated, very convex near the beak, ineqeuilateral, with the posterior part accounting for 67%—85% of the valve length. Valves suborbicular in shape, with height sometimes exceeding the length, very convex and equilateral, are less common. Very small, orthogyrate beak is placed close to the dorsal margin. Triangular umbo considerably projects above the dorsal margin; it is reinforced by white, smooth pseudoprodissoconch which bears a distinct byssal notch in the anterior part of the ventral margin.

The following types of sculpture of the left valve can be distinguished:

1. external surface smooth, with very fine, concentric lines, occasionally also with white concentric belts;
2. umbonal part smooth, the rest of the valve ornamented with distinct, erected, imbricated scales, forming more or less densely spaced radial lines;
3. umbonal part ornamented with radial sculpture, the remainder of the valve surface smooth;
4. the whole external surface sculptured with scales.

Growth stages are indistinct.

Internal ligament is placed beneath the beak in a semilunar ligamental groove. There are two muscle scars in the left valve: byssal muscle scar and adductor muscle scar. The former, located higher up, is larger; the latter, inferior, is slightly shifted posteriorly. Internal margin is smooth.

Remarks. — The species *P.* (*H.*) *squamulus* is frequently misidentified with juveniles of *Anomia* (*Anomia*) *ephippium* LINNÉ, 1758 (see e.g. GLIBERT 1945, MERRILL 1962, JAKUBOWSKI 1972, 1977). However, two muscle scars in the left valve make it different from the latter species. If muscle scars are indistinct or invisible, the identification of juvenile shells of *A.* (*A.*) *ephippium* is very difficult.

The investigations of Recent and fossil specimens of *Anomia* and *Pododesmus* from the collection of Dr. G. JAKUBOWSKI, allowed the present author to assess that only *A.* (*A.*) *ephippium* displays a small, triangular, white spot bearing three muscle scars, close beneath the beak. This feature enabled the identification of some specimens found in the limestones by Pińczów and Miechów as *Pododesmus* (*H.*) *squamulus*, although the inside of the valves is invisible.

Recent specimens of the two species under discussion are distinguishable after gill shape (WINCKWORTH 1922). *A.* (*A.*) *ephippium* has W-shaped gills, while *Pododesmus* (*H.*) *squamulus* /\-shaped.

Suborbicular forms of *P.* (*H.*) *squamulus*, namely those ornamented only with fine concentric lines, resemble juveniles of *P.* (*Monia*) *patelliformis* (LINNÉ, 1761), but they differ from the latter in the shape of ligamental groove and the beak position. In *P.* (*M.*) *patelliformis*

the semilunar ligamental groove bears a central process near the dorsal margin, while the beaks are placed at some distance from the dorsal margin.

Stratigraphic range. — Middle Miocene (SACCO 1897) — Recent.

Subgenus *Pododesmus* (*Monia*) GRAY, 1850
Pododesmus (*Monia*) *squamus* (GMELIN, 1791)
(pl. 6: 8a—b, pl. 8: 1, 4)

1922. [*Monia*] *squama* GMELIN, 1791 — *A. striata*, LOVÉN, *non* BOLTEN = *A. glauca* MONTEROSATO; WINCKWORTH, 33, pl. 1: 3, 10.
1966. *Monia squama* (GMELIN); TEBBLE, 37, text-fig. 18c, pl. 2: h—i.

Material. — Rybnica 2—148 left valves.
Dimensions (in mm):

	L	H
MZ VIII Ml–1611/1	16.5	20.5
MZ VIII Ml–1611/2	13.0	14.5
MZ VIII Ml–1611/3	12.5	13.0

Description. — Valves are variable in outline, with a tendency to suborbicularity. Valve convexity also changes within a wide range of variability, from very convex to concave in the umbonal part. Small, orthogyrate beak is very distinct, distant from the dorsal margin.

External surface is ornamented with fine, densely spaced concentric lines and delicate, undulated radial lines. Wrinkled, imbricated, concentric lamellae may occur near the ventral margin. White prodissoconch is distinctly defined. External surface is dark-grey to black in colour, with white concentric belts variable in width. Growth stages are very distinct.

Internal ligament is placed close beneath the beak in a deep, horizontally lined, semilunar groove provided with process in the middle of the dorsal margin. Two muscle scars, namely the adductor muscle scar and the byssal muscle scar, many times larger than the former, occur within an irregularly oval area limited with a shallow groove. Both the muscle scars are in direct contact with each other. Consequently, only a single, irregular, united muscle scar is visible. Very fine radial grooves are conspicuous at the upper part of this united muscle scar, but only in extremely well preserved specimens. Pallial line shows no sinus; it is distant from the ventral margin. The area within the pallial line is white, porcelaneous; the remainder of the surface is dark-grey in colour. Ventral margin is smooth.

Remarks. — The species *P.* (*M.*) *squamus* resembles closely *P.* (*M.*) *patelliformis* (LINNÉ, 1761), but it differs from the latter in its united muscle scars. *P.* (*M.*) *patelliformis* also has two muscle scars ornamented with radial grooves, but they are distinctly separated and distant from each other.

Allied with *P.* (*M.*) *squamus* is *P.* (*M.*) *striata* (BROCCHI, 1814). However, the shell of the latter displays beak placed at or near the dorsal margin; its orbicular adductor muscle scar and the overlying byssal muscle scar seem to be disconnected (ROSSI RONCHETTI 1951, 38—39, text-fig. 13). Furthermore, its radial sculpture is more distinct because the slightly undulated radial lines are deeper and more sparsely spaced than in *P.* (*M.*) *squamus*.

CERULLI-IRELLI (1907: 80—81) recognized the Recent species *P.* (*M.*) *glauca* (MONTEROSATO) for a younger synonym of *P.* (*M.*) *striata* (BROCCHI, 1814), and treated it as a variety *depressa* because of its smaller convexity. However, according to WINCKWORTH (1922: 33), *P.* (*M.*) *glauca* and *P.* (*M.*) *squamus* are conspecific. There seems to be no way to ascertain which one of the two opinions is the correct one. One can only philosophically quote WOOD (1850: 11): "... correct specific distinction cannot be expected in fossils, when the recent forms are so perplexing as to defy determination, or at least to produce great diversity of opinion;

it is therefore, only attempted with the Crag species, to assign them to what is believed to be identity of form or correspondence with those shells which are found in recent sea".

The species *P.* (*M.*) *squamus* has previously not been mentioned from the Polish Miocene.

Stratigraphic range. — Middle Miocene (this paper) — Recent.

Suborder **Ostreina** FÉRUSSAC, 1822
Superfamily **Ostreacea** RAFINESQUE, 1815
Family **Gryphaeidae** VYALOV, 1936
Subfamily **Pycnodonteinae** STENZEL, 1956
Genus *Neopycnodonte* STENZEL, 1971
Neopycnodonte navicularis (BROCCHI, 1814)
(pl. 7: 5, 6a—b)

1910. *Pycnodonta cochlear* POLI var. *navicularis* Br.; SCHAFFER, 21, pl. 11: 6.
1936. *Pycnodonta cochlear* POLI var. *navicularis* BROCC.; FRIEDBERG, 258—260, pl. 44: 2—6.
1936. *Pycnodonta leopolitana* NIEDŹW.; FRIEDBERG, 261—262, pl. 45: 1—3, pl. 48: 2.
1938. *Ostrea cochlear* POLI var. *navicularis* BROCC.; FRIEDBERG, 15.
1945. *Ostrea* (*Pycnidonta*) *cochlear* POLI, 1795; GLIBERT, 94—95, pl. 7: 1a—c, pl. 8: 1.
1947. *Pycnodonta leopolitana* NIEDŹW.; KRACH, 56, pl. 1: 11—12.
1950. *Ostrea leopolitana* NIEDŹW.; KRACH, 298, pl. 2: 6.
1951. *Ostrea* (*Pycnodonta*) *cochlear* POLI var. *navicularis* BROCCHI, 1814; ROSSI RONCHETTI, 48—50, text-fig. 18.
1959. *Ostrea* (*Pycnodonta*) *cochlear* POLI, 1795; ANDERSON, 105, pl. 14: 12.
1960. *Ostrea cochlear* POLI *navicularis* BROCCHI; DIENI and OMENETTO, 614—615, pl. 57: 10.
1960. *Pycnodonta cochler* var. *navicularis* (BROCCHI 1814); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 77 pl. 27: 2—3.
1960. *Pycnodonta leopolitana* (NIEDŹWIEDZKI 1909); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 78, pl. 27: 4—5.
1972. *Pycnodonte* (*Pycnodonte*) *cochlear* (POLI), 1795 *navicularis* (BROCCHI), 1814; CAPROTTI, 63—64, pl. 2: 8.
1973. *Pycnodonta leopolitana* (NIEDŹWIEDZKI); RADWAŃSKI, 394, pl. 5: 1—2.
1975. *Neopycnodonte navicularis* (BROCCHI); FRENEIX, 443—448, text-figs. 14—15.
1975. *Neopycnodonte cochlear* (POLI, 1795) [=*Ostrea cochlear* POLI, 1795, vol. 2, p. 179+*Ostrea Leopolitana* NIEDŹWIEDZKI, 1909, pp. 1073—1075, pl. 32, figs. 1—5]; PRZYBYSZEWSKI, 46—58, pl. 8: 1a—d, 2—11, pl. 9: 1—3.
1977. *Pycnodonte cochlear navicularis* (BROCCHI, 1814); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 98 text-pl. 7: 1—19, pl. 10: 6—8.
1979*a*. *Neopycnodonte cochlear* (POLI, 1795); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 55—56, pl. 3: 7—8.

Material. — Rybnica 1—20 valves; Rybnica 2—100 valves.

Dimensions (in mm):

	L	H
MZ VIII Mł-1612/$_1$	42.0	52.0
MZ VIII Mł-1612/$_2$	26.0	29.0

Remarks. — The specimens of *N. navicularis* from Rybnica are indistinguishable from those of Świniary sands attributed to *Pycnodonta leopolitana* (NIEDŹWIECKI, 1909) by RADWAŃSKI (1973) and to *Neopycnodonte cochlear* (POLI, 1795) by PRZYBYSZEWSKI (1975). The latter author investigated 104 left valves of freeliving individuals and demonstrated the occurrence of a broad intraspecific variability in shell shape, thickness and convexity as well as in direction of resilifer inflection. It has also become clear that *P. leopolitana* and *N. cochlear* represent, in fact, two ecotypes of a single species (PRZYBYSZEWSKI 1975). The thin-shelled, weakly convex specimens of *P. leopolitana* have been derived from sandy facies (FRIEDBERG 1936, KRACH 1947), while the thick, convex shells of *N. cochlear* or its variety *navicularis* BROCCHI occur in marly and clayey sediments (FRIEDBERG 1936). The name *navicularis* has for a long time been used at the level of either variety (HÖRNES 1870, FRIEDBERG 1936, KOJUMDGIEVA 1960), or subspecies

(CAPROTTI 1972, JAKUBOWSKI 1977) of *N. cochlear*. However, FRENEIX (1975) was able to demonstrate that differences in resilifer construction are big enough to consider *N. cochlear* (POLI, 1795) and its variety *navicularis* to represent two distinct species. Accordingly, the specimens from both Rybnica and Świniary are here assigned to *Neopycnodonte navicularis* (BROCCHI, 1814).

Stratigraphic range. — Early Miocene (KOJUMDGIEVA 1960) — Late Pliocene (DIENI and OMENETTO 1960).

Family **Ostreidae** RAFINESQUE, 1815
Subfamily **Ostreinae** RAFINESQE, 1815
Genus *Cubitostrea* SACCO, 1897
Cubitostrea digitalina (EICHWALD, 1830 emend. du BOIS de MONTPÉREUX, 1831)
(pl. 7: 2—3)

1830. *Ostrea digitata*, m.; EICHWALD, 213.
1853. *Ostrea digitalina* m. *cum varietatibus*; EICHWALD, 58—60, pl. 3: 14—17.
1870. *Ostrea digitalina* DUB.; HÖRNES, 447—450, pl. 73: 1—9.
1897*a*. *Ostrea* cf. *digitata* EICHW. (DUB.); SACCO, 11, pl. 3: 37.
1930. *Ostrea digitalina* EICHW.; KOWALEWSKI, 88.
1936. *Ostrea digitalina* DUBOIS n. var. *minor*; BOGSCH, 43, pl. 1: 10—11.
1936?. *Ostrea an frondosa* de SERRES; FRIEDBERG, 266—267, pl. 47: 4—8.
1943. *Ostrea digitalina* DUBOIS et var.; BOGSCH, 228, 230, pl. 1: 8—9, pl. 1: 10 [var. *minor* BOGSCH].
1945. *Ostrea* (*Ostrea*) *digitalina* MONTPÉREUX, 1831; GLIBERT, 92—94, pl. 7: 2a—b.
1950?. *Ostrea* (*Cubitostrea*) *frondosa* De SERRES; HEERING, 17, pl. 2: 33—34, 37—39.
1956. *Ostrea* (*Ostrea*) *digitata* EICHWALD; TEJKAL, 286—287.
1963? *Ostrea* (*Ostrea*) *frondosa* de SERR.; VENZO and PELOSIO, 163—164.
1977. *Ostrea digitalina* du BOIS de MONTPÉREUX, 1831; JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 98—99, pl. 9: 5—6 (*cum syn.*).
1979*a*. *Ostrea digitalina* du BOIS de MONTPÉREUX, 1831; JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 56, pl. 3: 9—13.

Material. — Nawodzice — 40 valves; Rybnica 1—15 valves; Rybnica 2—80 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml-1613/$_1$	81.5	71.5
MZ VIII Ml-1613/$_2$	46.0	81.5

Remarks. — The investigated specimens from Nawodzice and Rybnica are consistent with those from Podolia (Żukowce, Zaleśce) to which EICHWALD (1830) introduced the name *Ostrea digitata*. Du BOIS de MONTPÉREUX (1831: 74) changed this name to *O. digitalina* EICHWALD, which was later accepted by EICHWALD himself (EICHWALD 1853).

The species *C. frondosa* (de SERRES, 1829) is indistinguishable from *C. digitalina* (EICHWALD, 1830). According to FRIEDBERG (1936) the former species is characterized by its smallersized shell ornamented with less numerous ribs, larger area for attachment of the left valve, and by its adductor muscle scar more posteriorly shifted. However, HÖRNES (1870), STEFANINI (1916) and VENZO and PELOSIO (1963) considered these differences to be below the specific level. The present author is of the opinion, that *O. digitalina* may actually be synonymous with *O. frondosa*. However, to solve this problem, investigations on Tertiary European oysters should be done. The name *O. digitalina* is used in this paper as it is traditional in the Polish paleontological literature.

Stratigraphic range. — Middle Miocene (FRIEDBERG 1936) — Late Miocene (MERKLIN and NEVESSKAJA 1955).

Subclass **Heterodonta** NEUMAYR, 1884
Order **Veneroida** ADAMS and ADAMS, 1856
Superfamily **Lucinacea** FLEMING, 1828
Family **Lucinidae** FLEMING, 1828
Subfamily **Lucininae** FLEMING, 1828
Genus *Ctena* MÖRCH, 1821
Subgenus *Ctena* (*Ctena*) MÖRCH, 1821
Ctena (*Ctena*) *decussata* (da COSTA, 1843)
(pl. 7: 7a—b, 9a—b)

1850. *Lucina decorata*, S. WOOD; WOOD, 141—142, pl. 12: 6a—b.
1895. *Jagonia reticulata* POLI, sp. (*Tellina*); BUCQUOY *et al.*, 635—639, pl. 90: 8—14.
1901. *Jagonia reticulata* (POLI) et var.; SACCO, 97—98, pl. 20: 65—67, pl. 20: 68 [var. *perobliqua* SACC.].
part. 1909. *Lucina* (*Jagonia*) *pecten* LAMARCK; DOLLFUS and DAUTZENBERG, 260—261, pl. 16: 28—29, pl. 18: 1, 2, 5, 6, 9—11, *non* pl. 18: 7—8.
1909. *Lucina* (*Jagonia*) *decussata* O. G. COSTA; DOLLFUS and DAUTZENBERG, 257—260.
1912. *Codokia* (*Jagonia*) *decussata* (COSTA) et var.; COSSMANN and PEYROT, 680—682, pl. 28: 30—32, pl. 28: 33—35 [var. *perobliqua* (SACCO)].
1934. *Codokia* (*Jagonia*) *decussata* COSTA; FRIEDBERG, 119—120, pl. 20: 8—9.
1956. *Codakia* (*Jagonia*) *decussata* (O. COSTA, 1829); TEJKAL, 237—238, pl. 1: 15—17.
1957*c*. *Jagonia dautzenbergi* nov. nom.: GLIBERT, 20.
1960. *Codakia* (*Jagonia*) *decussata* (da COSTA 1829); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 33—34, pl. 10: 6—8.
1967. *Ctena* (*s. s.*) *decussata exigua* (EICHWALD, 1830); GLIBERT and VAN de POEL, 26.
1974. *Ctena* (*Ctena*) *decussata* (O. G. COSTA, 1829); MALATESTA, 73—74, pl. 7: 2.
1976. *Ctena* (*Ctena*) *decussata* (COSTA); BRAMBILLA, 104, pl. 27: 3—4.

Material. — Nawodzice — 4 valves; Rybnica 1—1 shell, 142 valves; Rybnica 2—60 valves. Dimensions (in mm):

	L	H
MZ VIII Ml-1614/$_1$	8.6	7.8
MZ VIII Ml-1614/$_2$	6.5	5.5

Description. — Shell in convex, inequilateral, variable in outline. Small specimens are oval in shape, transversally elongated, with the convex posterior margin, gently passing into the posterodorsal margin. Large specimens are obliquely anterodorsally elongated, with the straight, vertical posterior margin. Anterodorsal margin is always very concave. Small, acute, orthogyrate beaks are shifted posteriorly, with the posterior part of the shell accounting for 34% of the total length. Lunule is smooth, immersed, somewhat wider in the right valve.

External surface is sculptured with radial ribs and narrow, concentric bands; the latter are separated with deep grooves; the width of the bands increases ventrally. Radial ornamentation in form of 9—12 flattened, wide ribs, separated with twice wider grooves, begins 1.0 mm away from the beak. The ribs bifurcate or additional narrow ribs appear in grooves, so that the specimens 2.0 mm long bear 18 ribs while those 7.0 mm long have up to 48—50 very narrow ribs. Concentric bands and radial ribs are of equal strength; small, rectangular granules are formed by their intersection. Growth stages are clearly distinct.

Ligament is external. Nympha equals half the length of the slightly convex posterodorsal margin.

Hinge in the right valve: triangular 1, which is the strongest cardinal tooth, slightly bifurcated at its base, is placed close beneath the beak; small 3a is in form of a nodule near the lunular margin; very strong and prominent AI is placed at the beginning of the lunular margin, while PI occurs at the end of posterodorsal margin.

Hinge in the left valve: 2 is divided by a deep groove at the midheight, one branch being parallel to the lunular margin and separated from it by a shallow groove, the other one being

oblique; the top of 2 is situated close beneath the beak; thin, lamelliform 4b, perpendicular to the lunular margin, is separated from 2 by a triangular socket; very large and long AII is separated from weak AIV by a deep groove; PII is separated by a narrow groove from weak PIV which is placed at the edge of the dorsal margin.

Adductor muscle scars are situated high up, under the hinge. Anterior adductor muscle scar is rectangular, very long, nearly perpendicular to the lunular margin; the posterior one is small, oval in shape. Pallial line shows no sinus; it runs parallel to the crenulated ventral margin.

Remarks. — GLIBERT and VAN de POEL (1967) distinguished within *C.* (*C.*) *decussata* three subspecies which differ from each other in shell outline and sculpture characteristics. According to those authors, all the Miocene specimens should be attributed to *C.* (*s. s.*) *d. exigua* (EICHWALD) [= *C. dautzenbergi* GLIBERT, 1957] because *C.* (*s. s.*) *d. decussata* did not appear prior to the Pliocene of the Mediterranean Province, and *C.* (*s. s.*) *d. decorata* (WOOD) not prior to the Pliocene of the Northern Province. This statement, however, is unacceptable, as *C.* (*C.*) *decussata* has been repeatedly described from the Miocene (see synonymy).

The investigation of the specimens of *C.* (*C.*) *decussata* and *C.* (*C.*) *exigua* housed in the collections assembled by Drs W. FRIEDBERG and G. JAKUBOWSKI allowed the present author to recognize these two forms for two distinct species.

The species *C.* (*C.*) *decussata* differs from *C.* (*C.*) *exigua* in its stronger anterior lateral teeth, more distinct crenulation of the ventral margin, and sculpture. In *C.* (*C.*) *exigua* the external surface of the shell is ornamented with wide, rounded or flattened ribs or rather folds, separated from one another with narrow, flattened to concave grooves. At the length of 2.0 mm, specimens of *C.* (*C.*) *exigua* display 8 ribs, while at the lentgh of 5.0 mm the ribs are 12 in number. Concentric narrow bands separated with shallow, narrow grooves run across the radial ribs and grooves, the rectangular granules, however, not being formed as it is the case in *C.* (*C.*) *decussata*.

According to DOLLFUS and DAUTZENBERG (1909), *C.* (*C.*) *exigua* (EICHWALD, 1830) is a younger synonym of *C.* (*C.*) *pecten* (LAMARCK, 1818). However, the specimens figured by those authors under the name *Lucina* (*Jagonia*) *pecten* are undoubtedly different from those named *exigua* by EICHWALD (1830). GLIBERT (1957*c*) claimed that the Lower Miocene specimens from the Loire Basin, identified by DOLLFUS and DAUTZENBERG (1909) as *L.* (*J.*) *pecten*, belong actually to another species for which he proposed the name *dautzenbergi*. *Jagonia dautzenbergi* differs from *C.* (*C.*) *orbiculata* (MONTAGU, 1808) [= *pecten* LAMARCK, 1818, = *jagon* (ADANSON) RECLUZ, 1869] in its shell being more transversally elongated and more convex as well as in its ribs being devoid of bifurcations. Later on, GLIBERT (1967) withdrew the name *dautzenbergi*, as he realized *C. exigua* and *C. dautzenbergi* (*non pecten* LAMARCK, 1818) to refer to the same species, with the name *exigua* keeping the priority.

MALATESTA (1974) recognized *C. exigua* (EICHWALD, 1830) for a synonym of *C. pecten* LAMARCK, 1818, although be quoted GLIBERT and VAN de POEL (1967) in the synonymy of *C. decussata*.

Stratigraphic range. — Early Miocene (DOLLFUS and DAUTZENBERG 1909) — Recent.

Genus *Parvilucina* DALL, 1901
Subgenus *Parvilucina* (*Microloripes*) COSSMANN, 1910
Parvilucina (*Microloripes*) *dentata* (DEFRANCE, 1823)
(pl. 8: 2a—b, 3, 5, 6a—b)

1830. *L.*[*ucina*] *nivea*, m.; EICHWALD, 206.
1850. *Lucina nivea* m.; EICHWALD, 56, pl. 5: 2a—b, 3a—b.

1853. *Lucina nivea* m.; EICHWALD, 83, pl. 5: 2a—b, 3a—b, 18.
1864. *Lucina dentata* BASTEROT; HÖRNES, 238, pl. 33: 9a—c.
1899. *Lucina dentata* BAST., var.; SOKOLOV, 30, pl. 3: 37—41.
1901. *Loripes dentatus* (DEFR. BAST.) et var.; SACCO, 98, pl. 29: 7—11, pl. 29: 12—13 [var. *obliquatella* SACC.].
1903. *Lucina dentata* BAST.; LASKAREW, 68—70, pl. 2: 30—34.
1909. *Lucina* (*Loripes*) *dentata* DEFRANCE; DOLLFUS and DAUTZENBERG, 244—245, pl. 16: 13—17.
1912. *Loripes* (*Microloripes*) *dentatus* (DEFRANCE); COSSMANN and PEYROT, 644—645, pl. 26: 71—85.
1925. *Lucina* (*Loripes*) *dentata* BAST. var. *laevigata* nov. var.; KAUTSKY, 32, pl. 3: 15, 16a—b.
1930. *Loripes dentatus* BAST.; KOWALEWSKI, 79.
1934. *Loripes dentatus* DEFR. var. *nivea* EICHW.; FRIEDBERG, 112—114, pl. 19: 22—28.
1936. *Loripes dentatus* DEFRANCE et var.; BOGSCH, 49—50, pl. 3: 25—26, pl. 3: 23—24 [n. var. *hoernesi*].
1938. *Loripes dentatus* DEFR. var. *nivea* EICHW.; FRIEDBERG, 37.
1943. *Loripes* (*Microloripes*) *dentatus* (DEFRANCE); BOGSCH, 248—250, pl. 3: 7.
1955. *Loripes niveus* (EICHWALD), 1830; MERKLIN and NEVESSKAJA, 74—75, pl. 21: 8—13.
1956. *Loripes dentatus niveus* (EICHWALD, 1830); TEJKAL, 234—235, pl. 1: 8—14.
1960. *Loripes dentatus* (DEFRANCE, 1823); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 32, pl. 10: 3.
1963. *Loripes dentatus* (DEFRANCE); VENZO and PELOSIO, 169, pl. 55: 11—12.
1967. *Loripes* (*Microloripes*) *dentatus* (DEFRANCE, 1823); GLIBERT and VAN de POEL, 27.
1967. *Loripes* (*Microloripes*) *niveus* (EICHWALD, 1830); GLIBERT and VAN de POEL, 28.
1971. *Loripes niveus* (EICHWALD, 1853); ŠVAGROVSKY, 137—138, pl. 16: 4—11.
1972. *Loripes dentatus niveus* (EICHWALD, 1830); JAKUBOWSKI, 79—85, text-pl. 5: 1—30, pl. 5: 1—30.
1976. *Parvilucina* (*Microloripes*) *dentata* (DEFRANCE); BRAMBILLA, 104—105, pl. 27: 5—6.
1979*a*. *Parvilucina* (*Microloripes*) *dentata nivea* (EICHWALD, 1830); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 56, pl. 4: 13—16.

Material. — Nawodzice — 75 valves; Rybnica 1—90 valves; Rybnica 2 — ca 700 valves. Dimensions (in mm):

	L	H
MZ VIII Ml-1615/$_1$	11.5	10.5
MZ VIII Ml-1615/$_2$	10.0	10.0
MZ VIII Ml-1615/$_3$	5.8	7.0
MZ VIII Ml-1615/$_4$	3.0	3.4

Remarks. — There is a great variability in shell shape and convexity among the specimens of *P. (M.) dentata* from Rybnica and Nawodzice. Small-sized shells can be divided into two morphological types, one of which (pl. 8: 2a—b, 3, 5) is characterized by the moderately convex, suborbicular, subequilateral shell with concave lunular margin and straight posterodorsal margin, the latter forming an obtuse angle with the posterior margin. A distinct ridge runs from the small and slightly projected beak towards the posterior margin. The ridge defines triangular, flattened posterior area.

The other morphologic type (pl. 8: 6a—b), known as *Loripes niveus* (EICHWALD, 1830) or *L. dentatus niveus*, is characterized by its very convex, inequilateral, anteroventrally elongated shell, with steep anterodorsal margin being straight to slightly concave in outline. The posterodorsal margin gently connects with the posterior margin. The strongly prosogyrate beaks are more swollen, while the cordate lunule is squeezed weaker than in the former morphotype. The ridge on the external surface is lacking. In this morphotype, the ventral margin is always crenulated, while it may be smooth in suborbicular forms. In fact, suborbicular forms with smooth ventral margin were distinguished by BOGSCH (1936) into var. *hoernesi*.

The abundant shell material gathered by the present author in a single layer of sand allows to recognize *Lucina nivea* EICHWALD, 1830, and *Loripes dentatus* var. *hoernesi* BOGSCH, 1936 for morphological varieties of *P. (M.) dentata* (DEFRANCE, 1823), because there exist transitional stages between the endmember, extreme forms.

Large-sized specimens of *P. (M.) dentata* from Rybnica and Nawodzice are almost exclusively represented by suborbicular, flattened shells.

An interesting distributional feature of *P. (M.) dentata* is that suborbicular forms dominate

in sandy facies (SOKOLOV 1889, LASKAREW 1903, TEJKAL 1956), while oval forms tend to prevail in clayey facies (Dr. G. JAKUBOWSKI's collection from Korytnica).

Some authors (KOWALEWSKI 1950, BALUK and RADWAŃSKI 1968) erroneously assigned suborbicular forms of *P.* (*M.*) *dentata* with smooth ventral margin to *Loripes dujardini* DESHAYES, 1850. The two species differ in shape of the ligamental socket, as well as in hinge construction. The ligamental socket is very long, shallow, weakly oblique in *L. dujardini*; it does not cross the lower edge of the hinge plate. In turn, the short and deep resilifer of *P.* (*M.*) *dentata* is very oblique to the posterodorsal margin and it crosses the lower edge of the hinge plate. There is only a single cardinal 3b in the right valve in *L. dujardini*, AI and PI being very weak. In the right valve of *P.* (*M.*) *dentata*, two cardinals 3a and 3b do occur, along with strong laterals AI, AIII, PI, and PIII.

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1912) — Late Pliocene (SACCO 1901).

Subfamily **Myrteinae** CHAVAN, 1969
Genus *Myrtea* TURTON, 1822
Subgenus *Myrtea* (*Myrtea*) TURTON, 1822
Myrtea (*Myrtea*) *spinifera* (MONTAGU, 1803)
(pl. 8: 7a—b)

1909. *Lucina* (*Myrtea*) *spinifera* MONTAGU, sp. (*Venus*); DOLLFUS and DAUTZENBERG, 245—248, pl. 16: 18—27.
1934. *Myrtea spinifera* MONT.; FRIEDBERG, 120—121, pl. 20: 10—11, text-fig. 10 (*cum syn*).
1960. *Lucina* (*Myrtea*) *spinifera* (MONTAGU); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 30, pl. 9: 12—13.
1966. *Myrtea spinifera* (MONTAGU); TEBBLE, 76, text-fig. 33a, pl. 7: e.
1967. *Myrtea spinifera hiatelloides* (BASTEROT, 1825); GLIBERT and VAN de POEL, 35.
1972. *Myrtea* (*Myrtea*) *spinifera* (MONTAGU), 1803; CAPROTTI, 65—66, pl. 3: 4.
1974. *Myrtea* (*Myrtea*) *spinifera* (MONTAGU, 1803); MALATESTA, 78—80, pl. 7: 5.

Material. — Rybnica 2—1 left valve.
Dimensions (in mm):

	L	H
MZ VIII Ml-1616	11.8	9.5

Remarks. — The specimen under discussion is entirely consistent with the descriptions and figures referred to in the synonymy.

GLIBERT and VAN de POEL (1967) distinguished two subspecies within *Myrtea spinifera*, the Miocene subspecies *M. s. hiatelloides* (BASTEROT, 1825) and the Pliocene to Recent subspecies *M. s. spinifera* (MONTAGU, 1803). Unfortunately, any other criteria of this subdivision have not been mentioned.

Stratigraphic range. — Early Miocene (MALATESTA 1974) — Recent.

Genus *Lucinoma* DALL, 1901
Lucinoma borealis (LINNÉ, 1767)
(pl. 8: 10, 11a—b, 12—13)

1830. *Lucina affinis*, m.; EICHWALD, 206.
1831. *Lucina circinaire*, LAM.; du BOIS de MONTPÉREUX, 56—57, pl. 6: 4—7.
1850. *Lucina affinis* m.; EICHWALD, 53—54; 1851; pl. 5: 6a—b.
1853. *Lucina affinis* m.; EICHWALD, 80—82; 1851; pl. 5: 6a—b.
1875? *Lucina ottangensis* nov. sp.; HOERNES, 372—373, pl. 14: 2—4.
1909. *Lucina* (*Dentilucina*) *borealis* L. sp.; CERULLI-IRELLI, 162—163, pl. 19: 16—23.
1930. *Phacoides borealis* L.; KOWALEWSKI, 79—80.

1934. *Phacoides borealis* L. et var.; FRIEDBERG, 103—106, pl. 18: 5—10, pl. 18: 13—14 [var. *affinis* EICHW.].
1938. *Phacoides borealis* L. et var. *affinis* EICHW.; FRIEDBERG, 36.
1945. *Lucinoma borealis* LINNÉ, sp. 1766; GLIBERT, 155—158, pl. 8: 3a—b (*cum syn.*).
1950. *Phacoides* (*Ph.*) *borealis* (LINNÉ); HEERING, 27, pl. 4: 68, 72—76, 80—81.
1954. *Phacoides borealis affinis* EICHWALD; CSEPREGHY-MEZNERICS, 427, pl. 13: 23—24.
1959. *Phacoides* (*Lucinoma*) *borealis* (LINNÉ 1767); ANDERSON, 126—128, pl. 16: 6a—d.
1966. *Lucinoma borealis* (LINNAEUS); TEBBLE, 76—77, text-fig. 31b.
1967. *Lucinoma borealis* (LINNÉ, 1767); GLIBERT and VAN de POEL, 34.
1967. *Lucinoma borealis praecedens* (KOENEN, 1868); GLIBERT and VAN de POEL, 35.
1971. *Lucinoma borealis* (LINNAEUS, 1767); JANSSEN and VAN der SLIK, 43, pl. 16: 59.
1973. *Lucinoma borealis* (LINNÉ, 1767); BÁLDI, 201—202, pl. 14: 1.
1974. *Lucinoma borcalis* (LINNÉ, 1767); MALATESTA, 81—82, pl. 7: 10.

Material. — Nawodzice — 7 shells, 40 valves; Rybnica 1—23 shells, 60 valves; Rybnica 2—56 shells, 440 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1617/$_1$	33.0	30.5
MZ VIII Ml-1617/$_2$	30.5	28.0
MZ VIII Ml-1617/$_3$	26.0	27.0
MZ VIII Ml-1617/$_4$	12.5	11.6

Remarks. — Having taken measurements of some 500 specimens of *L. borealis*, GLIBERT (1945) was able to show a large variability in concentric ornamentation in the species under consideration. This variability had previously made the basis for establishment of distinct varieties (NYST 1881, SACCO 1901) and even distinct species (EICHWALD 1830, HOERNES 1875).

The specimens under discussion are entirely consistent with the descriptions and figures referred to in the synonymy.

The species *Lucinoma praecedens* (von KOENEN, 1868) from the Middle and Upper Oligocene, displays a close similarity to *L. borealis* in its outline and sculpture. The only difference between these two species is, according to GLIBERT (1945), that the tooth 3b is almost vertical, somewhat bent and deeply cut by a central furrow running all over its length in *L. borealis*, while the same 3b is somewhat longer, straight and very oblique in *L. praecedens* (see GLIBERT 1945, pl. 8: 4a). Furthermore, the inferior edge of the hinge plate is very convex near its connection with 3b in *L. borealis*, while it is almost straight in *L. praecedens*. To GLIBERT (1945) these slight differences appeared sufficient to distinguish two distinct species, but nevertheless, they appeared less important to GLIBERT and VAN de POEL (1957) who considered *L. praecedens* to be a subspecies of *L. borealis*. ANDERSON (1959) and BÀLDI (1973), in turn, considered *L. praecedens* to be synonymous with *L. borealis* which seems obvious for the present author, as the difference between the two forms in consideration are expressed only on one (right) valve. Moreover, the shape of 3b in the specimens from Nawodzice and Rybnica is intermediate between the forms named *borealis* and *praecedens*. The tooth is straight, only occasionally weakly convex and oblique, but never to such a degree as in *L. praecedens*. There exists also no relation between the shape of 3b and the shape of the hinge plate (see WOOD 1850, pl. 12: 1b).

In addition to the type form of *L. borealis*, the variety *affinis* EICHWALD, 1830 [= *L. flandrica* NYST] has been distinguished in the Polish Miocene, characterized by its shell being more convex and longer than in the type form (length 33 mm instead of 26 mm). The shell material derived from the *Lucinoma* assemblage from Rybnica (HOFFMAN and SZUBZDA 1976: 313—316) makes it sure that the specimens identified by FRIEDBERG (1934) and KOWALEWSKI (1950) as *L. borealis* var. *affinis* are nothing more than the shells of large-sized individuals of *L. borealis* (fig. 7).

Stratigraphic range. — Early Oligocene (BÀLDI 1973) — Recent.

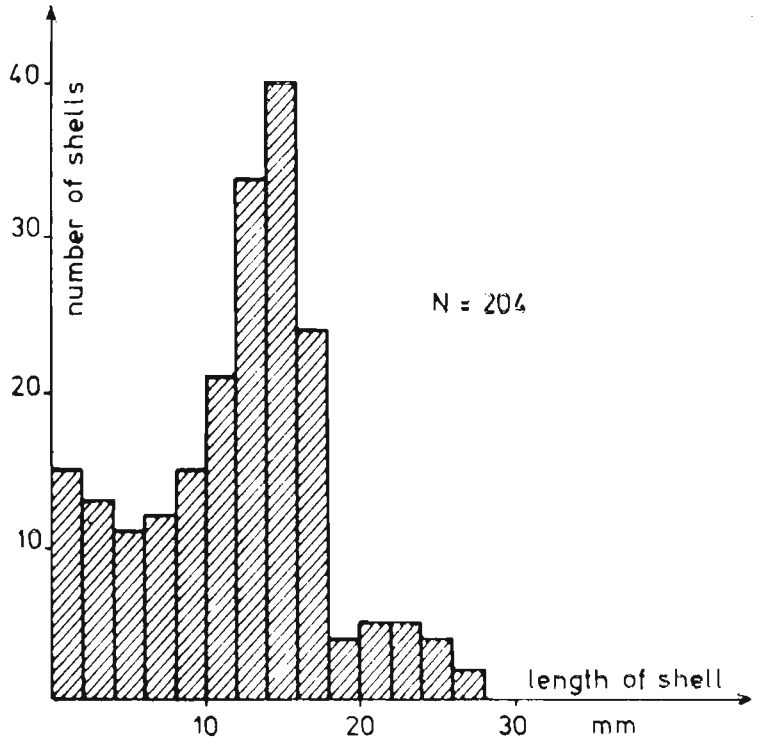

Fig. 7
Size-frequency distribution for shells of *Lucinoma borealis* derived from layer 1 in Rybnica 2.

Genus *Montilora* IREDALE, 1930
Subgenus *Montilora* (*Montilora*) IREDALE, 1930
Montilora (*Montilora*) *elegans* (DEFRANCE, 1823)
(pl. 9: 4a—b)

1824. *Lucina elegans* DEFR.; DESHAYES, 101; 1837, pl. 14: 10—11.
1860. *Lucina elegans* DEFR.; DESHAYES, 638.
1938. *Montilora elegans* (DEFRANCE); CHAVAN, text-fig. 14.

Material. — Rybnica 2—2 valves.
Dimensions (in mm):

	L	H
MZ VIII Mł-1618	5.2	5.0

Description. — Valve is suborbicular in outline, equilateral, with concave anterodorsal margin and straight, oblique posterodorsal margin. Prosogyrate beak considerably projects above the dorsal margin. Lunule is small, cordate, deeply squeezed, limited by a sharp edge.

External surface is sculptured with fine concentric lines, variable in strength, the lines being distinct and parallel to each other in the umbonal part, while irregular on the remaining surface. Very fine radial lineas are conspicuous between the concentric lines. Growth stages are indistinct.

Inframarginal ligamental groove is subparallel to the posteroventral marging, attaining half of its length. The groove is very narrow; it does not intersect the lower edge of the hinge plate.

Hinge in the right valve: there is a shallow socket before nodular, suborbicular 3b; lateral teeth are indistinct, distant from the beak; AI is placed at the beginning of the lunular margin, while PI lies at the end of the posteroventral margin.

Hinge in the left valve: there is a shallow socket beyond very weak, nodular 2 which is placed close beneath the beak; AII is weak, placed at the beginning of the lunular margin.

Anterior adductor muscle scar is oval-shaped, with its longer axis perpendicular to the anterior margin; posterior adductor muscle scar is rhomboidal in shape. Pallial line shows no sinus; it is distant from the smooth ventral margin, as it begins at the midlength of the anterior adductor muscle scar. The valve is finely punctate inside.

Remarks. — The specimens of *M. elegans* from the Lutetian of the Paris Basin (DESHAYES 1824) have their concentric sculpture more distinct and more regularly developed than *M. elegans* from Rybnica.

The genus *Montilora* differs from the remaining genera of the family Lucinidae in its hinge features. It resembles *Callucina* DALL, 1901, in its shell outline, ligament charactere, shape of the adductor muscle scars, and shape of the pallial line, but it differs from the latter in the lack of 4b, weakness or even absence of lateral teeth, and smoothness of the ventral margin which is finely crenulated in *Callucina*.

The species *Montilora baudoni* (DESHAYES, 1860) is allied with *M. elegans*; however, it is less orbicular in shape, its anterior dorsal margin being somewhat longer and concave, and its beaks being more distinct than in the latter (DESHAYES 1860, 639, pl. 43: 20—22).

The genus *Montilora* has previously not been mentioned from the Polish Miocene.

Stratigraphic range. — Middle Eocene (DESHAYES 1860) — Middle Miocene (this paper).

Subfamily **Milthinae** CHAVAN, 1969
Genus *Anodontia* LINK, 1807
Subgenus *Anodontia* (*Loripinus*) de MONTEROSATO, 1883
Anodontia (*Loripinus*) *fragilis* (PHILIPPI, 1836)

1881. *Lucina Sismondae* DESHAYES; FONTANNES, 110—111, pl. 6: 22.
1934. *Lucina fragilis* PHIL.; FRIEDBERG, 102—103, pl. 18: 4 (*cum syn.*).
1958. *Lucina fragilis* PHIL.; SENEŠ, 75—76.
1976. *Anodontia* (*Loripinus*) *fragilis* (PHIL.); BRAMBILLA, 105, pl. 27: 9—10.

Material. — Nawodzice — 1 left valve.

Dimensions (in mm):

	L	H
MZ VIII MI-1619	1.4	1.2

Remarks. — The investigated valve of *A. (L.) fragilis* (PHILIPPI) from Nawodzice is consistent with the descriptions and figures referred to in the synonymy.

COSSMANN and PEYROT (1912) distinguished two mutations among the specimens of *A. (L). fragilis* from the Miocene of Aquitaine different from each other in their shell shape and hinge margin characteristics. Very convex, almost spheroidal shells with centrally placed beaks and small pseudocardinal teeth in each valve have been called *Lucina* (*Loripinus*) *fragilis* mut. *Benoisti* (see COSSMANN and PEYROT 1912, 638—639, pl. 26: 63—67). Less convex, somewhat asymmetrical shells, with poorly defined anal depression have been named *L.* (*L.*) *fragilis* mut. *Lecointreae* (see COSSMANN and PEYROT 1912, 636—638, pl. 26: 59—62). Shells of *L.* (*L.*) *fragilis* type form are more asymmetrical than in mut. *lecointreae*, less convex, with distinct anal depression.

The difference between the type form and mut. *benoisti* is so sharp that HEERING (1950, 28, pl. 4: 93) considered the two forms to represent distinct species. The opposite opinion has been represented by MALATESTA 1974, 83—84, pl. 7: 1a—b) who included both the mutations erected by COSSMANN and PEYROT (1912) to the synonymy of *A.* (*L.*) *fragilis*.

The specimens attributed by COSSMANN and PEYROT (1912) to mut. *benoisti* were derived from the Aquitanian and Burdigalian; the specimens attributed to mut. *lecointreae* came from the Helvetian; finally, the specimens attributed to *L. fragilis* type form were derived from the Tortonian. The changes in shell shape seem to be gradual, evolutionary ones. The forms orbicular in outline, with pseudocardinal teeth, were replaced by toothless, somewhat asymmetrical forms. Only the endmembers of this evolutionary sequence are unequivocally distinguishable from each other; these extremities could be separated as distinct temporal subspecies if future investigations would exclude the effects of ecological factors on the shell shape.

Stratigraphic range. — Early Miocene (SENEŠ 1958) — Recent.

Family **Thyasiridae** DALL, 1901
Genus *Thyasira* LEACH in LAMARCK, 1818
Subgenus *Thyasira* (*Thyasira*) LEACH in LAMARCK, 1818
Thyasira (*Thyasira*) *flexuosa* (MONTAGU, 1803)
(pl. 7: 10a—b)

1850. *Cryptodon sinuosum*, DONOVAN.; WOOD, 134—135, pl. 12: 20a—b.
1909. *Thyasira flexuosa* MTG. sp.; CERULLI-IRELLI, 155, pl. 18: 29.
1945. *Thyasira flexuosa* (MONTAGU), sp. 1803, GLIBERT, 153—154, pl. 6: 5.
1959. *Thyasira* (*Thyasira*) *flexuosa* (MONTAGU); ANDERSON, 124—126, pl. 16: 5a—d.
1957*a*? *Thyasira hanseata* KAUTSKY, sp. 1925; GLIBERT, 33, pl. 3: 8.
1966. *Thyasira flexuosa* (MONTAGU); TEBBLE, 79, text-fig. 5a—b.
1969. *Thyasira flexuosa* (MONTAGU); KAUFFMAN in MOORE, N184, text-fig. 93, 1—3.
1971. *Thyasira* (*Thyasira*) *flexuosa* (MONTAGU, 1803); JANSSEN and VAN der SLIK, 44, pl. 16, 17: 62.
1974. *Thyasira flexuosa* (MONTAGU, 1803); ABBOTT, 463, text-fig. 5335.

Material. — Nawodzice — 1 valve; Rybnica 1—1 valve; Rybnica 2—17 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml-1620	7.0	7.2

Remarks. — The investigated specimens from Rybnica have their ventral margin more regularly arched than it is the case with those figured by KAUFFMAN (1969), GLIBERT (1945) and TEBBLE (1966).

WOOD (1850) recognized *Th. flexuosa* MONTAGU for being synonymous with *Cryptodon sinuosum* (DONOVAN, 1801) as the Recent North American specimens are indistinguishable from the forms found in the Pliocene of England. However, the shells identified by HÖRNES (1864, 244—246, pl. 34: 1a—d) as *Lucina sinuosa* DON. are completely different from *Th. flexuosa*. They are very asymmetrical, with strongly prosogyrate beaks being considerably shifted anteriorly. Furthermore, their anterodorsal margin is very short and concave, whereas main and marginal grooves are deeper and longer than in *Th. flexuosa*.

The specimens from the Middle Miocene of Crimea and Caucasus attributed to either *Th. laevis* (ZHIZHCHENKO, 1934) (see ZHIZHCHENKO 1959, 197—198, pl. 4: 3—6), or *Th. flexuosa laevis* (see MERKLIN and NEVESSKAJA 1955: 55) differ from *Th.* (*Th.*) *flexuosa* in their more regularly orbicular outline, greater dimensions (length 15 mm and 4—12 mm, respectively) and weaker main groove.

The species *Th. flexuosa* resembles very closely *Th. hanseata* KAUTSKY, 1925 from Northern Germany, however, the latter is somewhat more symmetrical, with its anterodorsal margin being less steep and less concave than in the former. *Th. hanseata* is also more regularly orbicular in outline than *Th. flexuosa*. The specimens from the Upper Oligocene of Belgium assigned by GLIBERT (1957*a*) to *Th. hanseata*, resemble in fact *Th. flexuosa* rather than *Th. hanseata* in their outline.

The shell of *Th. merklini* ZHIZHCHENKO, 1959 is, according to ZHIZHCHENKO (1959, 197, pl. 4: 1—2) distinctly different from its congeners in the beak being strongly projected and bent anteriorly and in the occurrence of two distinct grooves in its posterior part. However, these supposedly diagnostic features of *Th. merklini* make it actually indistinguishable from *Th. hanseata* KAUTSKY, 1925.

Stratigraphic range. — Late Oligocene (GLIBERT 1957*a*) — Recent.

Superfamily **Chamacea** LAMARCK, 1809
Family **Chamidae** LAMARCK, 1809
Genus *Chama* LINNÉ, 1758
Subgenus *Chama* (*Psilopus*) POLI, 1795
Chama (*Psilopus*) *gryphoides* LINNÉ, 1758
(pl. 8: 8a—b, 9, pl. 9: 1a—b, 2a—b)

1853. *Chama squamosa* m.; EICHWALD, 56—57, 1851, pl. 4: 8a—b.
1861. *Chama Austriaca* HÖRN.; HÖRNES, 214—215, pl. 31: 3a—c.
1910. *Chama gryphoides* LIN. et var.; SCHAFFER, 74—75, pl. 34: 15—19, pl. 34: 20—21 [var. *Austriaca* HÖRN.].
1912. *Chama gryphoides* LINNÉ et var.; COSSMANN and PEYROT, 533—535, pl. 24: 14—15, pl. 24: 6—9 [var. *mioasperella* SACCO].
1913. *Chama gryphoides* LINNÉ et var.; DOLLFUS and DAUTZENBERG, 302—306, pl. 23: 37—50, pl. 23: 51—52 [var. *pseudounicornis* SACCO].
1930. *Chama gryphoides* L.; KOWALEWSKI, 82.
1934. *Chama gryphoides* L.; FRIEDBERG, 130—132, text-fig. 18, pl. 21: 12—17.
1945. *Chama* (*Chama*) *gryphoides* LINNÉ, 1767; GLIBERT, 168—169, pl. 8: 5.
1955. *Chama toulai* DAVITASCHVILI, 1932; MERKLIN and NEVESSKAJA, 95, pl. 38: 10—11.
1959. *Chama gryphoides* LINNÉ var. *konkensis* PAVLINOVA-ILIINA; ZHIZHCHENKO, 215, pl. 21: 27—28.
1959. *Chama toulai* DAVITASCHVILI: ZHIZHCHENKO, 215—216, pl. 12: 8—16.
1966*a*. *Chama gryphoides gryphoides* LINNÉ, 1758; GLIBERT and VAN de POEL, 63.
1966*a*. *Chama gryphoides austriaca* HÖRNES, 1861; GLIBERT and VAN de POEL, 63—64.
1969. *Chama gryphoides pseudounicornis* SACCO; CSEPREGHY-MEZNERICS; 111, pl. 8: 17, 21.
1969. *Chama gryphoides borsodensis* n. ssp.; CSEPREGHY-MEZNERICS, 111, pl. 8: 15, 19.
1971. *Chama* (*Psilopus*) *gryphoides* LINNAEUS, 1758; JANSSEN and VAN der SLIK, 46, pl. 21: 66.
1972. *Chama gryphoides* LINNEO, 1758; CAPROTTI, 64, pl. 2: 10—11.
1974. *Chama* (*Chama*) *gryphoides* LINNÉ, 1758; MALATESTA, 88—89, pl. 8: 1a—d.

Material. — Nawodzice — 1 valve; Rybnica 1—19 valves; Rybnica 2—32 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml-1621/$_1$	24.6	34.5
MZ VIII Ml-1621/$_2$	9.0	12.0
MZ VIII Ml-1621/$_3$	8.2	6.0
MZ VIII Ml-1621/$_4$	6.8	7.4

Remarks. — The specimens under discussion are entirely consistent with the descriptions and figures referred to in the synonymy.

The shell, and in particular the left valve, i.e. the one attached to the substrate, is extremely variable in shape in *Chama* (*P.*) *gryphoides*. The right valve, serving as an operculum, is more constistent in shape; however, it undergoes changes during ontogeny. In very small forms (0.7 mm — 0.9 mm long), the right valve is oval-shaped, flattened, with triangular umbonal part, prosogyrate beak, the pseudoprodissoconch is distinct, sculptured with densely spaced, delicate concentric lamellae, while the remaining surface is covered with concentric lamellae and fine spines arranged in 10 radial lines. Right valves 1.5 mm long are suborbicular in shape, convex, with beaks being more prosogyrate than in smaller forms. Right valves 2.5 mm long

have their beaks strongly bent, distant from the dorsal margin; their spiny stripes are not arranged in radial lines.

A great number of varieties and subspecies have been established according to the wide variability in shell shape (see the synonymy). The only exception has been made by GLIBERT and VAN de POEL (1966*a*: 63—64) who recognized two subspecies according to the geological age. Miocene shells were attributed to *Ch. gryphoides austriaca* HÖRNES, 1861, while those from Pliocene and Pleistocene deposits to *Ch. gryphoides gryphoides* LINNÉ, 1758.

Stratigraphic range. — Early Miocene (GLIBERT and VAN de POEL 1966*a*) — Recent.

Superfamily **Leptonacea** GRAY, 1847
Family **Erycinidae** DESHAYES, 1850
Genus *Scacchia* PHILIPPI, 1844
Subgenus *Scacchia* (*Scacchia*) (PHILIPPI, 1844)
Scacchia (*Scacchia*) *degrangei* (COSSMANN and PEYROT, 1912)

1912. *Erycina* (*Scachia*) *Degrangei* nov. sp.; COSSMANN and PEYROT, 553—554, pl. 25: 1—4.
1925. *Erycina* (*Scacchia*) *Degrangei* COSSM.; KAUTSKY, 33, pl. 3: 20a—b.
1939. *Erycina* (*Scacchia*) *degrangei* COSSM. u. PEYROT; Kautsky, 594—595, pl. 19: 15—16.
1964. *Erycina* (*Scacchia*) *degrangei* COSSMANN and PEYROT 1911; ANDERSON, 163—164, pl. 6: 51a—d.
1967. *Spaniorinus* (*Laseina*) *degrangei* COSSMANN and PEYROT, 1912; GLIBERT and VAN de POEL, 58—59.

Material. — Nawodzice — 1 right valve.

Dimensions (in mm):

	L	H
MZ VIII Ml-1622	1.1	0.9

Description. — Valve is very fragile, suborbicular in outline, inequilateral, with its posterior part accounting for 45% of the valve length. Anterodorsal margin is longer and more oblique than the posterodorsal one. Beak is very small, orthogyrate. External surface is ornamented with very fine concentric lines which in anterior and posterior parts of the valve intersect with delicate and densely spaced radial lines. The latter appear at the midheight of the valve. Smooth pseudoprodissoconch is distinctly defined. Growth stages are indistinct.

Internal ligament is placed in a small ligamental groove behind the beak. Hinge plate is lacking.

There is a single, conspicuous, conical 3b beneath the beak, directed anteriorly, with a shallow socket in front of it; AI and PI are very weak, distant from the beak and parallel to the dorsal margin.

Valve is brilliant inside, with no traces of pallial line and adductor muscle scars. Ventral margin is smooth.

Remarks. — The investigated valve is generally consistent with the holotype of *S.* (*S.*) *degrangei*; the only difference consisting in its weaker lamelliform lateral teeth, which makes it resembling the Austrian forms described by KAUTSKY (1939).

The species *S.* (*S.*) *degrangei* is close to *Spaniorinus austriacus* (HÖRNES, 1864), from which it differs in its greater convexity, triangular outline of the umbonal part, presence of lateral teeth, and shell ornamentation. According to HÖRNES (1864, 252, pl. 34: 8a—d), the external surface of *S. austriacus* is smooth and brilliant, but FRIEDBERG (1934, 128 text-fig. 16, pl. 21: 8) noticed in the anterior and posterior parts the presence of fine concentric as well as radial lines, this ornamentation being discernible only under a microscope. When describing the species *S. austriaca* HÖRNES, KAUTSKY (1939: 614—615) noted that the radial lines disappear abruptly in the middle part of the valve.

The fundamental difference between *S.* (*S.*) *degrangei* and *S. austriacus* however, is in hinge construction. The hinge in the left valve of *S.* (*S.*) *degrangei* consists of two cardinals 2 and 4b and two very weak laterals AII and PII, while there is only one cardinal tooth in the left valve of *S. austriacus*. The right valves of both the species bear one cardinal tooth each, but the hinge of *S.* (*S.*) *degrangei* is provided also with two lamelliform laterals AI and PI which are lacking in *S. austriacus*.

The species *Scacchia* (*S.*) *degrangei* has previously not been reported from the Polish Miocene.

Stratigraphic range. — Middle Miocene (ANDERSON 1964) — Pliocene (KAUTSKY 1939).

Family **Kelliidae** FORBES and HANLEY, 1848
Genus *Bornia* PHILIPPI, 1836
Subgenus *Bornia* (*Bornia*) PHILIPPI, 1836
Bornia (*Bornia*) *deltoidea* (WOOD, 1840)
(pl. 9: 3a—b)

1850. *Lepton deltoideum*, S. WOOD; WOOD, 115—116, pl. 11: 9a—d.
1864. *Lepton corbuloides* PHIL.; HÖRNES, 249, pl. 34: 4a—c.
1909. *Kellya* (*Bornia*) *sebetia* COSTA sp. (*Cyclas*); DOLLFUS and DAUTZENBERG, 268—270, pl. 18: 28—33.
1912. *Kellya* (*Bornia*) *Hoernesi* nov. sp.; COSSMANN and PEYROT, 578—580, pl. 25: 54—55.
1934. *Kellya* (*Bornia*) *sebetia* COSTA; FRIEDBERG, 127—128, pl. 21: 7.
1939. *Bornia hörnesi* COSSM. u. PEYR.; KAUTSKY, 600—601, pl. 19: 32—35.
1957*c*. *Bornia deltoideum* WOOD, s. 1851; GLIBERT, 22, pl. 2: 16.
1967. *Kellia* (*Bornia*) *deltoidea* (WOOD, 1851); GLIBERT and VAN de POEL, 66.
1971. *Bornia* (*Bornia*) *deltoidea* (S. V. WOOD, 1851); JANSSEN and VAN der SLIK, 47, pl. 22 and 26: 72.

Material. — Nawodzice — 5 valves; Rybnica 1—23 valves; Rybnica 2—5 valves.
Dimensions (in mm):

	L	H
MZ VIII Mł-1623	6.2	5.8

Remarks. — The specimens from Nawodzice and Rybnica closely correspond to the description and figures referred to in the synonymy.

The Viennese specimens ascribed by HÖRNES (1864) to *Lepton corbuloides* PHILIPPI are, according to COSSMANN and PEYROT (1912), different from the Recent ones and should, be separated as a new species. COSSMANN and PEYROT (1912) named that species *Kellya* (*Bornia*) *hoernesi*. However, the Viennese specimens are indistinguishable from *Bornia deltoidea* (WOOD, 1840) from the Pliocene of England and hence, the name *K.* (*B.*) *hoernesi* proposed by COSSMANN and PEYROT (1912) is a younger synonym of the former.

There is no resemblance between *B. deltoidea* (WOOD, 1840) and *B. geoffroyi* (PAYRAUDEAU, 1826) and these species should not be identified with each other, contrary to the opinion of KAUTSKY (1939: 601—603). *B. geoffroyi* presented by KAUTSKY (1939, pl. 19: 29—31, pl. 20: 1—2) is more orbicular in outline than *B. deltoidea*, with more gently sloped parts of the dorsal margin. Distinct radial ribs run from its weak, anteriorly shifted beak towards the extremities of the ventral margin.

The species *B.* (*B.*) *deltoidea* corresponds closely to *B.* (*B.*) *sebetia* (da COSTA, 1829) [= *B. corbuloides* (PHILIPPI, 1836)], from which it differs in its less triangular and more asymmetrical shell outline, wider but less oblique resilifer, and tooth PI being displaced further away from the beak.

Stratigraphic range. — Early Miocene (DOLLFUS and DAUTZENBERG 1909) — Pliocene (WOOD 1850).

Genus *Lasaeokellya* COSSMANN, 1911
Lasaeokellya cestasensis (COSSMANN and PEYROT, 1912)
(pl. 9: 7a—b, 8)

1912. *Kellya* (*Lasaeokellya*) *cestasensis* nov. sp.; COSSMANN and PEYROT, 583—584, pl. 25: 70—71.

Material. — Nawodzice — 10 valves; Rybnica 1—1 valve.

Dimensions (in mm):

	L	H
MZ VIII Ml-1624/1	2.6	2.4
MZ VIII Ml-1624/2	1.5	1.2

Description. — Valve is small, very convex, oval in outline, somewhat anteroventrally elongated, inequilateral, with its posterior part accounting for 40%—45% of the valve length. Anterodorsal margin is slightly concave beneath the beak. Very convex anterior margin gently passes into the arched ventral margin, while the connection of the straight posterodorsal margin with somewhat convex posterior margin is less gentle. Beaks are poorly defined. Umbonal part of the valve slightly projects above the dorsal margin. Lunule is small, deeply squeezed in, poorly defined.

External surface is sculptured with irregular, distant, concentric grooves, variable in width and depth. Growth stages are indistinct.

Internal ligament is placed in a wide and long resilifer which is very oblique to the posterodorsal margin. Hinge plate is lacking, the anterodorsal margin being somewhat thickened. Anterior lateral teeth are lacking.

Hinge in the right valve: 1 is hook-like, its longer, inferior part being parallel to the lunular margin; small, nodular 3a is almost entirely fused with the lunular margin; both 1 and 3a are situated in front of the beak; thin, lamelliform PI and PIII occur behind the resilifer, PI being somewhat oblique, separated by a narrow groove from weaker PIII which is parallel to the posterodorsal margin.

Hinge in the left valve: weak, nodular 2a is oblique to the anterodorsal margin, while more inferiorly placed 2b parallels it; PII is in form of a long, projected fillet, parallel to the one limiting the posterior edge of the resilifer.

Adductor muscle scars are large, oval in shape, the posterior being somewhat smaller than the anterior one. Pallial line shows no sinus; it is not very distant from the smooth ventral margin.

Remarks. — The discussed specimens from Nawodzice are more convex than the holotype from Cestas (Bordeaux region). In addition, they show a weak PIII in the hinge of the right valve, which feature has not been mentioned by COSSMANN and PEYROT (1912).

The species under consideration resembles very closely *Lasaea rubra* (MONTAGU, 1803) in its shell size, outline and sculpture, but differs from the latter in hinge construction and ligament characteristics. The shell of *L. rubra* has cardinal teeth not separated from the anterior lateral ones (except for 4b), two anterior lateral teeth being present in the hinge of both the valves. Internally, marginal ligament is placed in a shallow and narrow socket behind the posterior lateral teeth in *L. rubra*, while the internal ligament of *L. cestasensis* occurs in a wide, long resilifer in front of the posterior laterals.

The species *Kellia suborbicularis* (MONTAGU, 1803), which has the ligament of the same type as *L. cestasensis*, differs from the latter in its beaks being more projected above the dorsal margin and distinctly shifted anteriorly, the presence of a lamelliform anterior lateral tooth parallel to the anterodorsal margin, and the lateral teeth being somewhat weaker and shifted toward the beak. Furthermore, the well developed internal ligament may be supplemented in *K. suborbicularis* by a small external ligament situated close behind the beak.

Lasaeokellya cestasensis has previously not been reported from the Polish Miocene.

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1912) — Middle Miocene (this paper).

Family **Montacutidae** CLARCK, 1855
Genus *Montacuta* TURTON, 1822
Montacuta substriata (MONTAGU, 1808)
(pl. 7: 8a—b)

1850. *Montacuta substriata* MONTAGU; WOOD, 128—129, pl. 12: 12a—b.
1908. *Montacuta substriata* MTG. sp.; CERULLI-IRELLI, 12—13, pl. 1: 29—31.
1934. *Montacuta substriata* MONT.; FRIEDBERG, 125—126, pl. 21: 3, text-fig. 14.
1939. *Montacuta substriata* MONTAGU; KAUTSKY, 621—622, pl. 21, 22—25.
1957*c*. *Montacuta substriata* (MONTAGU); GLIBERT, 25; 1959, pl. 5: 6.
1958. *Montacuta substriata* (MONTAGU); SORGENFREI, 99, pl. 14: 46a—b.
1966. *Montacuta substriata* (MONTAGU); TEBBLE, 89—90, text-fig. 42a—c.
1971. *Montacuta substriata* (MONTAGU, 1808); JANSSEN and VAN der SLIK, 48, pl. 24 and 25: 73.

Material. — Rybnica 2—3 right valves.
Dimensions (in mm):

	L	H
MZ VIII MI-1625	2.7	2.3

Remarks. — The investigated specimens from Rybnica entirely correspond to the descriptions and figures referred to in the synonymy.

Stratigraphic range. — Middle Miocene (KAUTSKY 1929) — Recent.

Superfamily **Cyamiacea** PHILIPPI, 1845
Family **Sportellidae** DALL, 1899
Genus *Cerullia* CHAVAN, 1953
Cerullia ovoides (CERULLI-IRELLI, 1909)
(pl. 6: 11a—b)

1909. *Solecardia* (*Scintillula*) *ovoides* n. sp.; CERULLI-IRELLI, 198, pl. 23: 24.

Material. — Nawodzice — 1 left valve.
Dimensions (in mm):

	L	H
MZ VIII MI-1626	2.1	1.3

Description. — Valve is thin, brittle, very convex, oval in outline, with somewhat projected, triangular umbonal part; it is inequilateral, with its posterior part accounting for 34% of the valve length. Posterodorsal margin is shorter and more steep than the anterodorsal one. Beak is small, prosogyrate. Distinctly defined, whitish pseudoprodissoconch is smooth, while the remaining surface of the valve is ornamented with densely spaced, fine concentric lines which are more distinct in the posterior part of the valve than in the anterior one. Growth lines are clear.

Internal ligament is placed in a short ligamental groove, parallel to the posterodorsal margin. Hinge is very weak; hinge plate is lacking.

The tooth 1 is small, conical, strongly projected, situated beneath the beak, with a deep socket in front; long but very weak AI is fairly distant from the beak and oblique to the anterodorsal margin; PI is also weak, parallel to the posterodorsal margin.

Posterior adductor muscle scar is suborbicular in shape, placed close beneath the PI; anterior adductor muscle scar is larger than the posterior one, oval in shape. Pallial line shows no sinus; it is inconspicuous, distant from the smooth ventral margin.

Remarks. — The specimen from Nawodzice differs from the holotype of *C. ovoides* from Fenestina (Italy) in being more regularly elliptical in outline. The shells described by CERULLI-IRELLI (1909: 198) are more inequilateral and have somewhat lower anterior part than the valve from Nawodzice.

The species *C. intermedia* (CERULLI-IRELLI, 1909) differs from *C. ovoides* in its central beak, as well as in the posterior part of the shell being more angular than in the latter species.

The considered specimen from Nawodzice has nearly the same shape as *Scacchia* (*Scacchia*) *elliptica* (SCACCHI, 1833) as reported by WOOD (1850, 16—17, pl. 12: 13a—c). *S.* (*S.*) *elliptica* however, has its lateral teeth better developed; moreover, two cardinal teeth occur in the hinge in its left valve, compared to a single cardinal tooth in the left valve of *C. ovoides*.

The species *Cerullia ovoides* has previously not been reported from the Polish Miocene.

Stratigraphic range. — Middle Miocene (this paper) — Late Pliocene (CERULLI-IRELLI 1909).

Superfamily **Carditacea** FLEMING, 1820
Family **Carditidae** FLEMING, 1828
Subfamily **Carditamerinae** CHAVAN, 1969
Genus *Cyclocardia* CONRAD, 1867
Subgenus *Cyclocardia* (*Scalaricardita*) SACCO, 1899
Cyclocardia (*Scalaricardita*) *scalaris* (SOWERBY, 1825)
(pl. 9: 5a—b, 6a—b)

1850. *Cardita scalaris*, LEATHES 'MSS; WOOD, 166—167, pl. 15: 5.
1930. *Venericardia sclaris* SOW.; KOWALEWSKI, 81—82.
1934. *Pteromeris scalaris* SOW.; FRIEDBERG, 96—97, pl. 16: 14—16.
1938. *Cardita scalaris* SOW.; FRIEDBERG, 34.
1945. *Cardita* (*Cyclocardita*) *scalaris* SOWERBY, sp. 1825; GLIBERT, 130—131, pl. 8: 9.
1950. *Cardita* (*Venericardita*) *scalaris* (LEATHES M. S., J. SOWERBY 1825); HEERING, 23, pl. 2: 41—42.
1972. *Cyclocardia* (*Cyclocardia*) *scalaris* (SOWERBY 1825); JANSSEN and VAN der SLIK, 174—175, pl. 27 and 28: 80.
1976. *Cyclocardia* (*Scalaricardita*) *scalaris* (SOW.); BRAMBILLA, 109, pl. 27: 39—40.

Material. — Nawodzice — 5 valves; Rybnica 1—30 valves; Rybnica 2—1040 valves. Dimensions (in mm):

	L	H
MZ VIII Ml-1627/$_1$	12.5	12.5
MZ VIII Ml-1627/$_2$	12.0	11.0

Remarks. — The investigated specimens from Nawodzice and Rybnica entirely correspond to the descriptions and figures referred to in the synonymy.

A change in shell outline is observed in ontogeny of *C.* (*S.*) *scalaris*. Juvenile shells are suborbicular in shape, with triangular umbonal part, their arched ventral margin being gently connected with the posterodorsal margin. Adult forms, in contrast, are triangular in outline, with very steep anterior part and somewhat elongated, acute posterior part, their straight to slightly convex ventral margin forming an acute angle with the posterodorsal margin. In addition, juvenile shells are equilateral, while adult ones are inequilateral, with their posterior parts accounting for up to 70% of the shell length. The hinge structure also changes in ontogeny, the teeth 3a and AII undergoing gradual reduction.

Allied with *C.* (*S.*) *scalaris* is the species *C. unidentata* (BASTEROT, 1825). However, its shell is less convex than in the former species, and its hinge is provided with only one lateral (PI), while four weak laterals (AI, PI, AII and PII) are present in *C.* (*S.*) *scalaris*. Furthermore, the rectangular nodules resulting from intersection of wide radial ribs with narrow concentric lamellae are flattened and distinct in *C.* (*S.*) *scalaris*, while rounded, lower and less distinct in *C. unidentata*.

Stratigraphic range. — Early Miocene (GLIBERT 1945) — Late Pliocene (BRAMBILLA 1976).

Superfamily **Crassatellacea** FÉRUSSAC, 1882
Family **Astartidae** d'ORBIGNY, 1844
Subfamily **Astartinae** d'ORBIGNY, 1844
Genus *Astarte* SOWERBY, 1816
Subgenus *Astarte* (*Astarte*) SOWERBY, 1816
Astarte (*Astarte*) *radiata* NYST and WESTENDORP, 1839

1945. *Astarte* (*Astarte*) *radiata* NYST and WESTENDORP, 1839; GLIBERT, 102—106, pl. 6: 3a—e *(cum syn.)*.
1964. *Astarte* (*Astarte*) *radiata* NYST and WESTENDORP 1839; ANDERSON, 149—150, pl. 3: 35a—c.

Material. — Rybnica 1—1 valve; Rybnica 2—4 valves.
Dimensions (in mm):

	L	H
MZ VIII MI-1628	3.2	2.8

Description. — Valve is massive, weakly convex, suborbicular in outline, with marked triangular umbonal part, inequilateral, with its posterior part accounting for 44% of the valve length. Anterodorsal margin, which is somewhat concave beneath the beak, gently passes into the very convex anterior margin. Posterodorsal margin is slightly convex, steep. Posterior margin is shorter and less convex than the anterior one. Beaks are small, weakly prosogyrate. Lunule is very narrow, smooth, somewhat deepened under the beak, poorly defined.

External surface is sculptured with concentric bands, separated with deep grooves. The bands increase in width ventrally. The 1.9 mm high valve bears 10 bands, whereas the 2.8 mm high valve bears 18 bands. Umbonal part is smooth. Growth stages are indistinct.

Ligament is external; nympha is short and very oblique.

Hinge in the right valve: oblique, short, thin 3a is placed beneath the beak; it is separated by a triangular socket from triangular, massive 3b, behind which a socket and thin, weak 5b are placed; AI is long, lamelliform, separated by a narrow groove from the anterodorsal margin.

Hinge in the left valve: there is a small socket in front of triangular 2, while a deep socket occurs behind that tooth, separating it from oblique, thin 4b; PII is parallel to the posterodorsal margin, from which it is separated by a narrow groove.

Adductor muscle scars are oval-shaped, subequal, the posterior scar being somewhat higher than the anterior one. Pallial line shows no sinus; it is placed near the smooth ventral margin.

Remarks. — The investigated specimens from Rybnica are juveniles. Their shell outline and concentric ornamentation are characteristic of two distinct species, namely *Astarte* (*Astarte*) *radiata* NYST and WESTENDORP, 1839 and *A.* (*A.*) *gracilis* MÜNSTER, 1837 (see GLIBERT 1957*a*, 22—23, pl. 2: 3f). Those two species, however, differ in some details of hinge construction, and the specimens from Rybnica have their hinge consistent with the hinge of *A.* (*A.*) *radiata*.

The species under consideration has previously not been recorded in the Polish Miocene.

Stratigraphic range. — Middle Miocene (KAUTSKY 1925) — Late Miocene (GLIBERT 1945).

Genus *Tridonta* SCHUMACHER, 1817
Subgenus *Tridonta* (*Nicania*) LEACH, 1819
Tridonta (*Nicania*) *waeli* (GLIBERT, 1945)
(pl. 9: 9a—b, 10a—b)

1864? *Astarte triangularis* MONTAGU; HÖRNES, 282—283, pl. 37: 1a—f.
1867? *Astarte triangularis* MONT. sp.; REUSS, 136.
part. 1934. *Crassatella* (*Crassinella*) *concentrica* DUJ.; FRIEDBERG, 98, pl. 17: 10, *non* pl. 17: 8—9.
part. 1934. *Astarte* (*Goodallia*) *triangularis* MONT.; FRIEDBERG, 99, pl. 33: 8.
part. 1938. *Crassatella concentrica* DUJ.; FRIEDBERG, 34.
1945. *Astarte* (*Astarte*) *waeli* (NYST mss) nov. sp.; GLIBERT, 106—107, pl. 4: 6a—b.
1955. *Astarte* (*β Nicania*) *waeli* (NYST) GLIBERT and de HEINZELIN, 24.
1957*c*. *Astarte* (*Nicania*) *waeli* (NYST mss) GLIBERT, 1945; GLIBERT, 7.
1957*c*. *Astarte* (*Nicania*) *pseudopygmaea* nov. nom.; GLIBERT, 7, pl. 2: 4a—b.
1972. *Astarte waeli* GLIBERT, 1945; NORDSIECK, 30, pl. 4: 29.
1974. *Goodallia* (*Goodallia*) *waeli pseudopygmaea* (GLIBERT, 1957); JANSSEN and VAN der SLIK, 59, pl. 40: 50a—c.
1975. *Astarte* (?*Astarte*) *waeli* GLIBERT, 1945; VAN den BOSCH *et al.*, pl. 15: 4.

Material. — Rybnica 1—7 valves; Rybnica 2—7 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml-1629/1	5.0	4.7
MZ VIII Ml-1629/2	4.7	4.7

Description. — Valve is small, solid, slightly convex, subequilateral, with its posterior part accounting for 50%—55% of the valve length. Ventral margin is very convex; dorsal margin is ⋀-shaped, its anterior part being straight and the posterior one slightly convex. Beak is small, weakly prosogyrate. Lunule is long, lanceolate, smooth, poorly defined. Escutcheon is long, lanceolate, wider than lunule, limited by a blunt edge.

External surface is covered with 29—31 distinct concentric bands which are wider than the grooves separating them. The bands disappear at the border of lunule and escutcheon. Growth stages are indistinct.

Ligament is external, opisthodetic. Nympha equals to 1/4 of the posterodorsal margin in length. Hinge is solid, of lucinoid type. Hinge plate is triangular in shape.

Hinge in the right valve: large, triangular 3b occurs in the middle of the hinge margin, separated by a deep, triangular socket from small 3a, the latter being placed close to the lunular margin; thin, lamelliform AI is parallel to the anterodorsal margin.

Hinge in the left valve: thin, lamelliform 2 and 4b, oblique to the lower edge of the hinge plate, are separated by a wide, triangular socket; 2 is more prominent than 4b; groove separating 2 from the lunular margin is narrow and more distinct than that one separating 4b from the nympha; lamelliform PII is parallel to the posterodorsal margin.

Adductor muscle scars are distinct, the anterior one being larger and ellipsoidal in shape, while the posterior one almost rectangular in outline. Pallial line shows no sinus; it is distinct, distant from the finely crenulated ventral margin.

Remarks. — The specimens assigned by NYST (1868) to *A. waeli* and described under the same name by GLIBERT (1945) have three cardinal teeth in the right valve, namely 3a, 3b, and very indistinct 5b. The specimens from Rybnica, however, have no tooth 5b.

FRIEDBERG (1934) misidentified some specimens indistinguishable from those described above, as *Crassatella* (*Crassinella*) *concentrica* DUJARDIN. His mistake is hardly understandable, as the differences between *T.* (*N.*) *waeli* (GLIBERT, 1945) and *Crassinella concentrica* (DUJARDIN, 1837) are sharp and selfevident. The latter species has distinctly opisthogyrate beak and a sharp umbonal part with slightly convex anterodorsal margin and somewhat concave posterodorsal margin. The narrow and weak cardinal teeth are placed before large and deep

triangular resilifer in *C. concentrica*, while the external ligament is fixed to a distinct nympha, placed at the posterior part of solid hinge in *T.* (*N.*) *waeli*.

The specimens of *T.* (*N.*) *waeli* from Wieliczka, housed in FRIEDBERG's collection, were assigned by that author (FRIEDBERG 1934) to *Astarte* (*Goodallia*) *triangularis* MONTAGU, 1803. The latter species, however, differs from the former in its higher shell with orthogyrate beak being more projected above the dorsal margin, as well as in its external surface being sculptured only with fine growth lines.

The shells from Vienna Basin described by HÖRNES (1864) under the name *Astarte triangularis* (MONTAGU) differ from those named *Mactra triangularis* by MONTAGU (1803) and probably belong to *T.* (*N.*) *waeli*. In fact, their external surface is ornamented with very distinct, wide, concentric bands, and their anterodorsal margin is only a little shorter and steeper than in the holotype of *T.* (*N.*) *waeli*.

It is also reasonable to claim, that the specimens from Wieliczka assigned by REUSS (1867) to *Astarte triangularis*, belong in fact to *T.* (*N.*) *waeli*, as they are, according to REUSS, entirely consistent with those figured by HÖRNES (1864).

GLIBERT (1957*c*) introduced the name *Astarte* (*Nicania*) *pseudopygmaea* for the specimens from the Pliocene of England, ascribed by WOOD (1850) to *Astarte pygmaea* Münster, as well as for his own specimens from the sands of Belgian Scaldisien. According to GLIBERT (1957*c*), *A.* (*N.*) *pseudopygmaea* differs from *T.* (*N.*) *waeli* in its thicker concentric lamellae (18—19 in number, in contrast to 24—25 in *T.* (*N.*) *waeli*) and steeper anterodorsal margin. Unfortunately, GLIBERT did not give the dimensions typical of newly erected species. After the measurements have been made by the present author on the published figures, it became clear that *A.* (*N.*) *pseudopygmaea* with 18—19 lamellae is 3.0 mm high, *T.* (*N.*) *waeli* with 24—25 lamellae is 4.0 mm high, and the 5.0 mm high specimens from Rybnica have 29—31 lamellae. The present author is therefore convinced that *T.* (*N.*) *waeli* and *A.* (*N.*) *pseudopygmaea* are actually synonymous, a difference in slope of the anterodorsal margin seeming to be insufficient as a criterion to distinguish between species.

Stratigraphic range. — Early Miocene (NORDSIECK 1972). — Late Miocene (GLIBERT and de HEINZELIN 1955).

Superfamily **Cardiacea** LAMARCK, 1809
Family **Cardiidae** LAMARCK, 1809
Subfamily **Cardiinae** LAMARCK, 1809
Genus *Acanthocardia* GRAY, 1851
Subgenus *Acanthocardia* (*Acanthocardia*) GRAY, 1851
Acanthocardia (*Acanthocardia*) *paucicostata* (SOWERBY, 1839)
(pl. 10: 1a—b, 2a—b)

1892. *Cardium paucicostatum* SOWERBY; BUCQUOY *et al.*, 268—271, pl. 44: 1—5.
1912. *Cardium paucicostatum* SOW.; COSSMANN and PEYROT, 478—479, pl. 20: 30.
1960. *Cardium* (*Acanthocardia*) *paucicostatum* SOWERBY 1839; KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 41—42, pl. 13: 4—5.
1963. *Cardium paucicostatum* SOWERBY; TAVANI and TONGIORGI, 26, pl. 25: 1, 3, 5—8, 13—15.
1976. *Acanthocardia* (*Acanthocardia*) *paucicostata* (SOW.); BRAMBILLA, 111, pl. 28: 7—8.
1977. *Acanthocardia* (*Acanthocardia*) *paucicostata* (SOWERBY, 1839); MARASTI and RAFFI, 32, pl. 2: 5.

Material. — Nawodzice — 9 valves; Rybnica 1—7 valves; Rybnica 2—10 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml-1631/$_1$	12.0	10.5
MZ VIII Ml-1631/$_2$	5.5	5.0

Description. — Valve is suborbicular in outline, slightly transversally elongated, very convex, subequilateral, with its posterior part accounting for 54% of the valve length. Small, sharpened, prosogyrate beak considerably projects along with very convex umbonal part of the valve, above the dorsal margin. Slightly convex anterodorsal margin is shorter than the straight, oblique, posterodorsal margin. Straight posterior margin makes an obtuse angle with the posterodorsal margin. Angular connection of the posterior margin with the arched ventral margin is sharp. Ventral margin gently connects with the convex anterior margin. Lunule is cordate without any concentric ornamentation.

Valve sculpture consists of 16—18 wide, triangular ribs, separated with grooves which are plane and narrower than the ribs; four ribs in the posterior part of the valve are somewhat narrower and lower than the others. Both the ribs and the grooves are ornamented with closely spaced concentric lines which are straight or arched in grooves, while V-shaped on ribs. Top part of the ribs is devoid of concentric ornamentation. Each rib bears a row of fine, low spines, triangular in cross section. The spines usually get detached leaving a triangular-shaped trace, the triangle being isosceles with a short basis. Growth stages are indistinct.

The hinge is not very solid. Its anterior edge is strongly flanged close to the beak. The length of the nympha approximates half the length of the posterodorsal margin.

Hinge in the right valve: oblique 3a is nearly as solid as vertical 3b which is separated from the former by a triangular socket; AI is short, lamelliform; very strong, lamelliform PI is oblique to the posterodorsal margin.

Left valve: triangular 2, the strongest tooth of the hinge, is separated by a triangular socket from 4b, the latter being very weak and fused with the border of the nympha; lamelliform AII, parallel to the anterodorsal margin, is somewhat longer than PII.

Anterior adductor muscle scar is bean-shaped; the posterior one is larger and oval in shape. Pallial line shows no sinus; it is very distant from the ventral margin. The latter has deep crenulation extending up to 2/3 of the shell height.

Remarks. — According to GLIBERT and VAN de POEL (1970: 54—55), the specimens from Rybnica illustrated and described by FRIEDBERG (1934, 133—134, pl. 22: 6—7) under the name *Cardium paucicostatum* represent another species, viz. *Cardium* (*Acanthocardia*) *ciliare bianconianum* COCCONI, 1873. The two species differ in shape of the spines, the number of ribs being constant. GLIBERT and VAN de POEL (1970) ascertained that *C.* (*A.*) *ciliare* has triangular, narrow spines with their bases contacting with one another. *C.* (*A.*) *paucicostatum*, in turn, has more or less elongated triangular spines.

The specimens from Rybnica figured by FRIEDBERG and housed at present at the Institute of Geological Sciences, Cracow, have their sculpture completely worn out (which was mentioned by FRIEDBERG in his description); even the traces of detached spines forming grooves on the top of the ribs are not preserved. Thus, the shape of spines being diagnostic of *C. paucicostatum* and *C. ciliare*, an identification of the considered specimens with either of the two species would be impossible. However the present author is of the opinion that such a difference in construction of spines is insufficient to establish two distinct species. This is consistent with the opinion expressed by DESHAYES (1839: 73), who deleted the name *ciliare* LINNÉ, 1758 from the nomenclature.

Stratigraphic range. — Middle Miocene (COSSMANN and PEYROT 1912) — Recent.

Acanthocardia (*Acanthocardia*) *turonica* (HÖRNES, 1861)
(pl. 10: 4, 6a—b, 7, 8a—b, 9)

1830. *Cardium hispidum*, m.; EICHWALD, 209.
1831. *Cardium echinatum* LIN.; du BOIS de MONTPÉREUX, 62, pl. 4: 13—14.
1853. *Cardium hispidum* m.; EICHWALD, 94—95; *non* 1851, pl. 4: 21a—c.

1861. *Cardium turonicum* MAYER; HÖRNES, 188—189, pl. 27: 3a—e.
1866? *Cardium Brocchi*, MAYER, 67—68, pl. 2: 4.
1882. *Cardium prae-echinatum* HILBER, nova forma; HILBER, 13—14, pl. 1: 34—35.
1899. *Cardium taurinum* MICHT.; SACCO, 37, pl. 9: 1—3.
1900. *Cardium Barrandei* MAYER-EYMAR; IVOLAS and PEYROT, 195—196, pl. 3: 9—12.
non 1900. *Cardium turonicum* MAYER-EYMAR; IVOLAS and PEYROT, 213—214, pl. 3: 13, 16.
1903. *Cardium pseudoturonicum* n. sp.; MIKHAILOVSKY, 126.
non 1912. *Cardium turonense* MAYER em.; COSSMANN and PEYROT, 486—487, pl. 22: 19—20.
1912? *Cardium sallomacense* nov. sp.; COSSMANN and PEYROT, 489—490, pl. 22: 25—28.
1913. *Cardium turonicum* MAYER; DOLLFUS and DAUTZENBERG, 312—315, pl. 25: 1—12.
1925. *Cardium Schafferi* nov. spec.; KAUTSKY, 36.
1934. *Cardium* (*Trachycardium*) *praeechinatum* HILB.; FRIEDBERG, 134—136, pl. 21: 19—22, pl. 22: 1—2.
1938. *Cardium praeechinatum* HILB.; FRIEDBERG, 40.
1950. *Cardium* (*A.*) *taurinum* MICHELOTTI; HEERING, 32, pl. 6: 138.
1954. *Cardium* (*Acanthocardia*) *barrandei schafferi* KAUTSKY; SIEBER, 214—216, pl. 2: 2a—e, 4.
1955. *Cardium hispidum* EICHWALD, 1850; MERKLIN and NEVESSKAJA, 39, pl. 5: 1—6.
1956. *Cardium* (*Acanthocardia*) sp. 1 [= *Cardium schafferi* KAUTSKY]; TEJKAL, 25, pl. 5: 1.
1960. *Cardium* (*Acanthocardia*) *barrandei* var. *schafferi* (KAUTSKY, 1925); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 41, pl. 13: 3.
part. 1963. *Cardium* (*Acanthocardia*) *turonicum* MAYER; VENZO and PELOSIO, 173, pl. 32: 4, pl. 55: 10—13, 13a, 17—19, 21.
1968. *Cardium* (*Acanthocardia*) *barrandei schafferi* (KAUTSKY, 1925); HINÇULOV, 104, pl. 21: 11—14.
1970. *Cardium* (*Acanthocardia*) *praeechinatum* HILBER, 1882; GLIBERT and VAN de POEL, 56.
1970. *Cardium* (*Acanthocardia*) *turonicum* MAYER in HÖRNES, 1861; GLIBERT and VAN de POEL, 56.

Material. — Nawodzice — 2 shells, 20 valves; Rybnica 1—18 valves; Rybnica 2—270 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1632/$_1$	38.0	37.5
MZ VIII Ml-1632/$_2$	33.0	33.5
MZ VIII Ml-1632/$_3$	27.0	26.2
MZ VIII Ml-1632/$_4$	7.3	6.8
MZ VIII Ml-1632/$_5$	5.6	5.2

Description. — Juvenile shells, up to 15.0 mm in height, are orbicular in outline, while larger ones are posteroventrally obliquely elongated. Very slightly convex posterodorsal margin makes an obtuse angle with the anterior margin. Small beaks are weakly prosogyrate. Slightly swollen umbonal part projects above the dorsal margin. Lunule is large, cordate, smooth, poorly defined. Escutcheon is narrow, smooth, poorly defined.

External surface bears 20—26 (most commonly 22—23, see below) triangular ribs separated with very narrow, plane grooves.

ribs number	20	21	22	23	24	25	26
specimens number	8	45	69	70	29	10	2

(total number of investigated specimens — 233)

The grooves increase in width anteriorly and posteriorly from the middle of the ventral margin. They are ornamented with densely spaced, straight lines, forming concentric ornamentation, while the ribs bear only spines. Irregularly bent concentric lines occur also at the slopes of the ribs, but exclusively in large specimens. Spines commonly get detached from the ribs, leaving a row of drop-shaped traces. In small shells, they look like stuck spherules, whereas in larger shells, they are longer and display also vertical grooves which results in their wheat corn appearance. Growth lines are clear.

Anterodorsal margin is slightly flanged. Nympha does not reach half the posterodorsal margin in length. Cardinal teeth are small; there is no well developed hinge plate.

Hinge in the right valve: nodular 3a is situated on the flanged part of the anterodorsal margin; it is separated by a triangular socket from somewhat higher, triangular 3b which is placed close beneath the beak; lamelliform AI and AIII occur at the end of the anterodorsal margin; AI is long, parallel to the margin, and separated by a deep groove from the small, low and oblique AIII; PI, the largest lateral tooth, is oblique and separated by a deep and narrow groove from the posterodorsal margin.

Hinge in the left valve: triangular 2, the largest cardinal tooth, occurs close beneath the beak, bordered at both the sides by triangular sockets; 4b is thin and short, placed close to the nympha margin; AII is subparallel to the anterodorsal margin, from which it is separated by a shallow groove; PII is very small, situated close to the posterodorsal margin.

Adductor muscle scars are subequal in size, the anterior one being bean-shaped and the posterior one oval in outline. Pallial line shows no sinus; it is very distant from the deeply crenulated ventral margin. Internal ribs extend up to the beak.

Remarks. — A great deal of confusion concerns the name of this species which is very frequent in sandy sediments of European Miocene.

The specimens of *A.* (*A.*) *turonica* from the Vienna Basin, ornamented with 20 triangular ribs bearing small, orbicular spines, are, according to HÖRNES (1861, 188—189, pl. 27: 3a—c) almost indistinguishable from specimens from Touraine and Bordeaux. According to DOLLFUS and DAUTZENBERG (1913: 312—314), however, *C. turonicum* MAYER as described by HÖRNES (1861) is consistent only with some specimens from Touraine; other specimens are smaller and have less numerous ribs with pointed spines, which differences are at the level of variety. The latter forms from Touraine, assigned by DOLLFUS and DAUTZENBERG (1913, 313, pl. 25: 13—20) to *C. turonicum* var. *Vidali* COSSMANN and PEYROT, were illustrated by IVOLAS and PEYROT (1900, pl. 3: 13, 16) under the name *C. turonicum*. In turn, IVOLAS and PEYROT (1900, 97, pl. 3: 9—12) assigned those specimen from Touraine that are consistent with the Viennese ones, to *C. barrandei* MAYER, because, as they claimed, HÖRNES had erroneously given the name *turonicum* MAYER to the forms described in MAYER'S original manuscript as *C. Barrandei*. COSSMANN and PEYROT (1912: 486—487) also assessed that the shells from the Vienna Basin named *turonicum* by HÖRNES (1861) are distinctly different from those from Touraine named *turonicum* by MAYER himself. Consequently, they demanded to check the correctness of the identification of the Viennese specimens. Concerning MAYER'S species from Touraine, COSSMANN and PEYROT (1912) renamed it as *C. turonense* because the denomination *C. turonicum* refers misleadingly to the Turonian. KAUTSKY (1925: 36) confirmed the statement of COSSMANN and PEYROT (1912) and erected a new name, *C. schafferi*, for the specimens from Hemmoorer which resemble those from Pötzleisdorf identified by HÖRNES (1861) as *C. turonicum*.

SIEBER (1950: 308—309) attributed the specimens from the Vienna Basin to *C. barrandei schafferi*, without giving any explanations. Moreover, he subsequently published (SIEBER 1954) the original illustration of *C. turonicum* given by HÖRNES (1861) under the name *C.* (*A.*) *barrandei schafferi* KAUTSKY.

Shells of *A.* (*A.*) *turonica* have been widely known on Polish palaeontological literature as *C. praeechinatum* since HILBER (1882) established that name to replace *C. hispidum* EICHWALD, 1830, because the latter referred evidently to two distinct species. The description given by EICHWALD (1853: 94—95) entirely corresponds to the specimens from Rybnica, but the associated illustration (EICHWALD 1853, pl. 4: 21a—c) presents a juvenile specimen inconsistent with the description, which was named by HILBER (1882, 14, pl. 1: 32—33) as *subhispidum*.

Having investigated EICHWALD'S collection from Żukowce, MIKHAILOVSKY (1903: 126) introduced still another name, *C. pseudoturonicum*, for the large specimens described and identified by EICHWALD (1853) as "*C. hispidum*, m., *echinatum* DUBOIS", to prevent, as the stated, further misunderstandings.

The only differences between *C. turonicum* MAYER in HÖRNES and *C. praeechinatum* consist

in the shell shape and the presence or absence of nodular spines. Orbicular specimens with well preserved spines have been named *C. turonicum*, while the name *C. praecchinatum* has been used for slightly obliquely elongated specimens with less numerous spines. Thus far, orbicular specimens of *C. pseudoturonicum* [= *praeechinatum*] have been described only by MIKHAILOVSKY (1903). The present author's abundant collection from Rybnica, however, allows to conclude that the shell shape cannot be recognized for diagnostic of any of the above mentioned species. Similarly, the number of spines depends on the shell size; for instance, the investigated specimens up to 20 mm in height have all the ribs provided with spines.

Following the above discussion, the names *turonicum* MAYER in HÖRNES and *praeechinatum* HILBER [= *hispidum* EICHWALD = *pseudoturonicum* MIKHAILOVSKY] are here considered to refer to a single species which should be named *C. turonicum* HÖRNES. The denomination *turonicum* MAYER was first published by HÖRNES (1861), and the species should keep this name even if HÖRNES was mistaken as suggested by IVOLAS and PEYROT (1900) and COSSMANN and PEYROT (1912).

The form *C. sallomaccnse* COSSMANN and PEYROT (1912, 489—490, pl. 22: 25—28), characterized by orbicular shells with 26 ribs bearing spines indistinguishable from the spines of *C. turonicum*, should probably be included to the latter species, together with *C. brocchi* MAYER (1866, 67—68, pl. 2: 4), the shell of which is slightly posteroventrally elongated, with 23—26 ribs.

Stratigraphic range. — Early Miocene (SACCO 1899) — Middle Miocene (DOLLFUS and DAUTZENBERG 1913).

Genus *Parvicardium* MONTEROSATO, 1884

Parvicardium minimum (PHILIPPI, 1836)

(pl. 10: 3a—b, 5)

1908. *Cardium* (*Parvicardium*) *minimum* PHIL.; CERULLI-IRELLI, 27—28, pl. 4: 24—27, pl. 5: 1—4.
1930. *Cardium* (*Parvicardium*) *minimum* PHIL.; PARTINI, 35, pl. 3: 11—11a.
1954. *Cardium* (*Parvicardium*) *minimum* PHILIPPI; SIEBER, 35, pl. 1: 17a—b, pl. 2: 10a—b.
1963. *Corculum* (*Papillicardium*) *minimum* (PHILIPPI); VENZO and PELOSIO, 175, pl. 54: 2—4.
1966. *Cardium minimum* (PHILIPPI); TEBBLE, 100—101, text-fig. 11a—b.
1974. *Cardium* (*Parvicardium*) *minimum* PHILIPPI; MALATESTA, 103—104, pl. 8: 6.
1977. *Parvicardium* sp.; JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 100, pl. 11: 2—3.

Material. — Rybnica 1—3 valves; Rybnica 2—18 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1633/$_1$	5.3	5.7
MZ VIII Ml-1633/$_2$	5.2	4.7

Description. — Valve is small, fragile, almost orbicular in shape, more or less posteroventrally elongated, very convex, inequilateral, with its posterior part accounting for 63% of the valve lenght. Beaks are very small, prosogyrate, slightly projecting above the dorsal margin. Short, somewhat convex anterodorsal margin gently passes into the distinctly convex anterior margin which, in turn, genlty connects with the long, arched ventral margin. Straight, oblique, posterodorsal margin makes an obtuse angle with the slightly convex posterior margin; connection of the posterior margin with the ventral margin is angularly bent. Lunule is very small, cordate, smooth.

External surface is covered with 28—31 plane, wide ribs; 3 ribs at the posterodorsal margin are wider than the others. The ribs are sculptured with densely spaced, concentrically arranged, semilunar nodules. The nodules are preserved only in the anterior part of the shell and at the

ventral margin; commonly they get detached leaving a semilunar trace on the rib surface. The grooves are very narrow, plane, covered with dense, straight, rounded lines. The ribs do not appear simultaneously in the ontogentic development. Sculpture of specimens smaller than 0.7 mm in length consists of 14 narrow and smooth ribs separated with wide grooves. At the next developmental stage, one or two ribs appear in each groove. Growth stages are indistinct.

Hinge is very small; nympha equals 1/3 of the posterodorsal margin in length.

Hinge in the right valve: hardly discernible 3a is placed close to the anterodorsal margin and separated by a triangular socket from very small, triangular 3b; short, lamelliform AI occurs at the end of the anterodorsal margin, separated by a shallow socket from very small, nodular AIII; large, triangular socket separates long PI from the posterodorsal margin.

Hinge in the left valve: triangular 2, placed beneath the beak, is separated by a small socket from very weak, nodular 4b; short AII parallels the anterior part of the anterodorsal margin; PI is in the form of a hardly noticeable monticule at the end of the posterodorsal margin.

Adductor muscle scars are oval in shape, subequal in size, placed close beneath the dorsal margin. Pallial line shows no sinus; it is indistinct, distant from the deeply crenulated ventral margin. The ventral ribs extend up to the beak.

Remarks. — The species under discussion is similar to *Plagiocardium* (*Papillicardium*) *papillosum* (POLI, 1795). The latter has solid shell ornamented with 22—27 high, rounded ribs bearing orbicular nodules, while fragile shells of *P. minimum* have 28—31 plane ribs with semilunar nodules. The internal surface of *P.* (*P.*) *papillosum* is smooth, while *P. minimum* has internal surface with delicate ribs.

Parvicardium ovale is also allied with *P. minimum*. Both the species have the same shell shape but they differ in ornamentation. The external surface of *P. ovale* is covered with 24—26 plane ribs, smooth in the middle part of the shell, ornamented with semilunar nodules in the anterior part, and with short spines in the posterior part. In contrast to *P. minimum*, growth stages are clearly distinct from one another at the shell of *P. ovale*.

In the present author's opinion, the specimens from Monastyrz housed in the Museum of the Earth, Warsaw, identified by JAKUBOWSKI (1977: 100) as *Parvicardium* sp., belong to *P. minimum*.

The species *P. minimum* has previously not been mentioned from the Polish Miocene.

Stratigraphic range. — Middle Miocene (MALATESTA 1974) — Recent.

Genus *Plagiocardium* COSSMANN, 1886
Subgenus *Plagiocardium* (*Papillicardium*) SACCO, 1899
Plagiocardium (*Papillicardium*) *sonense* (COSSMANN, 1896)

(pl. 11: 7a—b, 8—11)

1912. *Cardium* (*Parvicardium*) *sonense* COSSMANN; COSSMANN and PEYROT, 509—511, pl. 22: 43—47.
1958. *Cardium* (*Parvicardium*) *sonense* COSSM.; SENEŠ, 82, pl. 15: 180.
1970. *Parvicardium sonense* (COSSMANN, 1896); GLIBERT and VAN de POEL, 47.
1979*a*. *Plagiocardium* (*Papillicardium*) *sonense* (COSSMANN, 1895); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 58, pl. 4: 23.

Material. — Nawodzice — 54 valves; Rybnica 1—4 shells, 372 valves; Rybnica 2—11 valves.

Dimensions (in mm):

	L	H
MZ VIII Mł-1634/$_1$	6.2	4.8
MZ VIII Mł-1634/$_2$	5.0	4.8

MZ VIII Ml-1634/$_3$	3.3	2.8
MZ VIII Ml-1634/$_4$	3.1	2.5
MZ VIII Ml-1634/$_6$	1.2	1.0

Description. — Shell is small, rhomboidal in shape, posterodorsally obliquely elongated, slightly convex, inequilateral, with its posterior part accounting for 66%—72% of the shell length. Short and slightly concave anterodorsal margin gently passes into the convex anterior margin. Long, straight, posterodorsal margin makes an obtuse angle with the slightly convex, oblique posterior margin which, in turn, makes an acute angle with the arched ventral margin. Weak, rounded ridge, directed posteroventrally, runs from the beak. Shell becomes plane behind the ridge. Beaks are small, weakly prosogyrate. Lunule is smooth, very narrow, poorly defined.

The shell shape and ornamentation change during the ontogeny. Shells smaller than 0.1 mm in height are smooth, orbicular in shape. Shells ranging from 0.1 mm — 0.5 mm in height are ornamented with 5—8 weak, smooth ribs separated with very wide grooves. In shells ranging from 0.5 mm to 1.2 mm in height, short ribs appear in grooves, bearing quadrate nodules in the anterior part of the shell and spines in the posterior part. Shells exceeding 1.2 mm in height are distinctly posteroventrally elongated and their external surface is covered with 21—23 wide, plane, and very low ribs. Very narrow grooves are ornamented with rounded, arched lines, their convexity being directed towards the ventral margin. The ribs bear densely spaced rectangular or quadrate nodules, but 7 narrow, posterior ribs (placed beyond the ridge) are ornamented with small, sparsely spaced spines. Large shells, 10.5 mm high, are rectangular in shape because the posteroventral elongation decreases. Their posterior ribs bear quadrate nodules, spaced more sparsely than on the remaining ribs. Growth stages are indistinct.

Hinge is not very solid. Anterodorsal margin is slightly flanged. Nympha equals half the posterodorsal margin in length.

Hinge in the right valve: small, nodular 3a is separated by a little socket from large, triangular 3b which is placed beneath the beak; AI is lamelliform, slightly oblique to the anterior part of the dorsal margin, separated from it by a socket; long and oblique PI is separated by a long, triangular socket from the posterodorsal margin.

Hinge in the left valve: triangular 2, smaller than 3b, placed beneath the beak, is separated by a small, triangular socket from very fragile, thin, lamelliform 4b fusing with the border of the nympha; AII is in form of a distinct but small nodule placed at the beginning of the anterodorsal margin; PII is in form of a weak, short knot at the end of the posterodorsal margin.

Adductor muscle scars are indistinct, the anterior one being small and orbicular, the posterior one large and oval in shape. Pallial line shows no sinus; it is indistinct, distant from the deeply crenulated ventral margin.

Remarks. — The species under discussion is allied with *Plagiocardium* (*Papillicardium*) *papillosum* (POLI, 1975), but it differs from the latter in shell shape and convexity. Individuals of *P.* (*P.*) *sonense* have shells slightly convex, rhomboidal in shape and inequilateral, while the shell of *P.* (*P*) *papillosum* is suborbicular in shape, subequilateral, and very convex. The number of ribs may be the same in both species, but the nodules at the rib surface are quadrate or rectangular in *P.* (*P.*) *sonense*, while their area orbicular in shape in *P.* (*P.*) *papillosum*. *P.* (*P.*) *sonense* abundantly occurs in sandy sediments in contrast to *P.* (*P.*) *papillosum* which is common in clayey sediments.

The species *P.* (*P.*) *sonense* is similar also to *P.* (*P.*) *subhispidum* (HILBER, 1882) which has very convex, trapezoidal shell, sculptured with 21 ribs with orbicular nodules on their surface. Additional differences between *P.* (*P.*) *subhispidum* and *P.* (*P.*) *sonense* are in the shorter posterodorsal margin, stronger posteroventral elongation, and presence of weak teeth AIII and PIII in the former species.

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1912) — Middle Miocene (SENEŠ 1958).

Subfamily **Laevicardiinae** KEEN, 1936
Genus *Laevicardium* SWAINSON, 1840
Subgenus *Laevicardium* (*Laevicardium*) SWAINSON, 1840
Laevicardium (*Laevicardium*) *dingdense* (LEHMANN, 1885)
(pl. 11: 1a—b, 2—3, 4a—b, 5—6)

1882? *Cardium Baranovense* HILBERT, nova forma; HILBER, 13, pl. 1: 34—35.
1892. *Cardium Dingdense* nov. sp.; LEHMANN, 238—240, pl. 4: 9.
1912. *Cardium* (*Laevicardium*) *pantecolpatum* nov. sp.; COSSMANN and PEYROT, 517—519, pl 23: 32—35.
1934. *Cardium* (*Trachycardium*) *rybnicense* FRIEDB.; FRIEDBERG, 137—138, pl. 22: 8.
1938. *Cardium rybnicense* FRIEDB.; FRIEDBERG, 40.
1945. *Laevicardium antwerpiense* nov. sp.; GLIBERT, 169—171, pl. 10: 7a—c.
part. 1950. *Laevicardium cyprium* (BROCCHI); HEERING, 30—31, pl. 6: 124.
1964. *Laevicardium dingdense* LEHMANN 1885; ANDERSON, 167—168, pl. 7: 56a—d.
1970. *Laevicardium* (*Habecardium*) *dingdense* (LEHMANN, 1892); GLIBERT and VAN de POEL, 36.
1972. *Laevicardium dingdense* (LEHMANN, 1892); NORDSIECK, 36, pl. 7: 53.

Material. — Nawodzice — 6 valves; Rybnica 1—31 valves; Rybnica 2—6 shells, 432 valves. Dimensions (in mm):

	L	H
MZ VIII Ml-1635/$_1$	50.5	53.0
MZ VIII Ml-1635/$_2$	32.0	31.0
MZ VIII Ml-1635/$_3$	31.0	31.5
MZ VIII Ml-1635/$_4$	5.6	5.4
MZ VIII Ml-1635/$_5$	4.9	4.6
MZ VIII Ml-1635/$_6$	1.7	1.6

Description. — Shell shape and convexity as well as convexity of the umbonal part undergo changes in ontogeny. Small shells are orbicular in shape, while larger ones are obliquely elongated with a distinct posteroventral angle. Shells are inequilateral, with their posterior part accounting for 52%—66% of the shell length. The larger the shell is, the stronger is also its inequilaterality. In small specimens, small, acute, distinctly prosogyrate beaks only slightly project above the dorsal margin; in larger specimens, on the contrary, the beaks are strongly elevated together with the swollen umbonal part. Lunule is cordate, very wide, poorly defined, without radial ornamentation.

Sculpture of the external surface changes according to the following pattern:

1. up to 1.5 mm in length — the surface is almost smooth, glossy; a single rib runs posteroventrally from the beak; 3 or 4 other ribs occur near the posterior margin;
2. up to 3.0 mm in length — 6 ribs run posteroventrally from the beak in the posterior part of the shell; there are 6 ribs in the anterior and 6 ones in the middle parts, but confined to the close neighborhood of the ventral margin;
3. up to 4.5—6.0 mm in length — there are 24 ribs along the ventral margin, but only 6 ribs in the posterior part of the shell begin at the beak;
4. more than 6.0 mm in length — the sculpture consists of 34—41 smooth ribs which are plane at the beginning, but rounded afterwards; the ribs are twice as wide as the interrib grooves; 5—7 posterior ribs and 3—4 anterior ribs are weaker than the remaining ones and asymmetrical, with their shorter and steeper slopes directed to the shell midline; delicate, densely spaced concentric lines intersect the grooves as well as the ribs, producing a wavy pattern, distinctly marked near the ventral margin of large-sized specimens.

Growth stages are clearly distinct from one another.

Narrow nympha attains 3/4 of the posterodorsal margin in length. Anterodorsal margin is slightly flanged. Hinge plate is lacking.

Hinge in the right valve: very weak 3a, placed on the flanged part of the anterodorsal margin, is separated by a triangular socket from strong, triangular, oblique 3b which is placed in front of the beak; top parts of 3a and 3b are fused; AI, placed at the end of the anterodorsal margin, is separated by a deep groove from small AIII which is oblique to the anterodorsal margin; AI and AIII are parallel to each other; very large PI, subparallel to the end part of the posterodorsal margin, is separated from it by a deep groove; very weak PIII is also present, but only in small specimens.

Hinge in the left valve: oblique 2, placed close to the beak, approximates 3b in size; very weak 4b is separated by a deep triangular socket from 2; solid AII, a little shorter than PI, is placed at the end of the anterodorsal margin to which it is parallel; very weak PII is separated from posterodorsal margin by a shallow socket.

Adductor muscle scars are oval in shape, the posterior one being somewhat higher and larger than the anterior. Pallial line shows no sinus; it is distant from the crenulated ventral margin. The internal ribs disappear near the ventral margin, leaving the internal surface smooth.

Remarks. — Subsequent ontogenetic stages of the considered species have been described under variable specific names. Some 11 mm long shells from the Miocene of northwestern Westphalia were named by LEHMANN (1885) as *Cardium dingdense*. COSSMANN and PEYROT (1912) gave the name *C. pantecolpatum* to 18 mm long specimens from Aquitaine. GLIBERT (1945) described *C. antwerpiense* from the Miocene of Belgium, with shells approximating 30—35 mm in length. The largest specimens of *L. dingdense* (40 mm long) were found by FRIEDBERG (1934) in Rybnica and named *C. rybnicense*.

Anderson (1964) was the first to note that *C. dingdense* is known from Aquitaine as *C.* (*L.*) *pantecolpatum* COSSMANN and PEYROT. GLIBERT and VAN de POEL (1970) recognized *L. antwerpiense* for a younger synonym of *L. dingdense*. *C. rybnicense* has up to date been considered to be an endemic species.

The specimens identified as *C. baranovense* HILBER, 1882, known as casts only, most probably belong to *L. dingdense*.

According to HEERING (1950), *L. dingdense* should be treated as a variety of the highly variable species *L. cyprium* (BROCCHI, 1814).

The species *L.* (*L.*) *dingdense* resembles very closely *L.* (*L.*) *gallicum* (MAYER, 1866). The resemblance is so striking that GLIBERT (1945: 170—171) considered the possibility to treat *L. dingdense* [= *L. antwerpiense*] as the northern phylum of *L. gallicum*, but finally he recognized these forms for two distinct species. In fact, the shell of *L.* (*L.*) *gallicum* is suborbicular in shape, with distinct triangular umbonal part which bears 44—50 plane and narrow ribs separated with very narrow grooves (cf. MAYER 1866, 72, pl. 2: 3). COSSMANN and PEYROT (1912, 520—522, pl. 23: 28—31) attributed to *L. gallicum* only those specimens with smooth, narrow anterior part and slightly wider, smooth posterior part, in contrast to form sculptured with narrow ribs at the whole surface, which they named *L. pantecolpatum* (i.e. whole-ribbed).

Stratigraphic range. — Middle Miocene (COSSMANN and PEYROT 1912) — Late Miocene (ANDERSON 1964).

Genus *Cerastoderma* POLI, 1795

Cerastoderma obsoleta (EICHWALD, 1830)

(pl. 11: 12a—b, 13—14, 15a—b)

1850. *Cardium obsoletum* m.; EICHWALD, 61; 1851, pl. 4: 19a—c.

1934. *Limnocardium obsoletum* EICHW.; FRIEDBERG, 152, pl. 24: 7—9 *(cum syn.)*.

1969. *Cardium* (*Cerastoderma*) *obsoletum obsoletum* EICHWALD; KOJUMDGIEVA, pl. 8: 7—8.

1976. *Cerastoderma (Obsoletiforma) obsoletum obsoletum* (EICHW.); ILJINA *et al.*, pl. 1: 37—48, pl. 2: 25—29, pl. 3: 3—26.

1978. *Obsoletiforma obsoletum* (EICHW.); BAGDASARJAN, pl. 16: 17—19, 21, pl. 17: 1—2.

Material. — Nawodzice — 18 valves; Rybnica 1—15 valves; Rybnica 2—11 valves. Dimensions (in mm):

	L	H
MZ VIII Ml-1636/1	8.0	6.8
MZ VIII Ml-1636/2	3.6	3.0
MZ VIII Ml-1636/3	3.3	2.8
MZ VIII Ml-1636/4	2.0	1.8

Description. — Valve is nearly rhomboidal in shape, inequilateral, with its posterior part accounting for 62% of the valve length. Convex anterior margin gently connects with the ventral margin and with the slightly concave, short anterodorsal margin. Straight to slightly convex, oblique posterior margin, shorter than the anterior one, makes, an obtuse angle with the straight, almost vertical posterodorsal margin. Arched ventral margin makes an acute angle with the straight posterior margin. The latter connection appears less sharp if the posterior margin is convex. Distinct ridge runs posterodorsally from the small, prosogyrate beak. The ridge is accentuated by the most prominent rib. Lunule is cordate, short, somewhat plunged, well defined.

External surface is ornamented with 23—26 ribs, triangular in cross-section, but with rounded tops; 7—8 ribs are placed beyond the ridge. The ribs and the plane interrib grooves are ornamented with densely spaced concentric lines which are straight in the grooves, while bent toward the dorsal margin on the ribs. The grooves and the ribs are equal in width. Concentric lines form scales on the ribs. The most prominent scales occur on the last rib near the posterodorsal margin. In the umbonal part of the shell, the ribs are smooth and rounded, concentric lines being present only in the grooves. Not all ribs extend to the beak. Shells 0.7 mm high have 14—15 low, narrow ribs separated with wide grooves in which additional ribs appear further on. Shells 5—8 mm high have concentric ornamentation poorly preserved; the ribs are low, almost rectangular in cross-section near the ventral margin. Growth stages are indistinct.

The flange of the anterodorsal margin is lacking. Nympha approximates 1/3 of the posterodorsal margin in length.

Hinge in the right valve: 3a and 3b are equally strong, the latter being placed close beneath the beak; long, thin, lamelliform AII, oblique to the anterodorsal margin, is separated by a groove from shorter AIII, the latter being parallel to the anterodorsal margin; PI attains half the length of the posterodorsal margin, from which it is separated by a triangular socket.

Hinge in the left valve: triangular 2, with a shallow socket in front, is placed beneath the beak; weak, thin, lamelliform 4b, placed near the nympha border, is separated from 2 by a socket; AII, parallel to the anterodorsal margin, is separated from it by a groove; PII is very weak, placed at the edge of the posterodorsal margin.

Adductor muscle scars are indistinct, subequal in size, the anterior one being bean-shaped, while the posterior is somewhat larger, oval in shape. Both the muscle scars are placed near the dorsal margin. Pallial line shows no sinus; it parallels the crenulated ventral margin. Internal ribs are distinct up to the pallial line, but they become indistinct higher up.

Remarks. — The specimens under discussion are identifiable only with much difficulty because several related species of the genus *Cerastoderma* (viz. *lithopodolica*, *obsoleta*, *sarmatica*) have been variously treated by the different authors. C. *lithopodolica* (du BOIS, 1831) [= *Cardium protractum* EICHWALD, 1829 = *Cardium protractum* EICHWALD, 1850 = *Cardium subprotractum* HILBERT, 1882] resembles *C. obsoleta* (EICHWALD, 1830) in number of ribs, but differs from the latter in hinge construction in the left valve. The hinge has two cardinal teeth in *C. ob-*

soleta, compared to a single cardinal tooth in *C. lithopodolica*, the number of lateral teeth being the same in both the species (see FRIEDBERG 1934, 154—157, pl. 24: 12—16; VOLKOVA 1974, 37, pl. 16: 4). According to FRIEDBERG (1934), the rib sculpture is the same in both the species, the ribs bearing densely spaced scales in the anterior and middle parts of the shell, while being ornamented with short spines in the posterior part.

KOJUMDGIEVA (1969, 42—43, pl. 13: 14—16) considered *C. lithopodolica* to include shells with anterior ribs smooth or scaled, and with smooth ribs in the middle and posterior parts of the shell. According to ZHIZHCHENKO (1934, 24—25, pl. 3: 17), only some individuals of *Cardium lithopodolicum* [= *Cardium protractum* EICHWALD, 1829 = *Cardium protractum* EICHWALD, 1850 = *Cardium protractum* EICHWALD, 1851] bear anterior ribs with scales, the ribs in the middle part of the shell being smooth and the posterior ones bearing either scales or merely densely spaced concentric lines. The reason for these misunderstanding was that EICHWALD had figured in 1829 and 1851 specimens belonging apparently to two distinct species, under the same name *Cardium protractum*. In 1829, EICHWALD had illustrated specimens with ribs sculptured with scales, which were recognized by LASKAREW (1903) and FRIEDBERG (1934) for synonymous to *C. lithopodolicum*. In 1851, however, EICHWALD had figured specimens with plane, smooth ribs, which were considered by KOLESNIKOV (1935, 102—103, pl. 14: 7—10) as entirely consistent with *Cardium lithopodolicum* du BOIS (1831, 62—63, pl. 7: 29).

In fact, it is impossible to state which of the two opinions is the proper one, because the shells from the type localities are unavailable; on the other hand, the original description of *Cardium lithopodolicum* inserted in the paper of du BOIS (1831) is too short and too vague, to solve the problem.

The specimen of *Cardium protractum* figured by EICHWALD (1829) more closely resembles *Cardium lithopodolicum* than that one figured by EICHWALD (1851). Thus, the present author agrees with the opinion of LASKAREW (1903) and FRIEDBERG (1934) concerning the synonymy of *Cardium protractum* EICHWALD, 1829 and *Cardium lithopodolicum* du BOIS, 1831.

The feature making difference between *Cardium obsoletum* and *Cardium protractum* EICHWALD, 1851 [= *Cardium sarmaticum* BARBOT in KOLESNIKOV, 1829] is, according to EICHWALD (1850: 61), the rib sculpture. Dense concentric lines intersecting the ribs do not form any scales in *Cardium protractum*, which is the case in *Cardium obsoletum*. Another difference between *Cardium sarmaticum* [= *Cardium protractum* EICHWALD, 1851] and *Cardium obsoletum* has been noted by KOJUMDGIEVA (1969: 43). The hinge is reduced in *Cardium sarmaticum*; it consists of two weak cardinals (3a and 3b), small lateral AI, and very weak PI in the right valve, while only a single weak cardinal (2) and a very weak lateral (AII) are present in the left valve.

The species *Cardium ruthenicum* HILBER, 1882, differs from *Cardium obsoletum* in having its anterior ribs scaled, the remaining ribs being smooth. But even the former species was previously variably treated. *C. ruthenicum* was considered by FRIEDBERG (1934) as synonymous to *C. lithopodolicum*, but by LASKAREW (1903, 75—78, pl. 3: 1—8) as a variety of the latter. ZHIZHCHENKO, in turn (ZHIZHCHENKO 1959, 178—179, pl. 22: 41—42), treated *ruthenicum* as a distinct species but because of much vagueness in HILBER's description (HILBER 1882, 15—16, pl. 1: 43) he considered the description and figures of *C. lithopodolicum* var. *ruthenicum* given by LASKAREW (1903) as diagnostic for *C. ruthenicum* (HILBER) LASKAREW. KOJUMDGIEVA (1969, 41—42, pl. 13: 9—12) described forms indistinguishable from those investigated by LASKAREW, (1903: 75—78) under the name *Cardium* (*Cerastoderma*) *kokkupicum* ANDRUSSOV, 1916. According to the opinion of ILJINA *et al.* (1976), *Cerastoderma ruthenica* (HILBER, 1882) as well as *C. lithopodolica* (du BOIS, 1831) should be considered as subspecies of *C.* (*Obsoletiforma*) *obsoleta* (EICHWALD).

Entirely different opinion was expressed by BAGDASARJAN (1978) who considered the forms *ruthenicum*, *obsoletum* and *lithopodolicum* to be distinct species representative of three genera:

Parvicardium ruthenicum (HILB.), *Protractiforma lithopodolicum* (DUB.) and *Obsoletiforma obsoletum* (EICHW.), even though with gradual transitions into each other.

The present author follows the opinion of LASKAREW (1903) as the most convincing one.

Stratigraphic range. — Middle Miocene (FRIEDBERG 1934) — Late Miocene (KOJUMDGIEVA 1969).

Cerastoderma praeplicata (HILBER, 1882)

(pl. 12: 1a—b, 2a—b, 3—5)

1882. *Cardium prae-plicatum* HILBER, nova forma; HILBER, 14—15, pl. 1: 40—41.
1929. *Cardium praeplicatum* HILBER; KOLESNIKOV, 35—37, pl. 12: 278—292.
1929? *Cardium bogatschevi* sp.; KOLESNIKOV, 37, pl. 12: 276—277.
1934. *Limnocardium* cf. *praeplicatum* HILB.; FRIEDBERG, 148, pl. 23: 6.
1935. *Cardium praeplicatum* HILB.; KOLESNIKOV, 112, pl. 16: 13—22.
1943. *Cardium edule* L. var. *arcella* DUJ.; STRAUSZ and SZALAI, 133, pl. 3: 19—22.
1955. *Cardium praeplicatum* HILBER, 1882; MERKLIN and NEVESSKAJA, 47—48, pl. 9: 22—25.
1959? *Cardium bogatschevi* KOLESNIKOV; ZHIZHCHENKO, 181, pl. 8: 16—22.
1969. *Cardium* (*Cerastoderma*) *kujoricum* sp. n.; KOJUMDGIEVA, 47—48, 130—131, pl. 15: 8—11.
1978. *Cerastoderma praeplicatum* (HILB.); BAGDASARJAN, pl. 5: 9, pl. 6: 15, pl. 8: 1—14, pl. 9: 1—2.
1978? *Cerastoderma bogatschevi* (KOLES.); BAGDASARJAN, pl. 6: 14, pl. 7: 1—11.
1978. *Cerastoderma* (*Plicatifora*) *praeplicatum praeplicatum* (HILBER); PARAMONOVA, 46—48, text-fig. 1a—1.

Material. — Nawodzice — 53 valves; Rybnica 1—2 valves; Rybnica 2—28 valves.

Dimensions (in mm):

	L	H
MZ VIII Mł-1637/$_1$	13.8	10.2
MZ VIII Mł-1637/$_3$	12.0	9.5
MZ VIII Mł-1637/$_4$	10.2	7.5
MZ VIII Mł-1637/$_5$	7.2	5.2
MZ VIII Mł-1637/$_6$	2.8	2.1

Description. — Valve is fragile, oval in shape, inequilateral, with its flattened posterior part accounting for 58% of the valve length. Anterodorsal margin, which is concave in juveniles but slightly convex in adults, gently passes into the slightly convex anterior margin. Anterodorsal margin attains 2/3 of the straight posterodorsal margin in length. Almost rectilinear oblique posterior margin makes an obtuse angle with the posterodorsal margin. Ventral margin is irregularly convex. Very small, pointed, distinctly prosogyrate beaks slightly project above the dorsal margin. Lunule is variable in width, cordate, well defined, ornamented with delicate lines.

External surface is covered with 21—24 low ribs, rectangular or triangular in cross-section, with rounded top parts. The ribs are somewhat wider than the plane interrib grooves. 5—7 ribs placed at the flattened posterior part are twice narrower than the others. Densely spaced, delicate concentric lines are distinct in the grooves, while indistinct at or completely absent from the ribs. The concentric lines are bent towards the dorsal margin on the posterior ribs, while almost straight on the remaining ribs. Growth stages are indistinct. Some specimens bear traces of pigmentation in form of white and grey-pink concentric belts variable in width.

Cardinal teeth are very weak. Solid, oblique lateral teeth are placed at the opposite ends of the dorsal margin.

Hinge in the right valve: small, nodular 3a is separated by a shallow, triangular socket from small 3b which is placed close beneath the beak; lamelliform AI is separated by a groove from the anterodorsal margin, the latter bearing sometimes very weak AIII; lamelliform PI, large than AI, is separated from the posterodorsal margin by a triangular socket.

Hinge in the left valve: small, shallow sockets occur to the both sides of small 2; thin, lamelliform 4b is placed close to the nympha border; lateral teeth are weaker than in the right valve, AII being longer and stronger than PII.

Anterior adductor muscle scar is orbicular in shape and smaller than the posterior one which is ovally elongated upwards. Pallial line shows no sinus; it is indistinct, very distant from the crenulated ventral margin, from which internal ribs extend to the inside of the shell.

Remarks. — According to KOJUMDGIEVA (1969), HILBER's name *praeplicatum* refers only to the Tortonian forms from the Carpathian Foredeep, while the specimens attributed by KOLESNIKOV (1929, 1935) and SOKOLOV (1899) to *Cardium praeplicatum* represent actually a new species, named *kujoricum*. The comparison of the neotype of *Cerastoderma praeplicata* established by PARAMONOVA (1978) with the descriptions given by KOLESNIKOV (1929, 1935) and SOKOLOV (1899) shows, however, that conspecific forms are concerned (PARAMONOVA 1978).

KOLESNIKOV (1929) and BAGDASARJAN (1974) are of the opinion that *C. praeplicata* is closely allied with *C. bogatschevi* (KOLESNIKOV, 1929) which differs from the former only in the angle between the lateral teeth ranging from 130°—145°, compared to 125°—130° in *C. praeplicata*. According to BAGDASARJAN (1974), *C. arcella* (DUJARDIN, 1837) is the ancestor of *C. praeplicata* and *C. bogatschevi*; and both the latter species display an array of five morphotypes similar in both the cases which is considered as an evidence for their parallel evolution. This, somewhat curious statement, as well as the range of variation in angle between the lateral teeth found in the specimens from Rybnica (116°—139°) are suggestive of *C. praeplicata* and *C. bogatschevi* being in fact synonymous. This problem, however, may be ultimately solved only after comparative investigations of the specimens from Poland and USSR.

Shells indistinguishable from *C. praeplicata* in either shape or sculpture were described from the French Miocene as *Cardium edule* LINNÉ var. *clodiensis* (RÉNIER) BROCCHI, 1804 (see BUCQUOY *et al.* 1892, pl. 13: 3) and from the Italian Pliocene as *Cerastoderma clodiense* (RÉN.) (an *C. edule* var.) (see SACCO 1899: 50, pl. 11: 33—35). However, one can hardly recognize the actual relation between specimens from the Western and Eastern Europe.

Stratigraphic range. — Middle Miocene (PARAMONOVA 1978) — Late Miocene (KOJUMDGIEVA 1969).

Cerastoderma plicata (EICHWALD, 1829)

(pl. 12: 6a—b)

1829. *G[lycymeris] plicata*, m.; EICHWALD, 279, pl. 5: 2.
1830. *Cardium plicatum*, m.; EICHWALD, 209.
1837. *Cardium gracile* m.; PUSCH, 66, pl. 7: 4a—b.
1848. *Cardium plicatum* EICHW. =*Cardium gracile* PUSCH; BRONN, 234.
1853. *Cardium plicatum*, m.; EICHWALD, 96; 1851, pl. 4: 20a—c.
1935. *Cardium gracile* PUSCH; KOLESNIKOV, 112—113, pl. 16: 23—28.
1936. *Limnocardium plicatum* EICHW.; FRIEDBERG, 143—145, pl. 23: 7—8.
1969. *Cardium (Cerastoderma) plicatum plicatum* EICHWALD, 1829; KOJUMDGIEVA, 48, pl. 16: 1—5.
1974. *Cardium plicatum* EICHWALD, 1830; VOLKOVA, 38, pl. 16: 1—2.
1978. *Plicatiforma plicatum* (EICHWALD, 1829); BAGDASARJAN, 36, pl. 9: 5—8.

Material. — Nawodzice — 2 left valves.

Dimensions (in mm):

	L	H
MZ VIII M1-1638	2.0	1.4

Description. — Valve is rectangular in outline, inequilateral, with its posterior part accounting for 60% of the valve length. Posterodorsal margin is straight, slightly oblique, making an obtuse angle with the straight, vertical posterior margin. Very convex anterior margin, shorter than the posterior one, gently passes into the slightly convex ventral margin. Beak is small, prosogyrate. Lunule very narrow, lanceolate, poorly defined.

Sculpture consists of 14 very narrow ribs, triangular in cross-section, separated with plane grooves which are several times wider than the ribs. Four posterior ribs are somewhat lower than the others. Grooves are ornamented with weak, straight lines, forming concentric ornamentation. The lines are very distinct and form low, semilunar scales at the ribs, the convexity of the scales being directed dorsally.

Nympha is very short, equal to 1/4 of the posterodorsal margin in length. Hinge plate is weakly developed.

Hinge in the left valve: shallow sockets occur to the both sides of triangular 2, the latter being placed beneath the beak; the posterior socket separates 2 from very weak 4b which is almost fused with the nympha border: thin, lamelliform AII is placed at the end of the anterodorsal margin; PII is indistinct.

Adductor muscle scars are indistinct, the anterior one being orbicular, while the posterior oval in shape. Pallial line is invisible. Internal surface is glossy, with internal ribs extending to the inside of the valve.

Remarks. — The investigated specimens from Nawodzice resemble young individuals of *C. praeplicata* which bear only 16 ribs on their surface because 5—7 remaining ribs appear but 0.5—0.7 mm from the beak. However, so small shells of *C. praeplicata* have no scales at the ribs. The concentric lines in grooves are very distinct in *C. praeplicata*, in contrast to *C. plicata* which has concentric lines weakly developed. The lunule also is different in these species, being narrow, lanceolate in *C. plicata*, while wide, cordate in *C. praeplicata*.

According to DAVITASCHVILI (1932) and KOLESNIKOV (1935), all the specimens attributed to *C. plicata* EICHWALD, 1830, should be named *C. gracile* Pusch, 1837, because EICHWALD figured his species not earlier than in 1851. However, this is invalid because all doubts have already been explained by BRONN (*in* PUSCH 1837) in the notes to *C. gracile*. Having compared specimens from the collections of PUSCH and EICHWALD, BRONN (*in* PUSCH 1837) recognized all of them as being conspecific, the EICHWALD's name keeping then the priority. This opinion was maintained by BRONN also in 1848.

Stratigraphic range. — Middle Miocene (KOWALEWSKI 1950) — Late Miocene (FRIEDBERG 1936).

Superfamily **Mactracea** LAMARCK, 1809
Family **Mactridae** LAMARCK, 1809
Subfamily **Mactrinae** LAMARCK, 1809
Genus *Mactra* LINNÉ, 1767
Subgenus *Mactra* (*Sarmatimactra*) KOROBKOV, 1954
Mactra (*Sarmatimactra*) *eichwaldi* LASKAREW, 1914
(pl. 12: 7a—b, 8a—b)

1853. *Mactra podolica* EICHWALD; EICHWALD, 128—129, *non* pl. 6: 9.
part. 1859. *Mactra Podolica* EICHWALD; HÖRNES, 62—65, pl. 7: 4—6, *non* pl. 7: 1—3, 7—8.
1903. *Mactra fragilis* n. sp. et var. *buglovensis*; LASKAREW, 84—90, text-fig. at p. 85, pl. 4: 1—10.
1934. *Mactra podolica* EICHW. var. *buglovensis* LASK.; FRIEDBERG, 33, pl. 7: 1—2.
1954. *Mactra vitaliana eichwaldi* LASKAREW; PAPP, 90, pl. 17: 1—6.
1969. *Mactra* (*Sarmatimactra*) *eichwaldi* LASKAREW, 1914; KOJUMDGIEVA, 19—20, pl. 3: 5—6, 9—10.

1971. *Mactra eichwaldi* LASKAREW, 1914; ŠVAGROVSKY, 177—179, pl. 18: 1—5.
1976. *Mactra (Sarmatimactra) eichwaldi eichwaldi* LASK.; ILJINA *et al.*, pl. 6: 1—15.

Material. — Rybnica 2—2 valves.
Dimensions (in mm):

	L	H
MZ VIII MI-1639/$_1$	15.5	12.8
MZ VIII MI-1639/$_2$	12.5	9.5

Description. — Valve is triangular in outline, fairly convex in its umbonal part, subequilateral, with its posterior part accounting for 55% of the valve length. Dorsal margin is angularly bent beneath the beak, its anterior part being longer and steeper than the posterior one. The anterior edge of the valve is rounded, while the posterior one is angular. Small, acute beak is more prosogyrate and more projected at the right than at the left valve. Rounded ridge runs from the beak posteroventrally, with 5 faint radial lines at its surface. Beyond the ridge valve flattens abruptly. Another ridge, running from the beak anteroventrally, is weak and distinct only near the beak. Lunule is very small, lanceolate, limited by a shallow but distinct groove.

External surface is ornamented with fine, densely spaced concentric lines. Growth stages are distinct.

Internal ligament is placed in the triangular ligamental socket limited anteriorly by a fine lamella which is more distinct and longer at the left than at the right valve. The internal ligament is separated from the very short external ligament by a short slate, oblique to the posterodorsal margin. Hinge is massive; the laterals are large, parallel to the dorsal margin.

Hinge in the right valve: 3a and 3b are equal in length, thin, lamelliform, connected with each other beneath the beak, with a broad, triangular socket in between; 3a is somewhat oblique to the lunular margin, placed close to the latter; 3b is almost vertical; long, lamelliform, strong, triangular AI is separated by a deep groove from thin, lamelliform AIII which is twice shorter than AI; PI is the longest lateral tooth in the right valve, separated by a deep groove from lamelliform PIII which is twice shorter than PI.

Hinge in the left valve: 2a and 2b, both lamelliform, are connected with each other at the midlength of vertical 2b which is placed close beneath the beak; 2a is longer than 2b, parallel to the lunular margin; very weak lamella (pseudotooth 4b); limiting anteriorly the resilifer, is parallel to 2b and placed close to it; long, massive AII, placed at the prolongation of 2a, is separated from the anterodorsal margin by a deep groove; PII is somewhat shorter than AII.

Bean-shaped anterior adductor muscle scar is somewhat smaller than the suborbicular posterior one. Pallial line with a small, shallow sinus, is placed near the smooth ventral margin.

Remarks. — The investigated species is allied with *Mactra* (*Eomactra*) *basteroti* MAYER, 1853, the shell of which is triangular, more elongated, and with the posterior edge more distinct than in *M.* (*S.*) *eichwaldi*. The lunule and corselet are more distinctly limited in *M.* (*E.*) *basteroti* than in *M.* (*S.*) *eichwaldi*, both of them being ornamented with regular and relatively strong wrinkles. There are broad, triangular sockets between 3a and 3b and also between 2a and 2b in *M.* (*E.*) *basteroti*, both the pairs of teeth being connected by their tips; the lower edge of the hinge plate is straight, ascending obliquely. In *M.* (*S.*) *eichwaldi*, in turn, lower edge of the hinge plate is convex along the resilifer, the latter being wider and more deepened than in the former species. The slate separating the resilium from the external ligament is weaker and shorter in *M.* (*E.*) *basteroti* than in *M.* (*S.*) *eichwaldi*.

The species *M.* (*S.*) *vitaliana* d'ORBIGNY, 1844, resembles *M.* (*S.*) *eichwaldi* but it differs from the latter in its teeth 2a and 2b being united until their midlength, 2a being very oblique the lunular margin (LASKAREW 1903, text-figs at p. 85).

Stratigraphic range. — Middle Miocene (LASKAREW 1903) — Late Miocene (ŠVAGROVSKY 1971).

Subfamily **Lutrariinae** ADAMS and ADAMS, 1856
Genus *Lutraria* LAMARCK, 1799
Subgenus *Lutraria* (*Lutraria*) LAMARCK, 1799
Lutraria (*Lutraria*) *lutraria* (LINNÉ, 1758)
(pl. 12: 9a—b, 10)

1909. *Lutraria lutraria* L. sp. et var.; CERULLI-IRELLI, 142—144, pl. 15: 1—3, pl. 15: 4—5 [var. *angustior* PHIL.], pl. 15: 6—7 [var. *gracilis* CONTI].
1934. *Lutraria lutraria* L.; FRIEDBERG, 28—30, pl. 6: 2—4.
1959. *Lutraria angustior* PHILIPPI, 1844; HOLME, 557—560, text-figs 1B—2B, pl. 1: 1—3, pl. 2: 4—5.
1966. *Lutraria angustior* PHILIPPI; TEBBLE, 135—136, text-figs 71—72.
1976. *Lutraria* (*Lutraria*) *lutraria* (L.); BRAMBILLA, 113, pl. 28: 19—20.

Material. — Nawodzice — 1 shell, 6 valves; Rybnica 1—2 shells, 2 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml–1640/$_1$	62.0	33.0
MZ VIII Ml-1640/$_2$	25.0	15.0

Remarks. — Judging after the collected material, there is an increase in shell assymetry during ontogeny. Shells up to 4.0 mm in length have their beaks acute and strongly projected above the arched dorsal margin which is equally inclined anteriorly and posteriorly. Small shells are subequilateral, with their posterior parts accounting for 55% of the shell length, while larger shells (longer than 13.0 mm) are more asymmetrical, with their posterior parts accounting for some 70% of the shell length. The latter are oval-shaped, with their beaks being less acute than in small forms, projected less or not at all above the dorsal margin, the posterior part being slightly ajar.

The investigated specimens of *Lutraria* (*L.*) *lutraria* from Rybnica and Nawodzice are entirely consistent with those figured by CERULLI-IRELLI (1909) and FRIEDBERG (1934) but they differ from those from Podolia, attributed by EICHWALD (1851, pl. 6: 11a—b) to *Lutraria primipara*. The latter are relatively low (H/L=0.4, while it equals 0.5 in *L.* (*L.*) *lutraria* at L=60 mm), with weak ridge running from the acute beak posteriorly. The pallial line is confluent with the pallial sinus along a considerable distance in *L. primipara*, the sinus being rectangular in shape, with rounded corners; whereas in *L.* (*L.*) *lutraria* the pallial sinus is rounded to rectangular, its ventral part running close to the pallial line but without any confluence with the latter.

These differences were considered negligible by FRIEDBERG (1934); consequently, *L. primipara* EICHWALD, 1850, was treated as a younger synonyme of *L. lutraria* (LINNÉ, 1758).

Conversely, MERKLIN and NEVESSKAJA (1955: 85—86) considered *L. primipara* to be a distinct species. On the basis of poorly preserved material (internal casts only) from the Middle Miocene of Turkhmenia and Kazakhstan, those authors assigned *L. lutraria* described by FRIEDBERG (1934) from Podolia as well as *L. oblonga* Chemnitz, 1782 described by DOLLFUS and DAUTZENBERG (1902, 98—101, pl. 5: 1—6) from the Loire Basin to the species *L. primipara* EICHWALD, 1850.

According to GLIBERT and VAN de POEL (1970: 27), EICHWALD's species should be treated as a subspecies of *L.* (*s. s.*) *lutraria*. The name *L.* (*s. s.*) *lutraria primipara*, however, was applied only to the Lower and Middle Miocene specimens, while indistinguishable forms from the Pliocene and Pleistocene have been attributed by GLIBERT and VAN de POEL (1970) to *L.* (*s. s.*) *lutraria lutraria* (LINNÉ).

The investigated specimens from Rybnica and Nawodzice are entirely consistent with the Recent forms described by TEBBLE (1966) under the name *Lutraria angustior* PHILIPPI, but

they are completely different from the figured specimen of *Lutraria lutraria* (LINNAEUS) (TEBBLE 1966, 133—134, text-fig. 69).

Stratigraphic range. — Early Miocene (MALATESTA 1974) — Recent.

Genus *Eastonia* GRAY, 1853

Eastonia rugosa (HELBLING, 1779)

(pl. 12: 12a—b)

1901. *Eastonia rugosa* (CHEMNITZ); SACCO, 28, pl. 7: 1—2.
1902. *Eastonia rugosa* CHEMNITZ sp. *(Mactra)*; DOLLFUS and DAUTZENBERG, 94—96, pl. 4: 1—2.
1909. *Eastonia rugosa* CHEMN. sp.; CERULLI-IRELLI, 142, pl. 14: 38—39.
1910. *Eastonia rugosa* CHEMN.; SCHAFFER, 93, pl. 43: 3—5.
1960. *Eastonia rugosa* (CHEMNITZ, 1782); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 38—39, pl. 11: 15.

Material. — Rybnica 1—2 fragments of valves; Rybnica 2—1 valve.
Dimensions (in mm):

	L	H
MZ VIII Ml-1641	20.0	10.5

Remarks. — The investigated specimens from Rybnica entirely correspond to the descriptions and figures referred to in the synonymy.

Stratigraphic range. — Early Miocene (KOJUMDGIEVA 1960) — Recent.

Family **Mesodesmatidae** GRAY, 1939
Subfamily **Erviliinae** DALL, 1895
Genus *Ervilia* TURTON, 1822

Ervilia podolica (EICHWALD, 1830)

(pl. 13: 8—10, 12a—b, 14a—b)

1830. *Crassatella podolica, m.*; EICHWALD, 206.
1830. *Crassatella dissita,* m.; EICHWALD, 207.
1850. *Crassatella podolica* m.; EICHWALD, 59; 1851, pl. 5: 22a—b.
1850. *Crassatella dissita* m.; EICHWALD, 60; 1851, pl. 5: 24a—b.
1859. *Ervilia Podolica* EICHW.; HÖRNES, 73—74, pl. 3: 12a—e.
1903. *Ervilia podolica* var. *dissita* EICHW.; LASKAREW, 71—73, pl. 2: 17—20.
1934. *Ervilia podolica* EICHW. et var.; FRIEDBERG, 41—43, pl. 7: 23—24, pl. 7: 25—28 [var. *dissita* EICHW.].
1934. *Ervilia dissita* EICHW. et var.; ZHIZHCHENKO, 32—34, pl. 5: 14, pl. 5: 5—6 [var. *nitida* N. var.].
1935. *Ervilia dissita* EICHW. et var.; KOLESNIKOV, 39—43, pl. 3: 9—16, pl. 3: 17—18 [var. *podolica* EICHWALD].
1953. *Ervilia podolica* EICHW.; SENEŠ, 223, pl. 23: 17—18.
1955. *Ervilia pusilla dissita* (EICHWALD), 1830; MERKLIN and NEVESSKAJA, 80, pl. 22: 13—21.
1958. *Ervilia dissita dissita* (EICHWALD); PAPP, 15—18, text-pl. 5: 1—5, 7—14.
1958. *Ervilia dissita podolica* (EICHWALD); PAPP, text-pl. 5: 15—18.
1960. *Ervilia dissita* (EICHWALD) 1830 et var.; STRACHIMIROV in KOJUMDGIEVA and STRACHIMIROV, 266—267, pl. 56: 22—27, pl. 56: 28—31 [var. *podolica* EICHWALD 1850].
1969. *Ervilia dissita dissita* (EICHWALD, 1830); KOJUMDGIEVA, 27—28, pl. 8: 1—3.
1971. *Ervilia dissita dissita* (EICHWALD, 1830); ŠVAGROVSKY, 185—187, pl. 21: 1—9, pl. 22: 1—5.
1971. *Ervilia dissita podolica* (EICHWALD, 1830); ŠVAGROVSKY, 187—189, pl. 23: 1—9.
1972. *Ervilia podolica dissita* (EICHWALD, 1850); JAKUBOWSKI, 101—105, text-pl. 9: 1—42, pl. 9: 1—42.

Material. — Rybnica 1—30 shells, 200 valves; Rybnica 2—5 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml-1642/$_1$	10.0	6.7
MZ VIII Ml-1642/$_2$	7.2	5.3

MZ VIII Ml-1642/3	5.1	3.6
MZ VIII Ml-1642/4	5.0	3.6
MZ VIII Ml-1642/5	4.0	3.0

Remarks. — The specimens of *E. podolica* from Rybnica are entirely consistent with those described by HÖRNES (1859) from the Vienna Basin as well as those described by JAKUBOWSKI (1972) from Dwikozy (near Sandomierz).

EICHWALD (1830) established three distinct species of *Crassatella* in the Tertiary of Podolia, Volhynia and Bessarabia, namely *C. dissita*, *C. concinna* and *C. podolica*. HÖRNES (1859) realized that these three names refer in fact to successive ontogenetic stages of a single species, for which he proposed the name *Ervilia podolica* instead of more frequently used name dissita. The name *podolica* was originally used by EICHWALD (1830) for large, well developed specimens which were thus treated by HÖRNES (1859) as the most typical of the considered species.

However, later paleontologists considered *E. podolica* and *E. dissita* either as two distinct species (KOJUMDGIEVA 1969), or as two varieties or subspecies of a species for which various names were applied. ZHIZHCHENKO (1934), KOLESNIKOV (1935), STRACHIMIROV (1960) and ŠVAGROVSKY (1971) used the name *dissita*, while LASKAREW (1903), FRIEDBERG (1934) and JAKUBOWSKI (1972) preferred the name *podolica*. To distinguish between the two varieties of this highly variable species, two different criteria have been used, namely the shell size and frequency occurrence index (!) (PAPP 1958). The following shell sizes have been thought to separate the varieties *dissita* and *podolica* from each other: 15.0 mm (STRACHIMIROV 1960), 16.0—17.0 mm (KOLESNIKOV 1935) and 17.5 mm (PAPP 1958); the varieties being of course connected by intermediate forms.

The present author agrees entirely with HÖRNES (1859) that the names *E. podolica* and *E. dissita* are in fact synonymous; they designate the same species which underwent an increase in shell size during the Late Miocene.

Stratigraphic range. — Middle Miocene (LASKAREW 1903) — Late Miocene (ŠVAGROVSKY 1971).

Ervilia pusilla (PHILIPPI, 1836)

(pl. 13: 11a—b, 13a—b)

1859. *Ervilia pusilla* PHIL.; HÖRNES, 75, pl. 3: 13a—g.
1931. *Ervilia pusilla* PHIL.; GADOMSKA, 192—202.
1934. *Ervilia pusilla* PHIL.; FRIEDBERG, 38—41, text-fig. 5, pl. 7: 10—21 *(cum syn.)*.
1938. *Ervilia pusilla* PHIL.; FRIEDBERG, 23.
1956. *Ervilia pusilla* (PHILIPPI, 1836); TEJKAL, 21—22, pl. 2: 6—15.
1960. *Ervilia pusilla* PHILIPPI 1836; STRACHIMIROV in KOJUMDGIEVA and STRACHIMIROV, 265, pl. 56: 5—8.
1970. *Ervilia castanea miopusilla* BOGSCH, 1939; GLIBERT and VAN de POEL, 7.
1977. *Ervilia pusilla* PHILIPPI, 1836; JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 101, pl. 11: 4—5.

Material. — Nawodzice — 19 valves; Rybnica 1 — ca 800 valves; Rybnica 2—6 shells, 570 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1643/1	7.2	4.5
MZ VIII Ml-1643/2	6.8	4.5

Remarks. — The specimens under discussion closely correspond to the descriptions and figures referred to in the synonymy.

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1909) — Pliocene (GLIBERT and VAN de POEL 1970).

Superfamily **Solenacea** LAMARCK, 1809
Family **Cultellidae** DAVIS, 1935
Genus *Cultellus* SCHUMACHER, 1817
Subgenus *Cultellus* (*Cultellus*) SCHUMACHER, 1817
Cultellus (*Cultellus*) *tenuis* (PHILIPPI, 1836)
(pl. 12: 13, pl. 14: 1a—b)

1850. *Cultellus tenuis*, PHILIPPI; WOOD, 258, pl. 25: 2a—d.
1947. *Cultellus* cf. *tenuis* PHIL.; KRACH, 58, pl. 1: 13.
1976. *Phaxas* (*Phaxas*) *tenuis* (PHIL.); BRAMBILLA, 114, pl. 29: 3—4.

Material. — Rybnica 2—4 shells, 15 fragmented shells.
Dimensions (in mm):

	L	H
MZ VIII Ml-1644/$_1$	26.0	8.5
MZ VIII Ml-1644/$_2$	11.0	8.0

Remarks. — The species *Cultellus* (*C.*) *tenuis* from the English Miocene (WOOD 1850) has its shell asymmetrical, with the anterior/posterior parts ratio equal 0.40; however, the forms figured by PHILIPPI (1836, *fide* WOOD 1850) have this ratio equal to 0.25, which WOOD (1850) interpreted as the drawer's mistake. As each of the four shells from Rybnica has different asymmetry (0.20 at L=26.2 mm; 0.31 at L=24.5 mm; 0.22 at L= 20.0 mm; 0.40 at L=17.3 mm) one may suppose that PHILIPPI's figures are correct. Moreover, the specimen presented by CERULLI-IRELLI (1909, 135, pl. 13: 43) is even more asymmetrical (0.17).

Allied with *C.* (*C.*) *tenuis* is *C.* (*C.*) *scaphoides* ZHIZHCHENKO, 1934. Its shell is considerably widened posteriorly, with a distinct edge running posteroventrally. Its hinge is weaker than in *C.* (*C.*) *tenuis*, with the smaller angle between 4a and 4b and weakly bifurcated 2, and consequently with the distance between 2a and 2b being smaller than in *C.* (*C.*) *tenuis*.

A misunderstanding concerning the diagnosis of the genus *Cultellus* SCHUMACHER, 1817 requires an explanation. According to SCHUMACHER (1817, 130, pl. 7: 4a—b), there are two somewhat flattened cardinals in the hinge of the right valve: one being straight and vertical, the other "lying"; in turn, the hinge of the left valve includes three cardinals, the median of which is almost bifurcated, with its top divergent. Nevertheless, CHENU (1862: 22—23) ascertained that in *Cultellus* SCHUMACHER, 1817 the hinge of one valve consists of two identical teeth, while there is only one tooth in the hinge of the other valve. The same diagnosis has been repeated by KEEN (1969: N611), who made it only clear that one tooth occurs in the right valve, and two teeth in the left one.

The hinge of the specimens from Rybnica is consistent with that recorded in *C.* (*C.*) *tenuis* from the English Miocene (WOOD 1850); it also corresponds with the following teeth formula given by SCHUMACHER (1817): $\frac{3a\ \ 3b}{4a\ 2a2b\ 4b}$, the 2a and 2b being not entirely separated.

Stratigraphic range. — Middle Miocene (JAKUBOWSKI 1977) — Recent.

Genus *Ensis* SCHUMACHER, 1817
Ensis ensis (LINNÉ, 1758)
(pl. 12: 11)

1881. *Solen ensis* LINNÉ; NYST, 232—233; 1879, pl. 25: 9d—f [*S. siliqua* var. *minor*].
1893. *Ensis ensis* LINNÉ sp. (*Solen*) var. *minor* RÉQUIEN, MONTEROSATO; BUCQUOY *et al.*, 501—506, pl. 73: 4—5.
1901. *Ensis ensis* (L.); SACCO, 18—19, pl. 4: 21—22.
1976. *Ensis ensis* (L.); BRAMBILLA, 114, pl. 29: 2.

Material. — Nawodzice — 7 fragmented valves; Rybnica 1—1 shell, 30 fragmented valves; Rybnica 2—45 fragmented valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1645	74.5	8.5

Remarks. — The investigated specimens closely correspond to the descriptions and figures referred to in the synonymy.

Stratigraphic range. — Middle Miocene (WOOD 1850) — Recent.

Superfamily **Tellinacea** de BLAINVILLE, 1814
Family **Tellinidae** de BLAINVILLE, 1814
Subfamily **Tellininae** de BLAINVILLE, 1814
Genus *Tellina* LINNÉ, 1758
Subgenus *Tellina* (*Moerella*) FISCHER, 1887
Tellina (*Moerella*) *donacina* LINNÉ, 1758
(pl. 13: 3a—b, 5a—b)

1901. *Moerella donacina* (L.); SACCO, 105—106, pl. 22: 24—27.
1934. *Tellina donacina* (L.); FRIEDBERG, 49—50, pl. 8: 10—12 (*cum syn.*).
1958. *Angulus* (*Moerella*) *donacina* LINNÉ, sp. 1758; GLIBERT, 23—24, pl. 4: 15.
1959. *Angulus* (*Moerella*) *donacina* (LINNÉ); GLIBERT, pl. 5: 1a—b.
1964. *Angulus* (*Moerella*) *donacinus* (LINNÉ, 1758); ANDERSON, 176—177, pl. 8: 64a—c.
1965. *Tellina* (*Moerella*) *donacina* LINNÉ; NEVESSKAJA, 270—271, pl. 15: 1—5.
1966. *Tellina* (*Moerella*) *donacina* LINNAEUS; TEBBLE, 145, text-fig. 74a—b.
1972. *Tellina* (*Moerella*) *donacina* (LINNEO), 1758; CAPROTTI, 74—75, pl. 3—13.

Material. — Nawodzice — 25 valves; Rybnica 2—1 valve.

Dimensions (in mm):

	L	H
MZ VIII Ml-1647/$_1$	3.4	2.1
MZ VIII Ml-1647/$_2$	3.0	1.7

Remarks. — The specimens under discussion are entirely consistent with the description and figures referred to in the synonymy.

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1911) — Recent.

Subgenus *Tellina* (*Oudardia*) MONTEROSATO, 1884
Tellina (*Oudardia*) *compressa* BROCCHI, 1814
(pl. 14: 3a—b)

1934. *Tellina* (*Oudardia*) *compressa* BROCC.; FRIEDBERG, 50—51, pl. 9: 1—2 (*cum syn.*).
1952. *Angulus* (*Fabulina*) (*Oudardia*) *compressa* (BROCCHI) 1814; ROSSI RONCHETTI, 85—87, text-fig. 35.
1963. *Angulus* (*Oudardia*) *compressus* (BR.); VENZO and PELOSIO, 194, pl. 57: 16.
1976. *Tellina* (*Oudardia*) *compressa* BR.; BRAMBILLA, 115, pl. 29: 11—12.

Material. — Nawodzice — 8 valves; Rybnica 2—12 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1648	17.6	10.0

Remarks. — The investigated specimens from Nawodzice and Rybnica are entirely consistent with those from Podolia figured by FRIEDBERG (1934).

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1911) — Recent.

Subfamily **Macominae** OLSSON, 1961
Genus *Gastrana* SCHUMACHER, 1817
Gastrana fragilis (LINNÉ, 1758)
(pl. 14: 2a—b, pl. 15: 1a—b, 2)

1934. *Gastrana fragilis* L.; FRIEDBERG, 52—53, text-fig. 6, pl. 9: 4—8 *(cum syn.)*.
1966. *Gastrana fragilis* (LINNAEUS); TEBBLE, 148—149, text-fig. 76.
1976. *Gastrana fragilis* (L.); BRAMBILLA, 116, pl. 29: 21—22.

Material. — Nawodzice — 4 valves; Rybnica 1—2 valves; Rybnica 2—9 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml–1650/$_1$	31.0	22.0
MZ VIII Ml–1650/$_2$	20.0	17.0
MZ VIII Ml–1650/$_3$	9.0	7.5

Remarks. — The specimens under discussion are entirely consistent with the descriptions and figures referred to in the synonymy.

There are two morphotypes of *G. fragilis* (LINNÉ 1758) among the specimens from Nawodzice and Rybnica. One of them resembles mut. *aquitanica* COSSMANN and PEYROT, 1911. Its shell has an acute and elongated posterior part accounting for some 60% of the shell length, the concentric lamellae on the external surface being delicate except for the corselet where they become more conspicuous. The corselet is devoid of radial ornamentation. The shell of the other morphotype is subquadrate in outline, with concentric lamellae more projected and more rarely spaced, but also with radial lines finer and more densely spaced than in the former morphotype. The latter morphotype is similar to *G. laminosa* (SOWERBY, 1827).

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1911) — Recent.

Family **Donacidae** FLEMING, 1828
Genus *Donax* LINNÉ, 1758
Subgenus *Donax* (*Paradonax*) COSSMANN and PEYROT, 1910
Donax (*Paradonax*) *transversa* DESHAYES, 1830
(pl. 13: 1, 2, 4a—b, 6, 7)

1852. *Donax transversa* DESH., 1835; d'ORBIGNY, 103, n° 1927.
1859. *Donax gibbosula* MAYER; MAYER, 297; 1860, pl. 5: 8—9.
part. 1906. *Donax burdigalensis* DEFRANCE; DOLLFUS and DAUTZENBERG, 164—165, pl. 11: 7—8, *non* pl. 11: 5—6.
1911. *Donax* (*Paradonax*) *transversa* DESH. et var.; COSSMANN and PEYROT, 295—299, pl. 11: 18—21, pl. 11: 22—25 [var. *gibbosula* MAYER].
1934. *Donax* cf. *sallomacensis* COSSM. i PEYR.; FRIEDBERG, 56—57, pl. 9: 14—15.
1950. *Donax burdigalensis* DEFRANCE; HEERING, 37, pl. 8: 186.

Material. — Rybnica 2—34 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml–1651/$_1$	8.8	4.7
MZ VIII Ml–1651/$_2$	8.0	4.3
MZ VIII Ml–1651/$_3$	7.8	4.5
MZ VIII Ml–1651/$_4$	6.8	4.3
MZ VIII Ml–1651/$_5$	4.5	3.0

Description. — Valve is wedge-shaped, very convex, inequilateral, with its posterior part accounting for 16%—32% of the valve length. Long, somewhat convex anterodorsal margin gently passes into the very short, very convex anterior margin which, in turn, gently connects with the arched ventral margin; the latter is somewhat indented in its ventral part. Beaks are very small, opisthogyrate. Distinct but rounded ridge runs from the beak posteroventrally. Lunule is long, lanceolate, poorly defined.

External surface is glossy, almost smooth. Valves up to 2.5 mm long bear very fine concentric lines. Weak radial lines appear at both the posterior and middle parts of the valves exceeding 2.5 mm in length. The appearance of radial ornamentation is related to a change in valve colour, from whitish to creamy-pink. Growth stages are clearly distinct.

External ligament is placed at the short and oblique nympha. Hinge is moderately strong, devoid of anterior laterals.

Hinge in the right valve: weak 3a is placed close to the lunular margin and subparallel to the latter; 3a is separated by a triangular socket from large, triangular 3b which is furrowed in its lower part; PI and PIII are placed behind the nympha; they are short, PIII being somewhat stronger than PI.

Hinge in the left valve: oblique, lamelliform 2 connects with 4b beneath the beak, the latter tooth being somewhat shorter than the former; 2 and 4b are perpendicular to each other; PII is very weak.

Anterior adductor muscle scar is oval-shaped, its longer axis being parallel to the anterodorsal margin. Posterior adductor muscle scar is smaller than the anterior one and suborbicular in outline. Pallial line is parallel to the ventral margin in its anterior part. Very deep, rounded sinus with the horizontal axis is confluent along its lower margin with the pallial line. Ventral and posterior margins are finely crenulated.

Remarks. — A large variability in shell shape has been observed among the specimens from Rybnica. The shells less asymmetrical in shape, with greater apical angle, longer and less steep posterior margin and rounded connection of the posterodorsal and posterior margins correspond to the type form of *D.* (*P.*) *transversa* DESHAYES, 1830. In turn, the shells with shorter posterior part, very steep posterior margin, more distinct edge, and apical angle approximating 90° are entirely consistent with *D.* (*P.*) *transversa* var. *gibbosula* MAYER, 1858, described by COSSMANN and PEYROT (1911) from Aquitaine.

D. (*P.*) *transversa* resembles *D.* (*P.*) *sallomacensis* COSSMANN and PEYROT, 1911 in its outline, hinge construction and shape of the pallial sinus, but it differs from the latter in the presence of radial ornamentation and stronger crenulation of the ventral margin. FRIEDBERG (1934) erroneously identified specimens from Rybnica as *D.* cf. *sallomacensis*.

The species *D.* (*P.*) *transversa* has previously not been reported from the Polish Miocene.

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1911) — Middle Miocene (HEERING 1950).

Donax (Paradonax) intermedia HÖRNES, 1859

(pl. 13: 15, 16a—b, 17)

part. 1906. *Donax burdigalensis* DEFRANCE; DOLLFUS and DAUTZENBERG, 164—165, pl. 11: 5—6, *non* pl. 11: 7—8.

1934. *Donax intermedia* HOERN.; FRIEDBERG, 54—55, pl. 9: 10—11 (*cum syn.*).

1950. *Donax intermedia* HORNES; HEERING, 37, pl. 8: 187.

1955. *Donax intermedia* M. HÖRNES, 1859; MERKLIN and NEVESSKAJA, 66, pl. 18: 14—16.

1960. *Donax* (*Paradonax*) *intermedia* HOERNES 1859; STRACHIMIROV in KOJUMDGIEVA and STRACHIMIROV, 261, pl. 55: 44—47.

1963. *Donax* (*Serrula*) *intermedia* M. HOERNES; VENZO and PELOSIO, 188—189, pl. 57: 19—19a.

Material. — Rybnica 2—13 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1652/$_1$	11.8	6.4
MZ VIII Ml-1652/$_2$	3.8	2.0
MZ VIII Ml-1652/$_3$	2.5	1.7

Remarks. — The investigated specimens from Rybnica entirely correspond to the descriptions and figures referred to in the synonymy.

The species *D.* (*P.*) *transversa* DESHAYES, 1830, is allied with *D.* (*P.*) ***intermedia***, but it differs from the latter in its shell being more convex, with fine radial ornamentation at the middle and posterior parts of the shell. The posterior part of the shell is ornamented with rounded lamellae perpendicular to the posterodorsal margin in *D.* (*P.*) *intermedia*, the radial sculpture being present only in the middle part of the shell. An obvious feature making difference between the two species under discussion is the shape of the pallial sinus and pallial line. In *D.* (*P.*) *transversa*, the pallial line runs along the whole ventral margin and it is confluent with the horizontal pallial sinus along a considerable part of its length. In turn, the pallial line runs only along the anterior part of the ventral margin in *D.* (*P.*) *intermedia*, the axis of the broadly open sinus being oblique.

Stratigraphic range. — Middle Miocene (KAUTSKY 1925)

Family **Semelidae** STOLICZKA, 1870
Genus *Abra* LAMARCK, 1818
Subgenus *Abra* (*Syndosmya*) RÉCLUZ, 1843
Abra (*Syndosmya*) *alba* (WOOD, 1802)

1934. *Syndesmya alba* WOOD; FRIEDBERG, 46, pl. 8: 7 (*cum syn.*).
1966. *Abra alba* (WOOD); TEBBLE, 151—152, text-fig. 78a—b.
1976. *Abra* (*Syndosmya*) *alba* (WOOD); BRAMBILLA, 118, pl. 29: 33—36 (*cum syn.*).

Material. — Rybnica 2—2 left valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1653	3.5	2.5

Remarks. — The specimens of *A.* (*S.*) *alba* from Rybnica are entirely consistent with those described by WOOD (1850) from Sutton and Bawdsey (England).

Stratigraphic range. — Middle Miocene (DOLLFUS and DAUTZENBERG 1904) — Recent.

Superfamily **Dreissenacea** GRAY in TURTON, 1840
Family **Dreissenidae** GRAY in TURTON, 1840
Genus *Congeria* PARTSCH, 1835
Congeria sandbergeri ANDRUSSOV, 1897
(pl. 14: 4a—b, 5a—b)

1903. *Congeria sandbergeri* ANDRUS.; LASKAREW, 52—54, pl. 1: 1—6.
1936. *Congeria Sandbergeri* ANDR.; FRIEDBERG, 187—188, text-fig. 22, pl. 29: 13—15.
1960. *Congeria sandbergeri* ANDRUSSOV 1897; KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 79—80, pl. 27: 11.
1967. *Congeria sandbergeri* ANDRUSSOV, 1897; GLIBERT and VAN de POEL, 73.

Material. — Nawodzice — 11 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1655/$_1$	4.5	9.6
MZ VIII Ml-1655/$_2$	4.6	8.0

Remarks. — The investigated specimens closely correspond to the descriptions and figures referred to in the synonymy.

Stratigraphic range. — Early Miocene (KOJUMDGIEVA 1960) — Late Miocene (GLIBERT and VAN de POEL 1967).

Superfamily **Arcticacea** NEWTON, 1891
Family **Kelliellidae** FISCHER, 1887
Genus *Alveinus* CONRAD, 1865
Alveinus nitidus (REUSS, 1867)
(pl. 13: 18a—b, 19a—b)

1867. *Spaniodon nitidus* REUSS; REUSS, 135—136, pl. 8: 3a—b.
1912. *Lutetia girondica* BENOIST in coll.; COSSMANN and PEYROT, 610—612, pl. 26: 16—19.
1934. *Lutetia nitida* REUSS; FRIEDBERG, 129—130, text-fig. 17, pl. 21: 9—11.
1939. *Lutetia nitida* REUSS; KAUTSKY, 634, 637—638, pl. 22: 23—26.
1966*b*. *Alveinus* (*s. s*) *nitidus* (REUSS, 1867); GLIBERT and VAN de POEL, 22.
1969. *Lutetia* (*Spaniodontella*) *nitida* (REUSS, 1867); KEEN in MOORE, N653, text-fig. E.130, 2a—b.
1970. *Lutetia nitida* (REUSS); BAŁUK, pl. 5: 1.
1972. *Lutetia nitida* (REUSS, 1867); JAKUBOWSKI, 94—101, pl. 8: 1—35, text-pl. 8: 1—35.
1977. *Lutetia* (*Spaniodontella*) *nitida* (REUSS, 1867); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 104, pl. 11: 9—10.
1979*a*. *Lutetia* (*Spaniodontella*) *nitida* (REUSS, 1867); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 59, pl. 4: 5—10.

Material. — Nawodzice — 47 valves; Rybnica 1—13 shells 65 valves; Rybnica 2—25 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1656/$_1$	2.1	1.8
MZ VIII Ml-1656/$_2$	1.9	2.0

Remarks. — The species was originally included to the monotypic genus *Spaniodon* REUSS, 1867. In the nineties, however, ANDRUSSOV (*fide* MERKLIN 1950) proposed to replace the name *Spaniodon* REUSS, 1867 with *Spaniodontella* because of the homonymy of the former with *Spaniodon* PICTET, 1860. The genus *Spaniodontella* comprised also other species, viz. *Sp. major* [=*Sp. pulchella* BAILY, 1858], described by ANDRUSSOV (1885) from the Kercz peninsula, *Sp. sokolovi* SINZOW, 1903, described by SOKOLOV (1899) from the Konka river, and *Sp. gentilis* EICHWALD, 1850, described by EICHWALD (1850) from the eastern shores of the Caspian Sea.

Having investigated the hinge of *S. nitidus*, COSSMANN and PEYROT (1912) recognized *Spaniodon* REUSS, 1867 for a younger synonym of *Lutetia* DESHAYES, 1860. The identity of these two genera has been confirmed by DAVITASCHVILI (1933, *fide* MERKLIN 1950), FRIEDBERG (1934) and KAUTSKY (1939). Moreover, DAVITASCHVILI (1933 *fide* MERKLIN 1950) and FRIEDBERG (1934) claimed that *Spaniodon* REUSS (considered to be represented by only one species) and *Spaniodontella* ANDRUSSOV in GOLUBIATNIKOV, 1902, are two distinct genera.

The genus *Spaniodontella* includes, according to MERKLIN (1950), two groups of species, well distinguishable from each other. One of these, including normal marine Middle Miocene species (*Sp. nitida* REUSS, 1867; *Sp. intermedia* ANDRUSSOV, 1910; *Sp. sokolovi* SINZOW, 1903, among others), has been recognized for the subgenus *Davidaschvilia* of the genus *Lutetia*. The name *Spaniodontella*, with its type species *Sp. pulchella* (BAILY, 1858), should be preserved,

according to MERKLIN (1950) for the other group of species, comprising Upper Miocene forms different from *Lutetia* in hinge construction, shell ornamentation and size. In turn, KEEN (1969) recognized *Spaniodontella* with its type species *Sp. nitida* (REUSS), for a subgenus of *Lutetia*, and identified it with the subgenus *Davidaschvilia* MERKLIN, 1950. This decision, however, is objectionable because *L.* (*D.*) *intermedia* (ANDRUSSOV in BAJARANUS, 1910), designated by MERKLIN (1950) as the type species of *Davidaschvilia*, has the hinge different from *S. nitidus* REUSS. The hinge in the latter is entirely consistent with *Alveinus* CONRAD, 1965. It is surprising that KEEN (1969), even though knowing the REUSS' paper (REUSS 1867), missed the identity of hinge construction in *Spaniodon nitidus* REUSS and *Alveinus minutus* CONRAD when presenting the diagnosis of *Alveinus*. These two species have the following teeth formula: right valve: AIII — 1 —, left valve — AII — 2. In turn, the teeth formula of *L.* (*D.*) *intermedia* is as follows: right valve: AIII — 3a — 3b —, left valve — AII — 2 — 4b.

Thus, *S. nitidus* REUSS cannot be treated as the type species of *Spaniodontella* and hence, it cannot be placed into the genus *Lutetia*. The present author's opinion is therefore in agreement with the statement made by GLIBERT and VAN de POEL (1966*b*).

The species *A. sokolovi* (SINZOW, 1903) is related to *A. nitidus* (REUSS, 1867) but it differs from the latter in hinge construction in the right valve. This slight difference being neglected, one might consider these two forms to be conspecific, as ZHIZHCHENKO (1959) did indeed suggest.

Comparative investigations of *Lutetia girondica* COSSMANN and PEYROT, 1912, and *L. nitida* (REUSS, 1867) enabled KAUTSKY (1939) to ascertain the identity of these two forms.

Stratigraphic range. — Late Oligocene (ANDERSON 1964) — Middle Miocene (FRIEDBERG 1934).

Family **Trapeziidae** LAMY, 1920
Genus *Coralliophaga* de BLAINVILLE, 1824
Subgenus *Coralliophaga* (*Coralliophaga*) de BLAINVILLE, 1824
Coralliophaga (*Coralliophaga*) *lithophagella* (LAMARCK, 1819)
(pl. 14: 6a—b)

1892. *Coralliophaga lithophagella* LAMARCK sp. *Cardita* et var.; BUCQUOY *et al.*, 318—320, pl. 50: 9—12, pl. 50: 13—16 [var. *Geurini* PAYRAUDEAU, 1826].
1900. *Coralliophaga lithophagella* (LK) var. *glabrata* (BR.); SACCO, 8, pl. 1: 33.
1912. *Coralliophaga* DESHAYESI (MAYER); COSSMANN and PEYROT, 465—467, pl. 20: 1—5, 9—10, 14—16, 27.
1934. *Coralliophaga* cf. DESHAYESI MAY.; FRIEDBERG, 100—101, pl. 17: 16—21.
1947? *Coralliophaga deshayesi* MAY?; KRACH, 59, pl. 1: 6—7.

Material. — Rybnica 2—3 valves.
Dimensions (in mm):

	L	H
MZ VIII MI-1657	10.5	7.5

Remarks. — The specimens from Rybnica are very similar to var. *Geurini* PAYRAUDEAU, 1826, as reported by BUCQUOY *et al.* (1892). Furthermore, they resemble in outline the specimens from Mérignac figured by COSSMANN and PEYROT (1912, pl. 20: 14—16, 27) and ascribed to *C. deshayesi* MAYER; the only difference is in connection of the posterodorsal and posterior margins, which is angular in the specimens from Rybnica while rounded in those from Mérignac. However, *C. deshayesi* from Bordeaux, and in part also from Mérignac (COSSMANN and PEYROT 1912, pl. 20: 1—5, 9—10), is more elongated, lower, and less widened in its posterior part than *C. lithophagella* from Rybnica.

The specimens of *C. lithophagella* from Bulgaria (KOJUMDGIEVA 1960; 50, pl. 16: 5—6) and Belgium (GLIBERT 1945, 146—148, pl. 7: 3a—g) are longer and more asymmetrical than those from Rybnica (posterior part accounts for 80% and 70% of the shell, length, respectively).

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1912) — Recent.

Coralliophaga (*Coralliophaga*) *transilvanica* (HÖRNES, 1861)

1831. *Petricola rupestris* BROCCHI; du BOIS de MONTPÉREUX, 53—54, pl. 7: 3—6.
1853. *Petricola rupestris* BROCCHI; EICHWALD, 126, pl. 7: 3—4.
1934. *Coralliophaga transilvanica* HOERN.; FRIEDBERG, 99—100, pl. 17: 11—15 (*cum syn.*).
1960. *Coralliophaga transilvanica* (HOERNES 1870); KOJUMDGIEVA, in KOJUMDGIEVA and STRACHIMIROV, 50, pl. 16: 7.

Material. — Rybnica 1—1 valve.

Dimensions (in mm):

	L	H
MZ VIII Ml-1658	11.0	5.2

Remarks. — The investigated specimen from Rybnica entirely corresponds to the descriptions and figures referred to in the synonymy.

Shells entirely consistent with *C.* (*C.*) *transilvanica* in shape and almost entirely in ornamentation are known from the Eocene of the Paris Basin under the name *Petricola elegans* DESHAYES, 1824. In the latter species however, concentric lamellae and radial ribs become more distinct in the posterior part of the shell (DESHAYES 1824, 67—68, pl. 10: 1—2), whereas the external sculpture of *C.* (*C.*) *transilvanica* does not show such a regularity.

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1912) — Middle Miocene (KOJUMDGIEVA 1960).

Superfamily **Glossacea** GRAY, 1847
Family **Glossidae** GRAY, 1847
Genus *Glossus* POLI, 1758
Subgenus *Glossus* (*Glossus*) POLI, 1758
Glossus (*Glossus*) *humanus* (LINNÉ, 1758)
(pl. 14: 10, 11a—b)

1850. *Isocardia* cor, LINNAEUS; WOOD, 193—195, pl. 15: 9a—b.
1881. *Isocardia* cor, LINNÉ; NYST, 202—203; 1879, pl. 22: 5a—c.
1934. *Isocardia* cor L.; FRIEDBERG, 101—102, pl. 18: 1—3 (*cum syn.*).
1938. *Isocardia* cor L.; FRIEDBERG, 34.
1960. *Isocardia* (*Isocardia*) cor (LINNAEUS 1758); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 49, pl. 16: 3—4.
1963. *Isocardia* (*Isocardia*) *hörnesi* DALL; CSEPREGHY-MEZNERICS, 122—124 pl. 1: 1—4.
1963. *Isocardia* cor (Linneo); TAVANO and TONGIORGI, 24, pl. 22: 5—6, pl. 25: 9.
1966. *Glossus humanus* (LINNAEUS); TEBBLE, 94—95, text-fig. 46.
1968. *Isocardia hoernesi* DALL; KRACH, 483, pl. 1: 13—14.
1977. *Glossus* cor (LINNAEUS, 1758); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 104, pl. 10: 5.
1979*a*. *Glossus* (*Glossus*) *humanus* (LINNAEUS, 1758); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 59, pl. 5: 4, 7.

Material. — Nawodzice — 3 valves; Rybnica 1—2 shells, 6 valves; Rybnica 2—2 shells, 30 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1659/$_1$	53.0	51.2
MZ VIII Ml-1659/$_2$	48.5	47.3

Remarks. — The specimens under discussion are entirely consistent with the descriptions and figures referred to in the synonymy.

Small specimens of *G.* (*G.*) *humanus* (up to 4.5 mm long) resemble very closely *Isocardia punctata* KAUTSKY, 1925, in the occurrence of the regular punctuation at their external surface.

The specimens from the Vienna Basin identified by HÖRNES (1861, 163—165, pl. 20: 2a—d) as *Isocardia cor* and later on named *Glossus hörnesi* by DALL (1910) differ from the investigated forms from Rybnica and Nawodzice in the shape of their ventral margin. It is regularly arched in the Viennese specimens, while weakly convex to rectilinear in the specimens under consideration.

GLIBERT and VAN de POEL (1966*b*: 18—19) tentatively referred *Isocardia cor* from the Tertiary of Poland figured by FRIEDBERG (1934) to the variety *crassus* of *Glossus lunulatus* (NYST, 1935). However, *G. lunulatus* figured by GLIBERT (1945, pl. 9: 1e—f) is more obliquely elongated than the specimens from Rybnica and Nawodzice, its anterodorsal margin being more concave, the beaks less lopped, and the anterior part bearing distinct radial ornamentation.

Stratigraphic range. — Middle Miocene (FRIEDBERG 1934) — Recent.

Superfamily **Veneracea** RAFINESQUE, 1815
Family **Veneridae** RAFINESQUE, 1815
Subfamily **Venerinae** RAFINESQUE, 1815
Genus *Venus* LINNÉ, 1758
Subgenus *Venus* (*Ventricoloidea*) SACCO, 1900
Venus (*Ventricoloidea*) *multilamella* (LAMARCK, 1818)
(pl. 15: 3, 4a—b, 5a—b, 6a—b, 7, 8)

non 1830. *Venus cincta* m.: EICHWALD, 205.
1840. *Cythera rugosa* BRONN; GOLDFUSS, 241—242, pl. 150: 1a—d.
1850. *Venus cincta* m.; EICHWALD, 66, pl. 5: 14a—b.
non 1861. *Venus cincta* EICHWALD; HÖRNES, 127, pl. 13: 4a—c.
1908. *Venus* (*Ventricoloidea*) *multilamella* LK. sp.; CERULLI-IRELLI, 52—53, pl. 10: 10—18, pl. 11: 1—7.
1930. *Venus multilamella* (LAM.) (var. *marginalis* EICHW.); KOWALEWSKI, 76—77.
1934. *Venus* (*Chione*) *multilamella* LAM. et var.; FRIEDBERG, 62—63, pl. 11: 4—5, pl. 11: 6—10 [var. *marginalis* EICHW.].
1934. *Venus cincta* EICHW.; FRIEDBERG, 66—68, pl. 11: 11—18, pl. 12: 1—3.
1936. *Venus* (*Clausinella*) (*Mioclausinella*) *cincta* EICHW.; KAUTSKY, 11—12, pl. 2: 10—13.
1938. *Venus cincta* EICHW.; FRIEDBERG, 28—29.
part. 1950. *Venus* (*Ventricola*) *multilamella* (LAMARCK); HEERING, 35, pl. 7: 163—165, *non* pl. 7: 158, 174, pl. 8: 195, *non* pl. 8: 196.
1950. *Venus cincta* EICHW.; KRACH, 299.
1960. *Venus* (*Ventricola*) *multilamella* LAMARCK 1818; KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 51, pl. 16: 10—11.
1960. *Venus* (*Ventricola*) *cincta* EICHWALD 1853; KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 52, pl. 16: 12.
1964. *Venus* (*Dosinia*) *multilamella* (LAMARCK 1818); ANDERSON, 169—170, pl. 8: 58.
1966*b*. *Venus* (*s. s.*) *cincta* EICHWALD, 1830; GLIBERT and VAN de POEL, 31.
1972. *Venus* (*Ventricoloidea*) *multilamella* (LAMARCK, 1818; CAPROTTI, 77, pl. 2: 13—14.
1973. *Venus* (*Ventricola*) *multilamella* (LAMARCK, 1818); BÁLDI, 210—211, pl. 18: 1—3, 5 *(cum syn.)*.
1974. *Venus* (*Ventricoloidea*) *multilamella* (LAMARCK, 1818); MALATESTA, 133—134, pl. 10: 1a—c.
1976. *Venus* (*Ventricoloidea*) *multilamella* (LK.); BRAMBILLA, 120, pl. 30: 9—10.
1979*a*. *Venus* (*Ventricoloidea*) *multilamella marginalis* EICHWALD, 1829; JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 59—60, pl. 4: 11—12.

Material. — Rybnica 1—30 valves; Rybnica 2—12 shells, ca 300 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml-1660/$_1$	34.5	30.5
MZ VIII Ml-1660/$_2$	34.0	27.5

MZ VIII Ml-1660/$_3$	32.0	27.5
MZ VIII Ml-1660/$_4$	28.4	25.5
MZ VIII Ml-1660/$_5$	27.0	24.5
MZ VIII Ml-1660/$_6$	26.0	26.0

Description. — Shell is massive, strongly convex, orbicular to oval in outline, inequilateral, with its posterior part accounting for 64%—75% of the shell length. Small, acute, strongly prosogyrate beaks slightly project above the short, moderately convex anterodorsal margin. Lunule is large, cordate, delimited by a narrow and deep groove, ornamented with fine, concentric lamellae. Escutcheon is asymmetrical, equal to the posterodorsal margin in length. It is larger and more distinct at the left valve, covered with lamellae that are weaker at the left than at the right valve. External surface is ornamented with two systems of concentric lamellae, different from each other in strenght. One system consists of prominent lamellae which are almost perpendicular to the shell surface and fairly distant from each other. Lamellae of the other system are fine, less prominent than the former, densely spaced, disposed in between the lamellae of the first system. Growth stages are indistinct.

Ligament is external. Very distinct nympha accounts for half the length of the posterodorsal margin. Hinge is strongly developed, the anterior laterals being placed near the cardinals and the posterior laterals lacking.

Hinge in the right valve: a deep triangular socket separates short and oblique 3a from massive, triangular 1 which is placed just beneath the beak and divided into two parts by a weak groove; long, thin, lamelliform 3b is parallel to the nympha margin; small, nodular AI, situated at the lower edge of the hinge plate, is separated from very weak AIII by a suborbicular socket.

Hinge in the left valve: thin, almost vertical 2a placed behind the beak, butts upon oblique, triangular 2b; thin, lamelliform 4b, parallel to the nympha margin, is separated from 2b by a long, subrectangular socket; large, nodular AII, parallel to the lunular margin, is placed at its midlength.

Adductor muscle scars are subequal in size, the anterior one being oval, while the posterior suborbicular in shape. Pallial line which is parallel to, and distant from the ventral margin, bears a small, shallow sinus, its peak being directed towards the beak. Anterior margin and a part of the ventral margin are finely crenulated.

Remarks. — The shell of *V.* (*V.*) *multilamella* is variable in shape, convexity, lunule width, and in sculpture, all these varying features displaying some correlations. Forms suborbicular or tetragonal in shape are very convex, their lunule being wide, cordate. Oval-shaped forms, in turn, are less convex than the former, their lunule being narrow, lanceolate, and the concentric lamellae at the surface being lower than in orbicular forms. This variability seems to be controlled by the bottom sediment. In fact, the shells of *V.* (*V.*) *multilamella* from sands (Rybnica 1) are suborbicular and very convex, while those from clayey sediments (Korytnica — Dr. G. JAKUBOWSKI'S collection) are oval-shaped, with elongated siphonal part. The sediment being sandy with some clay admixture (Rybnica 2 — *Glossus* assemblage; see HOFFMAN and SZUBZDA 1976), the shells are regularly oval in shape.

These ecotypes have been treated by Polish paleontologists as distinct species. The name *V. cincta* EICHWALD, 1850 has been used for the suborbicular form; *V. multilamella* (LAMARCK, 1818) for the regularly oval form; and *V. multilamella* var. *marginalis* EICHWALD, 1829, for the oval form with elongated siphonal part.

One more misunderstanding concerns the name *V. cincta* because Eichwald described two different species under the same name. *V. cincta* EICHWALD, 1850 is synonymous with *V. multilamella* (LAMARCK, 1818). The earlier name, *V. cincta* EICHWALD, 1830, refers to triangular shells, with convex anterior and posterior margins, ornamented with numerous, densely spaced concentric lamellae, which features resemble *Cytherea multisulcata* DESHAYES, 1824. Thus, *V. cincta* EICHWALD, 1830 is excluded by the present author from the synonymy of *V.* (*V.*)

multilamella. The same holds for *V. cincta* described by HÖRNES (1861) as it differs from *V. cincta* EICHWALD, 1850 in its weaker radial lines forming wrinkles at the posterior part of the valve. According to KAUTSKY (1936) the shells derived from the Leitha limestones (Austria) and attributed by HÖRNES (1861) to *V. cincta*, are referable to *V. tauroverrucosa* SACCO, 1900.

COSSMANN and PEYROT (1911, pl. 14: 28—29) confounded *V.* (*V.*) *multilamella* and *V. haidingeri* HÖRNES, 1848. The latter has shell triangular in outline, almost flattened, provided with an edge, ornamented with densely spaced, indistinct, concentric lamellae. *V. haidingeri* is, according to HÖRNES (1861: 134—135), similar to *V. plicata* GMELIN, 1791.

Stratigraphic range. — Late Oligocene (BÁLDI 1973) — Recent.

Venus (*Ventricoloidea*) *libella* de RAYNEVAL, VAN den HECKE and PONZI, 1854

(pl. 14: 8a—b, 9a—b)

1861. *Venus praecursor* MAYER; HÖRNES, 126, pl. 14: 5—9.
1900. *Ventricola libellus* (RAYN. V. d. ECK., PONZ.); SACCO, 34—35, pl. 9: 5—10.
1906. *Venus* (*Ventricola*) *circularis* DESHAYES; DOLLFUS and DAUTZENBERG, 200—201, pl. 11: 34—39.
1908. *Venus* (*Ventricola*) *libellus* De RAYN., V. d. H., PONZI; CERULLI-IRELLI, 55—56, pl. 11: 21—23.
1960. *Venus* (*Ventricola*) *circularis* DESHAYES 1852; KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 52, pl. 16: 13—14.
1966*b*. *Venus* (*Globivenus*) *libellus* RAYNEVAL, VAN den HECKE et PONZI, 1854; GLIBERT and VAN de POEL, 36.

Material. — Nawodzice — 5 valves; Rybnica 1—4 valves; Rybnica 2—2 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1661/$_1$	3.5	3.0
MZ VIII Ml-1661/$_2$	2.7	2.5

Description. — Valve is suborbicular in outline, convex, inequilateral, with its posterior part accounting for 64% of the valve length. Anterodorsal margin is straight and shorter than the straight posterodorsal margin. Other margins are strongly convex. Prosogyrate beaks are small. Lunule is cordate, delimited by a distinct groove, ornamented with fine lamellae. Escutcheon is very narrow, long, smooth, poorly defined.

External surface is covered by rounded, regularly spaced concentric lamellae. Both the lamellae and grooves in between bear secondary ornamentation in form of delicate concentric lamellae. Growth stages are indistinct.

External ligament is placed at the nympha which approximates half the posterodorsal margin in length. Lateral teeth are indiscernible.

Hinge in the right valve: weak and short 3a, somewhat oblique to the lunular margin, is separated by a triangular socket from triangular, prominent 1; 3b is longer than 1, divided into halves.

Hinge in the left valve: very thin, lamelliform 2a is higher than massive, slightly bifurcated 2b; long, lamelliform 4b is parallel to the edge of the nympha.

Adductor muscle scars are subequal, the anterior one being pear-shaped while the posterior suborbicular in outline. Pallial line is provided with wide, triangular sinus, it is moderately distant from the finely crenulated ventral margin.

Remarks. — Juvenile shells of the considered species resemble small specimens of *V.* (*V.*) *multilamella* (LAMARCK, 1818) from the sandy facies, but they differ from the latter in their greater convexity and massiveness, as well as in ornamentation. In fact, small, orbicular shells of *V.* (*V.*) *multilamella* are ornamented with very thin, prominent concentric slates, the surface inbetween being smooth, or finely concentrically lined.

The species *V.* (*V.*) *libella* has previously not been reported from the Polish Miocene.

Stratigraphic range. — Early Miocene (DOLLFUS and DAUTZENBERG 1906) — Late Pliocene (SACCO 1900).

Genus *Circomphalus* MÖRCH, 1853

Circomphalus subplicatus (d'ORBIGNY, 1847)

(pl. 16: 1, 2, 3a—b, 6—9)

part. 1840. *Venus plicata* GMEL.; GOLDFUSS, 248, pl. 151: 9a—b, f, *non* pl. 151: 9c—d.
1852. *Venus subplicata* d'ORB.; d'ORBIGNY, 107, n° 1987.
1861. *Venus plicata* GMELIN; HÖRNES, 132—134, pl. 15: 4—6.
1911. *Chione* (*Clausinella*) *subplicata* (d'ORB.); COSSMANN and PEYROT, 337—340, pl. 13: 19—23.
1930. *Venus subplicata* d'ORB.; KOWALEWSKI, 77.
1934. *Venus* (*Chione*) *subplicata* d'ORB. et var.; FRIEDBERG, 64—65, pl. 10: 7—8, 10—11, pl. 14: 8 [var. *orientalis* FRIEDB.], pl. 10: 9.
1936. *Venus* (*Circomphalus*) *plicata* GMEL. et var.; KAUTSKY, 9—10, pl. 2: 4—5 [var. *Grundensis* nov. var.], pl. 2: 2—3 [var. *rotundior* nov. var.].
1938. *Venus subplicata* d'ORB. var. *orientalis* FRIEDB.; FRIEDBERG, 28.
1960. *Chione* (*Clausinella*) *subplicata* d'ORBIGNY; KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 53, pl. 17: 1—2.
1966*b*. *Circomphalus casinoides orientalis* (FRIEDBERG, 1934); GLIBERT and VAN de POEL, 42.
1966*b*. *Circomphalus foliaceolamellosus subplicatus* (ORBIGNY, 1852); GLIBERT and VAN de POEL, 42—43.
1979*a*. *Circomphalus orientalis* (FRIEDBERG, 1934); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 60, pl. 5: 1—2.

Material. — Nawodzice — 24 shells, 300 valves; Rybnica 1—10 valves; Rybnica 2 — ca 800 valves.

Dimensions (in mm):

	L.	H
MZ VIII Ml-1662/$_1$	40.5	36.5
MZ VIII Ml-1662/$_2$	40.0	38.5
MZ VIII Ml-1662/$_3$	39.0	37.0
MZ VIII Ml-1662/$_4$	38.2	36.0
MZ VIII Ml-1662/$_5$	35.5	33.2
MZ VIII Ml-1662/$_6$	34.0	33.5
MZ VIII Ml-1662/$_7$	12.0	10.0

Description. — Shell is subtrigonal in outline, more or less convex, inequilateral, with is posterior part accounting for 71—82% of the shell length. Small, acute, strongly prosogyrate beaks slightly project above the dorsal margin. Straight to weakly convex anterodorsal margin is short and steep. Short and convex anterior margin gently passes into the regularly arched ventral margin which, in turn, connects angularly with the almost straight posterior margin. The latter connects angularly with the long, slightly convex posterodorsal margin. Lunule is narrow, cordate, equal at both the valves, delimited by a narrow groove. It is ornamented with densely spaced, fine lamellae. Escutcheon is triangular in otuline, its length being equal to the posterodorsal margin. It is wider at the left than at the right valve, delimited by a sharp edge, ornamented with fine lamellae parallel to the posterior part to the posterodorsal margin.

External surface is ornamented with fine, concentric slates of variable height, almost perpendicular to the shell surface. The slates are angularly bent at the line connecting the beak with the posteroventral angle, thus marking the limit of the corselet. Concentric slates at the surface of the corselet are lower than at the remaining surface and lean towards the beak. The surface between the slates is either smooth or finely concentrically lined. Fine, radial striae become distinct at some abraded shells, but never at the surface of the corselet. Traces of original

pigmentation are preserved in some specimens, in form of alternating concentric bands: narrow (white) and wide (pinky-grey in colour). Growth stages are indistinct.

External ligament is placed in a deep nympha accounting for 2/3 of the posterodorsal margin in length. Hinge is massive.

Hinge in the right valve: very short, lamelliform 3a, subparallel to the lunular margin, is separated by a deep, rectangular socket from massive, triangular 1; the latter is perpendicular to the lower edge of the hinge plate; longitudinal groove divides 1 into two parts, the anterior one being larger and higher than the posterior; long, wide, deeply furrowed 3b is separated from the nympha by a deep, narrow groove; two small monticules, AI and AIII, separated from each other by a shallow, suborbicular socket, are placed at the base of 3a.

Hinge in the left valve: 2a is triangular, oblique to the lunular margin, separated from the latter by a small, triangular socket; there is a deep socket between 2a and large, massive 2b; the latter is divided by a longitudinal groove into two parts, the anterior one being narrower and lower than the posterior; very long, lamelliform 4b is placed close to the edge of the nympha; small, nodular AII is placed at the base of 2a.

Anterior adductor muscle scar is oval in outline, while the posterior one is bean-shaped. Pallial line is parallel to the ventral margin. Pallial sinus is small, shallow, triangular in outline, with somewhat oblique axis. Both anterior and ventral margins are finely crenulated.

Remarks. — The species *Circomphalus subplicatus* has frequently been identified with the Recent *C. foliaceolamellosus* (DILLWYN, 1817) [=*Venus plicata* GMELIN, 1791] from which it differs in shell outline and hinge construction. The shell of *C. foliaceolamellosus* is more flattened and more transversally elongated than that of *C. subplicatus*; it has also very small, strongly anteriorly shifted beaks, narrower, less steep corselet, and shorter, less acute palial sinus, its axis being very oblique. The teeth 2a and 3a are more distant from the lunular margin in *C. foliaceolamellosus* than in *C. subplicatus*; furthermore, the tooth 4b is almost horizontal, 1 weaker and less bent, 2b divided into two subequal parts. Laterals are entirely lacking in *C. foliaceolamellosus*.

The investigated specimens from Rybnica and Nawodzice are not entirely identifiable because of their great variability in shell shape and ornamentation. Forms up to 2.0 mm long are subequilateral, with their posterior part accounting for 56%—60% of the shell length, and with slightly prosogyrate beaks placed at the maximum shell height. Larger forms are more asymmetrical; their posterior part accounts for up to 82% of the shell length and the strongly prosogyrate beaks are shifted anteroventrally. Large, strongly convex shells, relatively high, with convex posterodorsal margin, covered with lamellae rounded at the limit of the corselet, are referable to the variety *rotundior* KAUTSKY, 1936. In turn, those shells with less convex posterodorsal margin, covered with densely spaced, low concentric lamellae are referable to the variety *orientalis* FRIEDBERG, 1934.

According to GLIBERT and VAN de POEL (1966*b*), the specimens attributed by FRIEDBERG (1934) to *Venus subplicata* d'ORB., as well as those described by him under the name *V. subplicata* var. *orientalis*, should be identified as *Circomphalus casinoides orientalis* (FRIEDBERG, 1934).

The specimens identified by COSSMANN and PEYROT (1909) as *Chione* (*Clausinella*) *subplicata* (d'ORB.) have been ascribed by GLIBERT and VAN de POEL (1966*b*) to *C. foliaceolamellosus subplicatus*, which is a very dim statement. COSSMANN and PEYROT (1909), in fact, evidenced the distinctness of *Chione* (*C.*) *subplicata* (d'ORB.) from the Recent species *Venus plicata* GMELIN, as well as from its Pliocene variety *V. pliocaenica* de STEFANI, 1888. In addition, COSSMANN and PEYROT (1909) showed the identity of *Ch. subplicata* from Aquitaine with the specimens from the Vienna Basin assigned by HÖRNES (1861) to *V. plicata*. GLIBERT and VAN de POEL (1966*b*) however, attributed the Viennese specimens to *C. casinoides orientalis* which

should then be regarded as a descendent of *C. c. haidingeri* (HÖRNES, 1848). However, HÖRNES (1861: 134—135) ascertained that *V. haidingeri* and *V. plicata* = *C. c. orientalis*] are equivalent in geological age, their cooccurrence in the same outcrops being observed but without any transitional forms.

The investigated specimens from Rybnica and Nawodzice are indistinguishable from *Ch.* (*C.*) *subplicata* from Aquitaine (COSSMANN and PEYROT 1909), as well as from *V. plicata* from the Vienna Basin (HÖRNES 1861). There is therefore no ground whatsoever to distinguish between those two forms.

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1909) — Early Pliocene (SACCO 1900).

Subfamily **Circinae** DALL, 1896
Genus *Gouldia* C. B. ADAMS, 1847
Subgenus *Gouldia* (*Gouldia*) C. B. ADAMS, 1847
Gouldia (*Gouldia*) *minima* (MONTAGU, 1803)
(pl. 14: 7a—b)

1893. *Circe minima* MONTAGU sp. (*Venus*); BUCQUOY *et al.*, 335—340, pl. 39: 24—35.
1908. *Gouldia minima* MTG. sp.; CERULLI-IRELLI, 44—45, pl. 9: 12—19.
1945. *Gouldia minima* MONTAGU, sp. 1803; GLIBERT, 192—193, pl. 12: 1a—b *(cum syn.)*.
1964. *Gouldia minima* (MONTAGU 1803); ANDERSON, 173—174, pl. 8: 61a—b.
1965. *Gafranium* (*Circe*) *minimum* (MONTAGU); NEVESSKAJA, 243—248, pl. 13: 14—23.
1966. *Gafranium* (*Gouldia*) *minima* (MONTAGU); TEBBLE, 113, text-fig. 60, pl. 9: d—e.

Material. — Rybnica 1—1 valve; Rybnica 2—1 valve.

Dimensions (in mm):

	L	H
MZ VIII Ml-1663	6.0	4.9

Remarks. — The specimens of *G.* (*G.*) *minima* from Rybnica are closely consistent with the descriptions and figures referred to in the synonymy.

Stratigraphic range. — Early Miocene (GLIBERT and VAN de POEL 1966*b*) — Recent.

Subfamily **Pitarinae** STEWART, 1930
Genus *Pitar* RÖMER, 1857
Subgenus *Pitar* (*Pitar*) RÖMER, 1857
Pitar (*Pitar*) *rudis* (POLI, 1795)
(pl. 15: 9a—b, 11a—b)

1850. *Cytherea rudis*, POLI; WOOD, 208—209, pl. 20: 5a—d.
1893. *Meretrix rudis* POLI, sp. (*Venus*); BUCQUOY *et al.*, 330—334, pl. 53: 1—11.
1900. *Pitar rudis* (POLI); SACCO, 19—20, pl. 4: 22—25.
1906. *Meretrix* (*Pitar*) *rudis* POLI sp. (*Venus*); DOLLFUS and DAUTZENBERG, 217—220, pl. 14: 2—9.
1908. *Meretrix* (*Pitar*) *rudis* POLI sp.; CERULLI-IRELLI, 43—44, pl. 9: 4—11.
1911. *Meretrix* (*Pitaria*) *rudis* (POLI); COSSMANN and PEYROT, 383—385, pl. 15: 7—8, 15—16.
1945. *Pitar* (*Pitar*) *rudis* POLI, sp. 1795; GLIBERT, 184—185, pl. 11: 8a—d.
1950. *Pitaria* (*P.*) *rudis* (POLI); HEERING, 34, pl. 7: 159, 161.
1960. *Pitar* (*Pitar*) *rudis* (POLI); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 55, pl. 17: 8—9.
1965. *Pitar* (*Pitar*) *rudis* (POLI, 1795); NEVESSKAJA, 235—236, pl. 13: 1—13.

Material. — Rybnica 2—4 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1664/$_1$	15.6	13.5
MZ VIII Ml-1664/$_2$	7.0	6.1

Remarks. — The investigated specimens from Rybnica entirely correspond to the descriptions and figures referred to in the synonymy.

The species *Pitar* (*P.*) *rudis* has previously not been reported from the Polish Miocene.

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1911) — Recent.

Genus *Callista* POLI, 1791
Subgenus *Callista* (*Callista*) POLI, 1791
Callista (*Callista*) *italica* (DEFRANCE, 1818)

(pl. 16: 11, pl. 17: 8, 9a—b)

1934. *Meretrix* (*Callista*) *italica* DEF.; FRIEDBERG, 76—78, pl. 13: 4—8 (*cum syn.*).
1938. *Meretrix italica* DEFR.; FRIEDBERG, 30.
1945. *Pitar* (*Callista*) *chionoides* NYST sp. 1844; GLIBERT, 182—183, pl. 11: 4a—c.
1960. *Pitar* (*Callista*) *chione* var. *italica* (DEFRANCE 1818); KOJUMDGIEVA in KOJUMDGIEVA and STRACHIMIROV, 56, pl. 17: 12—14.
1974. *Callista* (*Callista*) *italica* (DEFRANCE, 1818); MALATESTA, 138—140, pl. 11: 2a—b.

Material. — Nawodzice — 1 shell, 40 valves; Rybnica 1—20 shells, 70 valves; Rybnica 2—1 shell, 145 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1665/$_1$	73.0	56.0
MZ VIII Ml-1665/$_2$	69.0	56.0
MZ VIII Ml-1665/$_3$	66.0	52.0

Remarks. — The specimens from Nawodzice and Rybnica closely correspond to the descriptions and figures referred to in the synonymy.

The shell shape undergoes changes in ontogeny in *Callista* (*C.*) *italica* (DEFRANCE). Shells 1.5 to 4.0 mm long are regularly oval in outline, relatively asymmetrical (with the posterior part accounting for 53%—65% of the shell length), their beaks being less projected and less swollen than in larger forms. They resemble *Callista* (*C.*) *chione* (LINNÉ, 1758). In contrast, forms that are 52—76 mm long, have their beaks swollen, strongly prosogyrate and considerably projected above the dorsal margin. Furthermore, the posterior part of their dorsal margin is longer than in juveniles, less convex and oblique; it accounts for 70%—82% of the shell length.

Those shells of *C.* (*C.*) *italica* from Rybnica and Nawodzice which have less sloped posterodorsal margin are wholly consistent with the Lower Miocene specimens from Boldenberg (Belgium) assigned by GLIBERT (1945) to *Pitar* (*C.*) *chionoides* (NYST, 1844).

The species under discussion is similar to *C.* (*C.*) *chione* (LINNÉ, 1758). The shell of the latter, however, is less massive, oval in outline, with its beaks slightly projected. Its external surface is ornamented with fine concentric lines, while the shell sculpture in *C.* (*C.*) *italica* consists of deep, irregularly spaced concentric grooves. In addition, the short and relatively weak cardinals are placed at the very narrow hinge plate in *C.* (*C.*) *chione*, and the anterior laterals are long, lamelliform; whereas the hinge plate is relatively large, the cardinals are long and massive and the anterior laterals are short and thick in *C.* (*C.*) *italica*.

The species *C.* (*C.*) *italica* has been treated by KOJUMDGIEVA (1960) as a variety of *C.* (*C.*) *chione*, whereas TEJKAL (1955) regarded it as a subspecies of the latter species. The forms named

italica and *chione* are here considered as two distinct species. Their apparent distinctness in the investigated material from Rybnica and Nawodzice, as well as the above described differences, substantiate, in the present author's opinion, this statement.

Stratigraphic range. — Early Miocene (MALATESTA 1974) — Late Pliocene (GLIBERT and VAN de POEL 1966*b*).

Callista (*Callista*) *sobrina* (CONRAD, 1847)
(pl. 15: 13a—b, 14)

1927. *Callista* (*Callista*) *sobrina* (CONRAD); VAN WINKLE PALMER, 76, pl. 12: 4—5, 13.

Material. — Rybnica 2—2 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1666/$_1$	9.0	7.2
MZ VIII Ml-1666/$_2$	8.5	7.0

Description. — Valve is massive, triangular in outline, moderately convex, inequilateral, with its posterior margin accounting for 65% of the valve length. Beak is prosogyrate, acute, slightly projected above the dorsal margin. Lunule is small, cordate, somewhat deepened, delimited by a faint groove. Escutcheon is indiscernible.

External surface is ornamented with flattened concentric lamellae variable in width, separated with deep, very narrow grooves. Growth stages are indistinct.

External ligament is placed at the nympha which extends to the lower edge of the hinge plate. Hinge is massive, with strongly developed anterior laterals placed near the cardinals.

Hinge in the right valve: lamelliform 3a is parallel to the triangular 1, from which it is separated by a very narrow socket; a triangular socket separates 1 from long, lamelliform 3b which, in turn, borders another triangular socket, larger than the former; 3b and 1 are distinctly furrowed; AI and AIII are parallel to each other, the former being slightly longer than the latter.

Hinge in the left valve: thin, lamelliform 2a, somewhat bent towards the nympha, connects beneath the beak with thicker and shorter 2b which is perpendicular to the lunular margin; 4b is very weak, entirely fused with the edge of the nympha; AII is massive, parallel to the anterodorsal margin, equal to the cardinals in length.

Anterior adductor muscle scar is oval-shaped, somewhat smaller than the subsquare posterior one. Pallial line displays a large, oval, horizontal sinus, extending up to the valve midline. Ventral margin is smooth.

Remarks. — The investigated specimens from Rybnica are entirely consistent with *Meretrix meretrix* LINNÉ, 1758 in shell outline but they differ from the latter in hinge construction. In fact, *M. meretrix* has divergent cardinals, while 3a and 1 are parallel to each other in *C.* (*C.*) *sobrina*. Moreover, the lower edge of the hinge plate is concave in *M. meretrix*, but convex in *C.* (*C.*) *sobrina*.

The specimens from Rybnica are entirely consistent with some Oligocene specimens of *Callista* (*C.*) *sobrina* (CONRAD) figured by VAN WINKLE PALMER (1927, pl. 12: 13), but they differ in outline from the others (VAN WINKLE PALMER 1927, pl. 12: 4—5). The latter are very convex and oval in outline. The only other difference between the specimens from USA and Poland is in shell size, as the former are 29.0 mm long and 24.0 mm high.

The species *C.* (*C.*) *sobrina* has previously not been reported from the Polish Miocene.

Stratigraphic range. — Oligocene (VAN WINKLE PALMER 1927) — Middle Miocene (this paper).

Genus *Pelecyora* DALL, 1902
Subgenus *Pelecyora* (*Cordiopsis*) COSSMANN, 1910
Pelecyora (*Cordiopsis*) *islandicoides* (LAMARCK, 1818)

1910. *Amiantis islandicoides* LAM.; SCHAFFER, 82, pl. 38: 2—4.
1934. *Meretrix* (*Cordiopsis*) *islandicoides* LAM.; FRIEDBERG, 79—80, pl. 13: 9—10, pl. 14: 1 *(cum syn.)*.
1938. *Meretrix islandicoides* LAM.; FRIEDBERG, 30.
1960. *Pitar islandicoides* (LAMARCK) 1818; STRACHIMIROV in KOJUMDGIEVA and STRACHIMIROV, 272, pl. 57: 5—6.
1974. *Sinodia islandicoides* (LAMARCK, 1818); MALATESTA, 143—144, pl. 12: 6.

Material. — Nawodzice — 1 left valve, 1 incomplete valve; Rybnica 1—1 left valve.
Dimensions (in mm):

	L	H
MZ VIII Ml-1667	51.0	50.0

Remarks. — The specimens from Nawodzice and Rybnica are entirely consistent with the descriptions and figures referred to in the synonymy.

Stratigraphic range. — Early Miocene (MALATESTA 1974) — Late Pliocene (GLIBERT and VAN de POEL 1966*b*).

Subfamily **Tapetinae** ADAMS and ADAMS, 1857
Genus *Tapes* MEGERLE von MÜHLFELD, 1811
Subgenus *Tapes* (*Tapes*) MEGERLE von MÜHLFELD, 1811
Tapes (*Tapes*) *vitalianus* (d'ORBIGNY, 1844)
(pl. 17: 1a—b, 4)

1844. *Venus vitaliana* d'ORB. 1844; d'ORBIGNY, 486—487, pl. 5: 22—25.
part. 1853. *Venus dissita* m.; EICHWALD, 105—106, pl. 5: 13a—b.
1899. *Tapes vitaliana* d'ORB.; SOKOLOV, 19—20, pl. 2: 22—24.
1903. *Tapes Vitaliana* d'ORB.; LASKAREW, 65—67.
1935. *Tapes vitalianus* d'ORB.; KOLESNIKOV, 69—71, pl. 8: 4—6.
1954. *Irus* (*Paphius*) *vitalianus* (d'ORBIGNY); PAPP, 82—83, pl. 16: 1—5.
1955. *Tapes vitalianus vitalianus* (ORBIGNY), 1844; MERKLIN and NEVESSKAJA, 59—60, pl. 16: 7—15.
1969. *Tapes vitalianus* (d'ORBIGNY, 1844); KOJUMDGIEVA, 52—53, pl. 17: 11, 16.
1974. *Tapes vitalianus* ORBIGNY, 1844; VOLKOVA, 61, pl. 14: 11, pl. 17: 4—5.

Material. — Nawodzice — 6 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml-1668/$_1$	6.7	4.0
MZ VIII Ml-1668/$_2$	2.5	1.6

Description. — Valve is fragile, transversally elongated, with acute posteroventral part and the posterior part accounting for some 70% of the valve length. Short and straight but oblique anterodorsal margin gently connects with the short and convex anterior margin which, in turn, passes into the rectilinear and long ventral margin. Straight and oblique posterodorsal margin makes an obtuse angle with the slightly convex, oblique posterior margin. Swollen, prosogyrate beaks strongly project above the dorsal margin. A weak ridge is marked at the umbonal part of the shell, which gradually declines posteroventrally. Lunule is large, cordate, delimited by a weak groove; it bears the same ornamentation as the remainder of the shell surface does. Long and very narrow escutcheon is delimited by a distinct edge; its surface bears delicate radial lines.

External surface is ornamented with irregular concentric lines. Growth stages are very distinct.

External ligament is placed at the nympha, the latter attaining 1/3 of the posterodorsal margin in length. The hinge is relatively weak, without any lateral teeth.

Hinge in the right valve: short and narrow 3a is placed in front of the beak; it is parallel to the lunular margin and separated by a shallow socket from triangular 1, the latter beginning to bifurcate at its lower part: 3b is equal in length to 3a but it is higher and stronger than the latter.

Hinge in the left valve: there is a long groove in front of triangular 2a connected with 2b; the latter is shorter than the former and bifurcated at its lower part; the connection of 2a with 2b is situated close beneath the beak; short, thin, lamelliform 4b placed at the edge of the nympha is separated from 2b by a shallow, short socket.

The anterior adductor muscle scar is oval in outline and somewhat greater than the orbicular posterior adductor muscle scar, the latter being situated very high, near the end of the posterodorsal margin. Pallial sinus is triangular in shape, very deep, its vertex reaching the level of the end of the nympha. Ventral margin is smooth.

Remarks. — Allied with *T.* (*T.*) *vitalianus* is *T. tricuspis* (EICHWALD, 1829). It has a massive shell, more inequilateral and less elongated than in the former species, ornamented with distinct lines tending to form lamellae. The beaks are more acute in *T. tricuspis* than in *T.* (*T.*) *vitalianus*, the umbonal part of the shell being better defined and more projected above the dorsal margin; moreover, the hinge is more conspicuous and more massive.

The difference between *T.* (*T.*) *vitalianus* and *T. erroneus* ZHIZHCHENKO, 1936, consists mostly in shell shape, which is less inequilateral in *T. erroneus* than in *T.* (*T.*) *vitalianus*; the shell is very narrow, sometimes even acute in the posterior part in *T. erroneus*.

The species *T.* (*T.*) *vitalianus* and *T. modesta* (du BOIS de MONTPÉREUX, 1831) differ from each other in shape of the siphonal sinus, which is very large, oval-shaped, with horizontal axis in *T. modesta*, the wide, arched anterior part of the sinus coinciding with the nympha mid-length (LASKAREW 1903, pl. 4: 17—18); while the longer axis of the triangular siphonal sinus in *T.* (*T.*) *vitalianus* is directed towards the beak, the rounded part of the sinus corresponding to the end of the nympha.

Stratigraphic range. — Middle Miocene (LASKAREW 1903) — Late Miocene (KOJUMDGIEVA 1969).

Genus *Irus* SCHMIDT, 1818
Subgenus *Irus* (*Irus*) SCHMIDT, 1818
Irus (*Irus*) *irus* (LINNÉ, 1758)
(pl. 17: 2a—b, 3a—b)

1850. *Venerupis irus* LINNAEUS; WOOD, 205—206, pl. 19: 6a—b.
1900. *Venerupis irus* (L.) var. *minima* SACC.; SACCO, 59, pl. 14: 4—6.
1934. *Venerupis irus* L.; FRIEDBERG, 81—82, text-fig. 9, pl. 15: 2 (*cum syn.*).
1966. *Notirus irus* (LINNAEUS); TEBBLE, 124, pl. 7: g.

Material. — Nawodzice — 6 valves; Rybnica 1—27 valves; Rybnica 2—2 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml-1669/$_1$	6.0	3.8
MZ VIII Ml-1669/$_2$	4.3	2.5

Remarks. — The specimens under discussion are entirely consistent with the descriptions and figures referred to in the synonymy.

A change in shell shape and ornamentation is observed in ontogeny of *I. (I.) irus*. Valves 0.8 to 1.5 mm long are smooth, suborbicular in outline, subequilateral. Larger valves are ornamented with narrow, concentric lamellae, subperpendicular to the valve surface. External surface between the first 2 or 3 lamellae is smooth, while it is covered with rounded radial ribs between the remaining ones, the rib width being subequal to the width of the interrib grooves. Both the ribs and the grooves are transected with faint concentric lines. Valves bearing the above described ornamentation are rectangular in outline and strongly inequilateral; their posterior part accounts for 78% of the valve length.

Allied with *I. (I.) irus* is *I. pseudoirus* (BAJARANUS, 1904), the shell of which is trapezoidal in outline, less asymmetrical than that of the former species, with stronger convexity at the anterior margin, and weaker or completely absent concentric, but also with stronger radial ornamentation.

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1912) — Recent.

Subfamily **Chioninae** FRIZZELL, 1936
Genus *Timoclea* BROWN, 1827
Subgenus *Timoclea* (*Timoclea*) BROWN, 1827
Timoclea (*Timoclea*) *sobieskii* (HILBER, 1882)
(pl. 16: 10a—b, 12a—b)

1882. *Venus Sobieskii* HILBER, nova forma HILBER, 12—13, pl. 1: 30—31.
1899. *Venus konkensis* sp. n.; SOKOLOV, 16—19, pl. 2: 3—13.
1903. *Venus konkensis* var. *media* SOKOL.; LASKAREW, 62—63, pl. 3: 25—30.
1934. *Timoclea Sobieskii* HILB.; FRIEDBERG, 73—74, pl. 12: 14—19.
1934. *Timoclea Sobieskii* HILB. var. *media* SOK.; FRIEDBERG, 74, pl. 12: 20—22.
1955. *Venus konkensis* SOKOLOV, 1899; MERKLIN and NEVESSKAJA, 57, pl. 15: 11—14.
1956. *Venus sobieskii* HILBER, 1882; KUDRIN, 187—190, pl. 3: 8—15.
1956. *Venus sobieskii* HILB. var. *media* SOK.; KUDRIN, 190—192, pl. 1: 1—45, pl. 2: 1—44, pl. 3: 1—7, 16—26.
1970. *Timoclea sobieskii media* (SOKOLOV); BALUK, pl. 6: 1a—b.

Material. — Nawodzice — 1 valve; Rybnica 1—4 valves; Rybnica 2—1 valve.
Dimensions (in mm):

	L	H
MZ VIII Ml-1670/$_1$	3.0	2.8
MZ VIII Ml-1670/$_2$	2.5	2.0

Description. — Valve is small, massive, oval in outline, with well defined triangular umbonal part, inequilateral, with its posterior part accounting for 80% of the valve length. Small, prosogyrate beaks sligthly project above the anterodorsal margin. Lunule is cordate, radially lined, delimited with a distinct groove. Smooth prodissoconch is separated with a deep groove from the remaining surface of the shell which is ornamented with concentric lines. At the anterior and posterior parts of the shell radial lines sometimes may occur together with oblong knots formed by thickening concentric lines. Growth stages are clearly distinct.

External ligament is placed at the very short nympha. Hinge is strong, without lateral teeth.

Hinge in the right valve: thin, lamelliform 3a is parallel to the lunular margin; 1 is triangular, massive; 3b is very long and thick; 3a is separated by a shallow, triangular socket from 1which, in turn, is separated from 3b by a socket deeper and longer than the former.

Hinge in the left valve: thin, lamelliform 2a makes a right angle with triangular 2b, somewhat bifurcated downwards; weak, flattened 4b is situated behind the latter.

Anterior adductor muscle scar is oval-shaped and smaller than the suborbicular posterior one. Small, circular retractor muscle scar is situated above the anterior adductor muscle scar. Pallial line with a very shallow sinus is very distant from the ventral margin. Internal margin is finely crenulated.

Remarks. — Great variability in shell outline, convexity and sculpture is characteristic of the considered species. Very convex, posteroventrally elongated, thick-shelled forms, with distinct umbonal part and a weak rounded ridge, have been ascribed to *T. konkensis* var. *media* (SOKOLOV, 1899) or *T. sobieskii* var. *media* (see LASKAREW 1903, FRIEDBERG 1934, KUDRIN 1956). Less convex, oval, transversally elongated, thin-shelled forms, with less projected beaks and more regular and distinct concentric ornamentation, resemble *T. marginata* (HÖRNES, 1861). The latter, however, is rhomboidal in outline, more convex than the former, its ornamentation being distinctive between immature and adult forms. Small shells of *T. marginata* have their whole surface covered with concentric lamellae, with radial lines confined to the lunule, while large shells of this species bear concentric lamellae only at their marginal parts (HÖRNES 1861, 138—139, pl. 15: 11a—c). In turn, the shell of *T.* (*T.*) *sobieskii* bears radial lines not only at the lunule but also at the anterior and posterior parts of the shell, and in large forms (over 9—10 mm in length) even near the ventral margin. The sinus is shallow and rounded in *T.* (*T.*) *sobieskii* while deeper, triangular in shape, with its longer axis directed towards the beak in *T. marginata* (see HÖRNES 1861, pl. 15: 11a—c).

An intermediate form exists, according to MIKHAILOVSKY (1903: 206—207), between *T. marginata* and *T.* (*T.*) *sobieskii*, named by him *Venus ukrainica*. The latter species resembles *T. marginata* in shell outline and dimensions, and *T.* (*T.*) *sobieskii* (together with var. *media*) in shell sculpture. However, FRIEDBERG (1934: 74) considered *V. ukrainica* MIKHAILOVSKY, 1903 merely as a variety of *T. sobieskii*, in analogy to *V. konkensis* SOKOLOV, 1899.

The similarity of *T. marginata* to *T.* (*T.*) *sobieskii* is so striking, that specimens from the type locality in Olesko (Ukraine) named *Venus sobieskii* by HILBER (1882), were previously assigned by HÖRNES (1861) to *V. marginata*.

Stratigraphic range. — Middle Miocene (FRIEDBERG 1934) — Late Miocene (KUDRIN 1956).

Family **Petricolidae** DESHAYES, 1839
Genus *Petricola* LAMARCK, 1801
Subgenus *Petricola* (*Rupellaria*) FLEURIAU, 1802
Petricola (*Rupellaria*) *lithophaga* (RETZIUS, 1786)

1893. *Petricola lithophaga* RETZIUS, sp. (*Venus*); BUCQUOY *et al.*, 445—450, pl. 67: 20—28.
1900. *Petricola lithophaga* (RETZ.); SACCO, 60, pl. 14: 7—8.
1965. *Petricola lithophaga* (RETZIUS); NEVESSKAJA, 248—249, pl. 13: 34—38.

Material. — Rybnica 1—1 incomplete right valve.

Dimensions (in mm):

	L	H
MZ VIII Ml-1671	6.8	3.0

Remarks. — NEVESSKAJA (1965) showed *P.* (*R.*) *lithophaga* to be characterized by a wide intraspecific variability in shell shape. The investigated specimen from Rybnica fall within the range of variability of *P.* (*R.*) *lithophaga*.

Stratigraphic range. — Early Miocene (GLIBERT and VAN de POEL 1966) — Recent.

Order **Myoida** STOLICZKA, 1870
Suborder **Myina** STOLICZKA, 1870
Superfamily **Myacea** LAMARCK, 1809
Family **Corbulidae** LAMARCK, 1818
Subfamily **Corbulinae** GRAY, 1823
Genus *Corbula* BRUGUIÉRE, 1797
Subgenus *Corbula* (*Varicorbula*) GRANT and GALE, 1931
Corbula (*Varicorbula*) *gibba* (OLIVI, 1792)
(pl. 16: 13a—b, 14, 15, pl. 18: 2, 3, 6, 8, 10)

1901. *Corbula gibba* OLIVI et var.; SACCO, 34—35, pl. 9: 1—4, pl. 9: 5—7 [var. *curta* LOC. (an *rotundata* SOW. 1828)], pl. 9: 8—9 [var. *rosea* BROWN.].
1930. *Corbula gibba* OLIVI; KOWALEWSKI, 74.
1934. *Corbula gibba* OLIVI; FRIEDBERG, 16—19, p. 2: 9—20 (*cum syn.*).
1945. *Aloidis* (*Varicorbula*) *gibba* OLIVI, sp. 1792; GLIBERT, 215, pl. 3: 10a—c.
1955. *Aloidis gibba* (OLIVI), 1792; MERKLIN and NEVESSKAJA, 77, pl. 21: 19—22.
1956. *Aloidis* (*Varicorbula*) *gibba* (OLIVI, 1792); TEJKAL, 64, pl. 5: 14—16.
1959. *Corbula gibba* OLIVI var. *curta*; ZHIZHCHENKO, 167—168, pl. 3: 8—12.
1959. *Corbula gibba* OLIVI var. *pulchra* ZHIZHCHENKO; ZHIZHCHENKO, 168, pl. 3: 13—15.
1972. *Corbula* (*Varicorbula*) *gibba* (OLIVI), 1792; CAPROTTI, 80—82, pl. 2: 5.
1976. *Corbula* (*Varicorbula*) *gibba* (OLIVI); BRAMBILLA, 124, pl. 31: 17—18.
1977. *Corbula* (*Varicorbula*) *gibba* (OLIVI, 1792); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 104—105, pl. 12: 1—3, 5.

Material. — Nawodzice — 250 valves; Rybnica 1—110 valves; Rybnica 2—3 shells, 330 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1672/$_1$	9.2	6.8
MZ VIII Ml-1672/$_2$	9.0	8.5
MZ VIII Ml-1672/$_3$	7.8	6.5
MZ VIII Ml-1672/$_4$	7.5	6.3
MZ VIII Ml-1672/$_5$	7.0	5.2
MZ VIII Ml-1672/$_6$	7.0	4.8

Remarks. — The investigated specimens from Rybnica and Nawodzice entirely correspond to the descriptions and figures referred to in the synonymy.

The shell of *C.* (*V.*) *gibba*, and especially the right valve, is considerably variable in outline. The specimens from Rybnica 1 and Nawodzice, derived from sandy sediments, have their right valves oval-shaped, transversally elongated, with slightly projected umbonal part, the acute or perpendicularly truncated posterior part accounting for 60%—65% of the valve length. Their external surface is sculptured with fine, narrow and low concentric lamellae, resembling sculpture of *C.* (*V.*) *theodisca* HILBER, 1879, from the Miocene of Steiermark.

On the other hand, the specimens derived from sands with clay admixture (Rybnica 2, see also HOFFMAN and SZUBZDA 1976) have their right valves thick, ovally-triangular in outline, convex, almost equilateral, with the posterior part accounting for 49%—55% of the valve length, and the umbonal part strongly swollen, considerably projected above the dorsal margin. Concentric lamellae are wider and higher than those observed in the sandy facies. The shells from Rybnica 2 are also relatively higher than those from Rybnica 1 and Nawodzice (H/L $\approx$0.90 and 0.70, respectively). In fact, they correspond partly to the type form of *C. gibba* and partly to var. *curta* LOCARD, 1886 (if the shell length equals the height).

Stratigraphic range. — Late Eocene (MALATESTA 1974) — Recent.

Superfamily **Gastrochaenacea** GRAY, 1840
Family **Gastrochaenidae** GRAY, 1840
Genus *Gastrochaena* SPENGLER, 1783
Subgenus *Gastrochaena* (*Gastrochaena*) SPENGLER, 1783
Gastrochaena (*Gastrochaena*) *lata* (DOLLFUS and DAUTZENBERG, 1886)
(pl. 9: 11a—b, 12a—b)

1888. *Rocellaria lata* n. sp., D. et D.; DOLLFUS and DAUTZENBERG, 267—269, pl. 12: 6—6a.
1889. *Gastrochaena curta*, MAYER-EYMAR, 239, pl. 11: 3.
1902. *Gastrochaena lata* DOLLFUS and DAUTZENBERG; DOLLFUS and DAUTZENBERG, 62—63, pl. 1: 26—30.
1909. *Gastrochaena intermedia* HÖRNES, mut. *curta* MAYER; COSSMANN and PEYROT, 77—79, pl. 2: 35—37.
1966*a*. *Gastrochaena lata* (DOLLFUS and DAUTZENBERG, 1886); GLIBERT and VAN de POEL, 23.

Material. — Rybnica 2—1 shell.
Dimensions (in mm):

	L	H
MZ VIII MI-1673	4.5	0.8

Description. — Shell is small, fragile, rhomboidal in outline, posteroventrally elongated, with very low, acute anterior part and high, rounded posterior part accounting for 93% of the shell length. Prosogyrate beak considerably projects above the dorsal margin. Weak groove runs from the beak anterodorsally. Very short, somewhat concave anterodorsal margin forms a sharp angle with the slightly concave anterior margin. Somewhat convex posterodorsal margin, seven times longer than the anterodorsal one, forms a right angle with the convex, oblique posterior margin; the latter is subparallel to the anterior margin. Both the anterior and the posterior margins gently connect with the strongly convex ventral margin.

External surface is ornamented with fine, densely spaced lines, parallel to the shell outline. At the anterior part of the shell, the lines are densely spaced and form delicate slates, while they are rarely spaced at the posterior part. Growth stages are indistinct.

Hinge margin is toothless.

Anterior adductor muscle scar is triangular in outline, placed at the anterior projection of the shell, while the posterior scar, suborbicular and larger than the former, is placed beneath the connection of dorsal and posterior margins. Pallial line with a wide, triangular sinus, rounded at its end, consits of a row of fine, suborbicular scars, placed close to one another along the anterior margin.

Remarks. — Allied with *G.* (*G.*) *lata* is *G.* (*G.*) *intermedia* HÖRNES, 1859, the shell of which is oval-shaped, with its arched anterior margin passing gently into the arched ventral margin; its posterior margin is less oblique than in *G.* (*G.*) *lata*. Anteroventral groove is lacking in *G.* (*G.*) *intermedia*. The triangular pallial sinus is sharply ended in this latter species.

The species *G.* (*G.*) *lata* has previously not been mentioned from the Polish Miocene.

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1909) — Middle Miocene (DOLLFUS and DAUTZENBERG 1902).

Superfamily **Hiatellacea** GRAY, 1824
Family **Hiatellidae** GRAY, 1824
Genus *Hiatella* BOSC, 1801
Subgenus *Hiatella* (*Hiatella*) BOSC, 1801
Hiatella (*Hiatella*) *arctica* (LINNÉ, 1767)
(pl. 15: 10a—b, 12a—b)

1966*a*. *Hiatella* (*s. s.*) *arctica* (LINNÉ, 1767); GLIBERT and VAN de POEL, 24—25.
1972. *Hiatella arctica* (LINNAEUS, 1767); JAKUBOWSKI, 105—110, text-pl. 10: 1—36, pl. 10: 1—36 (*cum syn.*).
1974. *Hiatella arctica* (LINNÉ, 1767); ABBOTT, 541, fig. 6019.

1975. *Hiatella arctica* (LINNÉ, 1767); VAN den BOSCH *et al.*, 81, text-figs 26—29.
1976. *Hiatella* (*Hiatella*) *arctica* (L.); BRAMBILLA, 125, pl. 31: 22—23.
1977. *Hiatella arctica* (LINNAEUS, 1767); JAKUBOWSKI in JAKUBOWSKI and MUSIAŁ, 105, pl. 12: 8—9.

Material. — Nawodzice — 28 valves; Rybnica 1—15 valves; Rybnica 2—27 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml-1674/$_1$	17.0	8.0
MZ VIII Ml-1674/$_2$	9.5	4.0

Remarks. — The investigated specimens from Rybnica and Nawodzice entirely correspond to the descriptions and figures referred to in the synonymy.

The species under discussion is similar to *H.* (*H.*) *rugosa* (LINNÉ, 1767) [=*H.* (*H.*) *striata* FLEURIAU, 1802]. The differences between the species *arctica* and *rugosa* were exhaustively explained by GLIBERT and VAN de POEL (1966*a*).

Stratigraphic range. — Middle Oligocene (BÁLDI 1973) — Recent.

Genus *Panopea* MÉNARD de la GROYE, 1807
Subgenus *Panopea* (*Panopea*) MÉNARD de la GROYE, 1807
Panopea (*Panopea*) *menardi* (DESHAYES, 1828)
(pl. 17: 7, pl. 18: 4, 7, 9)

1831. *Panopea Faujasii* MÉNARD de la GROYE; du BOIS de MONTPÉREUX, 51—52, pl. 4: 1—4.
1853. *Panopaea Rudolphii* m.; EICHWALD, 131—132, pl. 6: 12a—b.
1909. *Glycymeris Menardi* (DESH.); COSSMANN and PEYROT, 123—125, pl. 3: 40—41.
1909. *Glycymeris* cf. *Rudolphi* (EICHW.); COSSMANN and PEYROT, 125—126, pl. 3: 18—19 *(cum syn.)*.
1910. *Glycimeris Ménardi* DESH.; SCHAFFER, 96—97, pl. 45: 4, pl. 46: 1—2.
1930. *Glycimeris Rudolphi* EICHW.; KOWALEWSKI, 73—74.
1934. *Glycymeris menardi* (DESH. var. *Rudolphi* EICHW.; FRIEDBERG, 24—26, pl. 3: 15—16, pl. 4: 1—2.
1956. *Panope* (*Panope*) *menardi* (DESHAYES, 1828); TEJKAL, 289—290.
1957*a*. *Panopea menardi* DESHAYES, 1828; GLIBERT, 45, pl. 4: 6a—c.
1958. *Panopea meynardi meynardi* DESH.; SENEŠ, 116—118, pl. 17: 228—229, pl. 18: 233—237.

Material. — Nawodzice — 10 shells, 12 valves; Rybnica 1—2 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml-1675/$_1$	124	60
MZ VIII Ml-1675/$_2$	119	56
MZ VIII Ml-1675/$_3$	107	52

Description. — Shell is oval in outline, transversally elongated, expanding anteriorly and tapering posteriorly, with the maximum convexity in its umbonal part, inequilateral, with its posterior part accounting for 65% of the shell length. Small, acute, orthogyrate beaks are somewhat shifted towards each other, the one at the right valve being placed more anteriorly than the other. They slightly project above the slightly concave dorsal margin. Anterodorsal margin, straight or somewhat concave near the beak, gently passes into the convex or straight, oblique anterior margin. Unevenly convex ventral margin gently passes into the more or less convex posterior margin.

External surface is covered with irregular concentric lines variable in conspicuousness, transected with irregular, fine, short, rounded rolls in the posterior part of the shell and near the ventral margin. Umbonal part of the shell is densely dotted. The shell is broadly open in the anterior and posterior ends because the valves contact with each other along the middle part of the ventral margin only.

External ligament is placed at the short and deeply squeezed nympha. Hinge is not very strong, devoid of laterals, with one cardinal in each valve. Vertical conoidal tooth in the hinge

of the right valve is placed close beneath the beak, with a triangular socket behind. Triangular tooth in the hinge of the left valve is more massive than that in the right valve.

Anterior adductor muscle scar is long, semilunar in outline, dotted, while the posterior one is quadrangular in outline, distant from the posterior margin. Pallial line is very distinct, parallel to, and distant from the ventral margin. Pallial sinus is triangular in outline, with its acute to rounded end placed off the end of the nympha or its midline. Ventral margin is smooth.

Remarks. — As judged from the figures given by COSSMANN and PEYROT (1909, 123—125, pl. 3: 40—41), SORGENFREI (1940, 26, pl. 4: 15), SENEŠ (1958), ANDERSON (1959, 150—152, pl. 18: 3a—b) and BÁLDI (1973, 230—231, pl. 21: 6), *P. (P.) menardi* displays a large variability in shell shape. This also is the case with the investigated specimens from Nawodzice. The morphologic varieties have earlier been treated as distinct species.

Two valves from Nawodzice are consistent with *Glycymeris* cf. *Rudolphi* (EICHWALD, 1830) figured in COSSMANN and PEYROT (1909). One specimen conforms *Panopea meynardi* DESHAYES, 1828, illustrated by SENEŠ (1958, pl. 18: 235). Still another specimen resembles the one attributed by GLIBERT (1957*a*, pl. 4: 6a) to *P. menardi*, but reinterpreted thereafter by the same author (GLIBERT and VAN de POEL 1966*a*: 28—29) as *P. angusta inflata* GOLDFUSS, 1841. However, the majority of specimens from Nawodzice combine features typical of various species. They are as low as *P. angusta* NYST, 1836; strongly widened in their anterior part as *P. menardi* (DESHAYES, 1828) or *P. kazakovae* (GLIBERT and VAN de POEL, 1966); with the pallial line resembling *P. kazakovae* in outline and the pallial sinus resembling *P. rudolphi* (EICHWALD, 1830); finally, their external surface is similar as in *P. angusta inflata*.

GLIBERT (1957*a*) evidenced on the basis of the Oligocene material the following names: *P. angusta* NYST, 1836, *P. heberti* BOSQUET in DESHAYES, 1856, and *P. menardi* DESHAYES, 1828, to have been given to successive ontogenetic stages of a single species which should be named *P. menardi*. On the other hand, GLIBERT and VAN de POEL (1966*a*) stated that *P. angusta* NYST [=*P. heberti* BOSQUET] and *P. menardi* (DESHAYES) represent two distinct species. Moreover, they divided *P. angusta* into two "stratigraphic subspecies": *P. a. angusta* characteristic for the Rupelian, and *P. a. inflata* NYST, 1841, characteristic for the Chattian. The Upper Miocene specimens described previously by GLIBERT (1945: 211—213) under the name *P. menardi* were now assigned to the new species *P. kazakovae*. To be in agreement with this opinion, one should establish a new species for the specimens from Nawodzice.

The present author, however, agrees with the earlier statement made by GLIBERT (1957*a*), as well as with the opinion of TEJKAL (1956) concerning *P. rudolphi* (EICHWALD, 1830). TEJKAL (1956) considered *Glycymeris menardi* var. *rudolphi* figured by FRIEDBERG (1934) and also the specimens from Aquitaine attributable to *P. rudolphi* to represent merely the ecotypes of *P. menardi*.

Stratigraphic range.— Late Oligocene (SENEŠ 1958) — Late Miocene (BÁLDI 1973).

Suborder **Pholadina** ADAMS and ADAMS, 1858
Superfamily **Pholadacea** LAMARCK, 1809
Family **Pholadidae** LAMARCK, 1809
Subfamily **Pholadinae** LAMARCK, 1809
Genus *Pholas* LINNÉ, 1758
Pholas sp.

Material. — Nawodzice — 1 right valve; Rybnica 1—18 fragmened valves.
Dimensions (in mm):

	L	H
MZ VIII Ml-1676	4.0	1.6

Description. — Valve is small, oval in outline, transversally elongated, inequilateral, with short, very convex, distinctly beaked anterior part. Posterior part is flattened and high. Beak is very small, partly covered by the strongly deflected dorsal margin. The latter is connected with the external surface of the valve by means of 9—11 vertical septa.

External surface is ornamented with numerous concentric lamellae variable in strength, transected by radial ribs, the latter being distinct and closely spaced at the anterior, while indistinct and rarely spaced at the posterior part of the valve. The intersection produces imbricate scales, strongly projected at the anterior part of the valve. Growth stages are indistinct.

Hinge is toothless. Very short apophysis is placed beneath the beak.

Anterior adductor muscle scar is indistinct, irregular in shape, partly placed at the dorsal extension; the posterior one is oval in outline. Pallial line is invisible.

Remarks. — The generic classification of the Pholadidae is based on their four additional plates, i.e. protoplax, mesoplax, metaplax and hypoplax, as well as on the presence/absence of apophyses and callum; the specific taxonomy, in turn, is based on the morphology of the shell itself, additional plates and siphon (TURNER 1954, 1955, 1971). The shell characteristics are shared by several pholadid species and hence, the generic identification of fossil pholadids becomes impossible when the additional plates are lacking. The investigated valve from Nawodzice cannot be assigned to any subgenus, as the shell is beaked anterioroy in both *Pholas* and *Monothyra*. The only difference between these two subgenera is in the nature of protoplax which is divided in *Pholas*, with the nucleus placed at its posterior end, while it is singular and with the central nucleus in *Monothyra*.

The valve from Nawodzice corresponds in its shape and sculpture to the specimens from Aquitaine (COSSMANN and PEYROT 1909, 58—59, pl. 1: 42—51, pl. 4: 35) identified as *Pholas desmoulinsi* BENOIST, 1877; but it differs from the latter species in shape of the apophysis which is long and somewhat deepened in *Ph. desmoulinsi*, while short and orbicular in cross-section in the specimens from Nawodzice.

Genus *Zirfaea* LEACH in GRAY, 1842

Zirfaea sp.

Material. — Rybnica 1—1 left valve.

Dimensions (in mm):

	L	H
MZ VIII Ml-1677	1.7	0.9

Description. — Valve is oval in outline, beaked anteriorly, with large, oval pedal gape, obliquely truncated at the posterior end, inequilateral, with its posterior part accounting for 75% of the valve length. Beak is entirely covered by an extension of the dorsal margin.

External surface is ornamented with lines parallel to the ventral margin, densely spaced at the anterior part of the shell, transected with fine, densely spaced radial lines. Small, transversally elongated nodules are formed at the points of intersection. The radial are very rarely spaced at the posterior part of the valve. A fragment of apophysis orbicular in cross-section is preserved beneath the beak. Oblique umbonal-ventral ridge is indistinct.

Anterior adductor muscle scar is suborbicular in outline, placed at the extension of the dorsal margin; the posterior one is large, oval-shaped, placed close behind the apophysis. Pallial lines displays a wide, shallow, rounded sinus.

Remarks. — The investigated specimen from Rybnica resembles adults of the genus *Martesia* SOWERBY, 1824, but it is different from their juvenile congeners which are similar to *Teredo* LINNÉ, 1758.

Genus *Zirlona* FINLAY, 1930
Zirlona? sp.
(pl. 18: 1a—b)

Material. — Rybnica 2—1 left valve.
Dimensions (in mm):

	L	H
MZ VIII Mł-1678	>10.0	6.5

Description. — Valve is convex, oval in outline, rounded anteriorly, inequilateral, with its posterior part accounting for 60% of the valve length. Beak is small, acute, strongly bent invards the valve. Valve is divided into two distinct areas by an oblique umbonal-ventral sulcus.

External surface is ornamented with distinct concentric lamellae, slightly crenulated at the anterior part of the valve. Radial ornamentation is lacking.

Fragment of apophysis oval in cross-section is preserved close beneath the beak. The apophysis is directed obliquely-anteriorly. Umbonal-ventral ridge is less distinct than the umbonal-ventral sulcus. Chondrophore is placed behind the beak.

Large, elongated anterior adductor muscle scar is placed at a straight anterodorsal extension; the posterior one is incompletely preserved as the valve is broken. Pallial line displays a large, rounded sinus.

Subfamily **Martesiinae** GRANT and GALE, 1931
Genus *Martesia* SOWERBY, 1824
Martesia sp.
(pl. 17: 6a—b)

Material. — Nawodzice — 2 valves; Rybnica 2—7 valves.
Dimensions (in mm):

	L	H
MZ VIII Mł-1679	7.5	7.0

Description. — Valve is globular in shape, anterodorsally and posteroventrally elongated. Beak is small, acute, hook-like, bent inwards the valve. Vertical umbonal-ventral sulcus divides the valve into two parts, the anterior of which is triangular, smaller and more convex than the posterior one. Anterior part of the valve is ornamented with densely and evenly spaced, finely imbricate, concentric lamellae transected by radial ribs. The lamellae are horizontal and distant from each other in the umbonal-ventral sulcus, while closely spaced and subparallel to the convex posterior margin at the posterior area. Complete shells bear a large pedal gape at the anterior end, while they are ajar at the posterior end. One specimen shows an initial stage of smooth callum. Anterodorsal margin is extended along its whole length.

Oval-shaped anterior adductor muscle scar is placed at a dorsal extension. Very large, oval-shaped posterior one is situated at a buttress, just behind the umbo. Umbonal-ventral ridge is very distinct.

Remarks. — The investigated specimens from Nawodzice and Rybnica resemble *Jouannetia* (*Jouannetia*) *semicaudata* DES MOULINS, 1828 in their outline and ornamentation, but they differ from it in the lack of siphonoplax and a special lamina for attachment of the posterior adductor muscle. *Jouannetia* (*Pholadopsis*) *bonneti* (DOLLFUS and DAUTZENBERG, 1899) also resembles the specimens from Rybnica and Nawodzice in its outline and ornamentation, but it is distinctive due to the pectinate margin of its siphonoplax in the right valve, as well as to the lack of apophyses.

Genus *Penitella* VALENCIENNES in ABEL du PETIT-THOUARS, 1846
Penitella sp.

Material. — Rybnica 1—1 left valve.
Dimensions (in mm):

	L	H
MZ VIII Ml-1680	1.5	1.2

Description. — Valve is oval in outline, posteroventrally elongated, with large pedal gape, inequilateral, with its posterior part accounting for 67% of the valve length. Beak is small, acute, prosogyrate. Smooth prodissoconch is not covered by short anterodorsal extension.

External surface is covered with densely spaced lamellae, slightly crenulated at the anterior part, but straight at the posterior one. Anterior part of the valve is ornamented also with wide, rounded radial ribs, distinct only near the ventral margin. Umbonal-ventral sulcus is invisible. Narrow, short apophysis is placed beneath the beak.

Small anterior adductor muscle scar is placed at the dorsal extension; the posterior one is large, oval-shaped. Pallial line is distinct, parallel to the anterior and ventral margins, with a large, triangular sinus. Umbonal-ventral ridge is distinct.

Remarks. — The shape and ornamentation of the specimen from Rybnica corresponds to the immature shell of *Penitella conradi* HABE, 1952, figured by TURNER in MOORE (1969, N724, fig. E186—4a—b).

Subfamily **Jouannetiinae** TRYON, 1862
Genus *Jouannetia* DES MOULINS, 1828
Subgenus *Jouannetia* (*Jouannetia*) DES MOULINS, 1828
Jouannetia (*Jouannetia*) *semicaudata* DES MOULINS, 1828
(pl. 17: 5a—c)

1909. *Jouannetia semicaudata* DES MOUL.; COSSMANN and PEYROT, 68—71, pl. 2: 25—29.
1934. *Jouannetia semicaudata* des MOUL.; FRIEDBERG, 6—7, pl. 1: 12—15.
1969. *Jouannetia* (*Jouannetia*) *semicaudata* DES MOULINS; TURNER in MOORE, N719, fig. E191 1a—h.

Material. — Nawodzice — 2 valves; Rybnica 1—65 valves; Rybnica 2—4 valves.
Dimensions (in mm):

	L	H
MZ VIII Ml-1681	2.6	3.5

Remarks. — The specimens of *J.* (*J.*) *semicaudata* from Nawodzice and Rybnica are entirely consistent with the descriptions and figures referred to in the synonymy.

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1909) — Middle Miocene (FRIEDBERG 1934).

Subclass **Anomalodesmata** DALL, 1889
Order **Pholadomyoida** NEWELL, 1965
Superfamily **Pandoracea** RAFINESQUE, 1815
Family **Thraciidae** STOLICZKA, 1870
Genus *Thracia* SOWERBY, 1823
Subgenus *Thracia* (*Thracia*) SOWERBY, 1823
Thracia (*Thracia*) *ventricosa* PHILIPPI, 1844
(pl. 16: 5, pl. 18: 5)

1850. *Thracia ventricosa*, PHILIPPI; WOOD, 262, pl. 26: 5a—c.
1909. *Thracia convexa* W. WOOD, sp.; CERULLI-IRELLI, 187—188, pl. 22: 4—11.

1934. *Thracia ventricosa* PHIL.; FRIEDBERG, 14—15, pl. 2: 5—7.
1940. *Thracia ventricosa* PHIL.; SORGENFREI, 26—27, pl. 4: 16.
1945. *Thracia ventricosa* PHILIPPI, sp. 1844; GLIBERT, 219, pl. 3: 7.
1957*a*. *Thracia ventricosa* PHILIPPI, 1843; GLIBERT, 47, pl. 4: 3a—c.
1959. *Thracia* (*Thracia*) *ventricosa* PHILIPPI 1844; ANDERSON, 158—159, pl. 18: 9.
1966*a*. *Thracia speyeri* KOENEN in SPEYER; GLIBERT and VAN de POEL, 7.
1968. *Thracia ventricosa* PHILIPPI; KRACH, 486—487, pl. 1: 4—6.
1973. *Thracia ventricosa* PHILIPPI; BÁLDI, 273, pl. 22: 4.

Material. — Rybnica 2—13 shells, 1 valve.
Dimensions (in mm):

	L	H
MZ VIII MI-1682/$_1$	60.0	40.0
MZ VIII MI-1682/$_2$	16.0	6.5

Remarks. — The considered specimens from Rybnica are hardly identifiable due their poor preservation state as well as due to their variability in shell outline and convexity. Some specimens are consistent with those from Anvers identified by GLIBERT (1945) as *T. ventricosa*; others are indistinguishable from the Oligocene *T. ventricosa* from Houthaelen which, according to GLIBERT (1957*a*, pl. 4: 3b), corresponds to *T. speyeri* KOENEN, 1884; still others are consistent with *T. convexa* WOOD, 1815 (CERULLI-IRELLI 1909, pl. 22: 4, 7). CERULLI-IRELLI (1909) considered *T. ventricosa* to be one of the five morphologic varieties he recognized among forms attributable to *T. convexa*. In contrast, GLIBERT and VAN de POEL (1966*a*: 7) distinguished between *T. ventricosa* and *T. convexa* because the shell of the latter is much higher than the shell of the former, its ventral margin being more bent in the anterior part and more concave in the posterior one.

The taxonomic problems associated with *T. ventricosa* can be resolved only after biometrical investigations. ALLEN's (1961) study of the Recent material made it clear that the best diagnostic feature for various species of the subgenus *Thracia* is the lateral outline of the shell. Unfortunately, the investigated shells from Rybnica are crushed by compaction and hence any measurements could not be made.

Sometimes, taxonomic problems are created by paleontologists themselves. The English Miocene specimens described by WOOD (1850) under the name *T. ventricosa* have been, according to GLIBERT (1945) indistinguishable from *T. ventricosa* from Anvers. Nevertheless, GLIBERT and VAN de POEL (1966) attributed them to *T. inflata* SOWERBY, 1845. Similarly, the Oligocene specimens ascribed by GLIBERT (1957*a*) to *T. ventricosa* have been later transferred by GLIBERT and VAN de POEL (1966*b*) to *T. speyeri*. GLIBERT and VAN de POEL (1966*b*) claimed also that the Oligocene form *T. speyeri* is the ancestor of the Miocene species *T. inflata* which, in turn, should be considered as the common ancestor of *T. convexa* from the Pliocene, as well as *T. ventricosa* from the Pleistocene.

Stratigraphic range. — Late Oligocene (BÁLDI 1973) — Late Pliocene (SACCO 1901).

Genus *Asthenothaerus* CARPENTER, 1864

Asthenothaerus desmoulinsi (COSSMANN and PEYROT, 1909)

(pl. 16: 4a—b)

1909. *Thracia Desmoulinsi* BEN. in coll.; COSSMANN and PEYROT, 41—42, pl. 1: 30—39.
1966*a*. *Thracia desmoulinsi* BENOIST mss in COSSMANN and PEYROT, 1909; GLIBERT and VAN de POEL, 4—5.

Material. — Nawodzice — 2 valves.

Dimensions (in mm):

	L	H
MZ VIII Ml-1683	1.5	1.2

Description. — Valve is small, subtrigonal in outline, weakly convex, with the anterior part rounded and the posterior one cut vertically and somewhat ajar, inequilateral, with its posterior part accounting for 34% of the valve length. Long, slightly convex anterodorsal margin gently passes into the short, convex anterior margin. Concave posterodorsal margin connects angularly with the straight, vertical posterior margin which, in turn, angularly connects with the straight, horizontal ventral margin. Small, opisthogyrate beak does not project above the dorsal margin. Faint ridge runs from the beak posteroventrally.

External surface is finely granulated. Growth stages are indistinct.

Hinge margin is toothless. A short slate (in front of the beak at the left valve) or two (to the both sides of the beak at the right valve), parallel to the dorsal margin, are present near the beak. Their function is to support the internal ligament. Anterior adductor muscle scar is bean-shaped, smaller than the suborbicular posterior one. Pallial line is distinct, unevenly distant from the smooth ventral margin. Pallial sinus is large and rounded, its axis being horizontal.

Remarks. — The characteristic feature of the genus *Asthenothaerus* is the absence of chondrophore from its hinge, which makes it different from *Thracia* SOWERBY, 1823.

The specimens from Nawodzice are almost entirely consistent with the Lower Miocene *Thracia desmoulinsi* presented by COSSMANN and PEYROT (1909), the only difference being in ornamentation of the posterior part of the shell which is devoid of granulation in the latter species; instead, it is covered with fine, horizontal wrinkles.

The species *Asthenothaerus desmoulinsi* has previously not been mentioned from the Polish Miocene.

Stratigraphic range. — Early Miocene (COSSMANN and PEYROT 1909) — Middle Miocene (this paper).

Superfamily **Clavagellacea** d'ORBIGNY, 1844
Family **Clavagellidae** d'ORBIGNY, 1844
Genus *Clavagella* LAMARCK, 1818
Clavagella sp.
(pl. 15: 15)

Material — Nawodzice — 14 siphonal collars; Rybnica 1—15 siphonal collars; Rybnica 2—4 siphonal collars;

Dimensions (in mm):

MZ VIII-Ml 1684 height 34.0 max. diameter 16.0

Remarks. — Only a series of siphonal collars have been found. They were placed around the distal extremity of the siphonal tube in adult individuals (SAVAZZI 1982: 85, text-fig. 1A).

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EXPLANATION OF PLATES 1—18

PLATE 1

Nucula (*Nucula*) *nucleus* (LINNÉ)

1. Right valve (MZ VIII Ml—1584/$_1$): a interior, b. exterior. Rybnica 2; ×4.

Nucula (*Nucula*) *nitidosa* WINCKWORTH

3. Left valve (MZ VIII Ml—1585/$_1$): *a* exterior, *b* interior. Rybnica 2; ×4.

Nuculana (*Saccella*) *fragilis* (CHEMNITZ)

2. Left valve (MZ VIII Ml—1586/$_3$): *a* exterior, *b* interior. Rybnica 2; × 3.
5. Dorsal view of the shell (MZ VIII Ml—1586/$_4$); Rybnica 2; ×3.

7. Right valve, exterior (MZ VIII Ml—1586/$_1$); Rybnica 2; ×3.
8. Left valve, exterior (MZ VIII Ml—1586/$_2$); Rybnica 2; ×3.
9. Left valve, exterior (MZ VIII Ml—1586/$_5$); Rybnica 2; ×3.
10. Left valve, exterior (MZ VIII Ml—1586/$_6$); Rybnica 2; ×3.

Barbatia (*Barbatia*) *barbata* (LINNÉ)

4. Left valve, exterior (MZ VIII Ml—1587/$_3$); Rybnica 2; ×2.
6. Left valve, exterior (MZ VIII Ml—1587/$_2$); Rybnica 1; ×2.
11. Left valve, exterior (MZ VIII Ml—1587/$_4$); Rybnica 2; ×3.
12. Left valve (MZ VIII Ml—1587/$_1$): *a* interior, *b* exterior. Rybnica 2; ×1.

PLATE 2

Barbatia (*Barbatia*) *polymorpha* (MAYER)

1. Right valve (MZ VIII Ml—1588/$_1$): *a* exterior, *b* interior. Rybnica 2; ×4.

Barbatia (*Acar*) *clathrata* (DEFRANCE)

2. Right valve, exterior (MZ VIII Ml—1589/$_2$); Rybnica 1; ×8.
3. Left valve (MZ VIII Ml—1589/$_1$): *a* interior, *b*, exterior. Rybnica 1; ×8.

Barbatia (*Calloarca*) *modioliformis* (DESHAYES)

4. Left valve (MZ VIII Ml—1591/$_1$): *a* interior, *b* exterior; Rybnica 2; ×4.

Anadara (*Anadara*) *diluvii* (LAMARCK)

5. Right valve (MZ VIII Ml—1592/$_1$): *a* exterior, *b* interior; Nawodzice; ×8.

Striarca lactea (LINNÉ)

6. Right valve (MZ VIII Ml/1593/$_2$): *a* exterior, *b* interior. Rybnica 2; ×3.
8. Right valve (MZ VIII Ml—1593/$_1$): *a* exterior, *b* interior; Rybnica 2; ×3.

Glycymeris (*Glycymeris*) *deshayesi* (MAYER)

7. Right valve, interior (MZ VIII Ml—1594/$_1$); Rybnica 2; ×1.
9. Left valve (MZ VIII Ml—1594/$_{16}$): *a* exterior, *b* interior. Rybnica 2; ×1.
10. Left valve, exterior (MZ VIII Ml—1594/$_{21}$); Rybnica 1; ×1.

PLATE 3

Barbatia (*Acar*) *bohemica* (REUSS)

1. Left valve (MZ VIII Ml—1590/$_1$): *a* interior, *b* exterior. Rybnica 2; ×4.

Musculus (*Musculus*) *biformis* (REUSS)

3. Right valve (MZ VIII Ml—1597/1): *a* exterior, ×6; *b* interior, Rybnica 2; ×8.

Gregariella coralliophaga (CHEMNITZ)

5. Left valve (MZ Ml—1598/1): *a* interior, *b* exterior. Rybnica 2; ×4.

Modiolula phaseolina (PHILIPPI)

2. Left valve, exterior (MZ VIII Ml—1599/1); Rybnica 2; ×3.
6. Right valve (MZ VIII Ml—1599/2): *a* exterior, *b* interior. Rybnica 2; ×3.
7. Right valve (MZ VIII Ml—1599/3): *a* exterior, *b* interior. Rybnica 2; ×8.

Modiolula volhynica (EICHWALD)

8. Left valve (MZ VIII Ml—1600/1): *a* interior, *b* exterior. Rybnica 1; ×8.

Pecten (*Flabellipecten*) *subarcuatus* TORNQUËR

4. Left valve (MZ VIII Ml—1608/1): *a* exterior, *b* interior. Rybnica 1; ×4.

Chlamys (*Aequipecten*) *scabrella* (LAMARCK)

9. Right valve, exterior (MZ VIII Ml—1604/6); Rybnica 1; ×5.

PLATE 4

Chlamys (*Aequipecten*) *scabrella* (LAMARCK)

1. Left valve (MZ VIII Ml—1604/3): *a* exterior, *b* interior. Rybnica 1; ×1.5.
2. Right valve (MZ VIII Ml—1604/4): *a* exterior, *b* interior. Rybnica 2; ×1.5.
3. Right valve (MZ VIII Ml—1604/5): *a* exterior, ×1; *b* detail of the external surface, Rybnica 2; ×2.5.
4. Right valve (MZ VIII Ml—1604/2): *a* exterior, ×1; *b* detail of the external surface; Rybnica 2; ×2.5.
6. Right valve (MZ VIII Ml—1604/1): *a* exterior; ×1; *b* detail of the external surface, Rybnica 2; ×2.5.

Chlamys (*Aequipecten*) *malvinae* (du BOIS)

5. Left valve, exterior (MZ VIII Ml—1603/3): Rybnica 2; ×4.
7. Right valve, exterior (MZ VIII Ml—1603/2); Rybnica 2; ×4.
10. Right valve (MZ VIII Ml—1603/1): *a* exterior; *b* interior. Rybnica 2; ×3.

Chlamys (*Flexopecten*) *scissa* (FAVRE)

8. Right valve, exterior (MZ VIII Ml—1606/3); Świniary; ×1.
9. Right valve, exterior (MZ VIII Ml—1606/5); Rybnica 2; ×3.

Chlamys (*Aequipecten*) aff. *zenonis* COWPER-REED

11. Left valve, exterior (MZ VIII Ml—1605/1); Rybnica 1; ×4.

PLATE 5

Chlamys (*Flexopecten*) *scissa* (FAVRE)

1. Left valve (MZ VIII Mł—1606/$_{10}$): *a* exterior, *b* interior. Rybnica 2; ×4.
2. Right valve, exterior (MZ VIII Mł—1606/$_{7}$); Rybnica 1; ×3.
3. Right valve, exterior (MZ VIII Mł—1606/$_{1}$); Świniary; ×1.
4. Right valve, exterior (MZ VIII Mł—1606/$_{9}$); Świniary; ×3.
5. Right valve (MZ VIII Mł—1606/$_{6}$): *a* exterior; *b* interior. Rybnica 1; ×3.
6. Left valve, exterior (MZ VIII Mł—1606/$_{8}$); Rybnica 2; ×3.
7. Right valve, exterior (MZ VIII Mł—1606/$_{2}$); Świniary; ×1.
8. Right valve, exterior (MZ VIII Mł—1606/$_{11}$); Rybnica 2; ×4.
9. Left valve, exterior (MZ VIII Mł—1606/$_{12}$); Rybnica 2; ×4.
10. Left valve, exterior (MZ VIII Mł—1606/$_{13}$); Rybnica 2; ×4.

PLATE 6

Chlamys (*Flexopecten*) *scissa* (FAVRE)

1. Right valve, exterior (MZ VIII Mł—1606/$_{16}$); Rybnica 2; ×8.
2. Right valve, exterior (MZ VIII Mł—1606/$_{14}$); Rybnica 2; ×8.
5. Right valve, exterior (MZ VIII Mł—1606/$_{15}$); Rybnica 2; ×8.
6. Left valve, exterior (MZ VIII Mł—1606/$_{17}$); Rybnica 2; ×8.
9. Left valve, exterior (MZ VIII Mł—1606/$_{18}$); Rybnica 2; ×8.
10. Left valve, exterior (MZ VIII Mł—1606/$_{4}$); Świniary; ×1.

Pododesmus (*Heteranomia*) *squamulus* (LINNÉ)

3. Right valve, exterior (MZ VIII Mł—1610/$_{3}$); Rybnica 2; ×4.
4. Left valve, exterior (MZ VIII Mł—1610/$_{2}$); Rybnica 2; ×4.
7. Left valve, exterior (MZ VIII Mł—1610/$_{1}$); Rybnica 2; ×4.

Pododesmus (*Monia*) *squamus* (GMELIN)

8. Left valve (MZ VIII Mł—1611/$_{1}$): *a* exterior; *b* interior. Rybnica 2; ×2.

Cerullia ovoides (CERULLI-IRELLI)

11. Right valve (MZ VIII Mł—1626/$_{1}$): *a* exterior; *b* interior. Nawodzice; ×12.

PLATE 7

Plicatula (*Plicatula*) *striata* DEFRANCE

1. Left valve (MZ VIII Mł—1609/$_{1}$): *a* interior; *b* exterior. Rybnica 1; ×3.
4. Left valve, interior (MZ VIII Mł—1609/$_{2}$); Rybnica 1; ×8.

Cubitostrea digitalina (EICHWALD)

2. Right valve, exterior (MZ VIII Mł—1613/$_{2}$); Nawodzice; ×1.
3. Left valve, exterior (MZ VIII Mł—1613/$_{1}$); Nawodzice; ×1.

Neopycnodonte navicularis (BROCCHI)

5. Left valve, exterior (MZ VIII Ml—1612/1); Rybnica 1; ×1.
6. Left valve (MZ VIII Ml—1612/2): *a* exterior; *b* interior. Rybnica 2; ×1.

Ctena (*Ctena*) *decussata* (da COSTA)

7. Left valve (MZ VIII Ml—1614/2): *a* interior; *b* exterior. Rybnica 2; ×5.
9. Right valve (MZ VIII Ml—1614/1): *a* exterior; *b* interior. Rybnica 2; ×5.

Montacuta substriata (MONTAGU)

8. Right valve (MZ VIII Ml—1625/1): *a* exterior; *b* interior. Rybnica 2; ×8.

Thyasira (*Thyasira*) *flexuosa* (MONTAGU)

10. Left valve (MZ VIII Ml—1620/1): *a* interior; *b* exterior. Rybnica 2; ×4.

PLATE 8

Pododesmus (*Monia*) *squamus* (GMELIN)

1. Left valve, exterior (MZ VIII Ml—1611/3); Rybnica 2; ×3.
4. Left valve, exterior (MZ VIII Ml—1611/2); Rybnica 2; ×3.

Parvilucina (*Microloripes*) *dentata* (DEFRANCE)

2. Left valve (MZ VIII Ml—1615/1): *a* interior; *b* exterior. Rybnica 2; ×3.
3. Right valve, interior (MZ VIII Ml—1615/3); Rybnica 2; ×3.
5. Right valve, exterior (MZ VIII Ml—1615/2); Rybnica 2; ×4.
6. Right valve (MZ VIII Ml—1615/4): *a* exterior; *b* interior. Rybnica 2; ×8.

Myrtea (*Myrtea*) *spinifera* (MONTAGU)

7. Left valve (MZ VIII Ml—1616/1): *a* interior; *b* exterior. Rybnica 2; ×4.

Chama (*Psilopus*) *gryphoides* LINNÉ

8. Right valve (MZ VIII Ml—1621/4): *a* interior; *b* exterior. Rybnica 2; ×5.
9. Left valve, interior (MZ VIII Ml—1621/1); Rybnica 2; ×2.

Lucinoma borealis (LINNÉ)

10. Left valve, exterior (MZ VIII Ml—1617/3); Rybnica 2; ×1.
11. Right valve (MZ VIII Ml—1617/1): *a* exterior; *b* interior. Rybnica 2; ×1.
12. Left valve, interior (MZ VIII Ml—1617/4); Rybnica 2; ×2.
13. Left valve, exterior (MZ VIII Ml—1617/2); Rybnica 2; ×1.

PLATE 9

Chama (*Psilopus*) *gryphoides* LINNÉ

1. Left valve (MZ VIII Ml—1621/$_2$): *a* interior; *b* exterior. Rybnica 1; ×4.
2. Right valve (MZ VIII Ml—1621/$_3$): *a* exterior; *b* interior. Rybnica 2; ×5.

Bornia (*Bornia*) *deltoidea* (WOOD)

3. Left valve (MZ VIII Ml—1623/$_1$): *a* interior; *b* exterior. Rybnica 2; ×4.

Montilora (*Montilora*) *elegans* (DEFRANCE)

4. Right valve (MZ VIII Ml—1618/$_1$): *a* exterior; *b* interior. Rybnica 2; ×6.

Cyclocardia (*Scalaricardita*) *scalaris* (SOWERBY)

5. Right valve (MZ VIII Ml—1627/$_9$): *a* exterior; *b* interior. Rybnica 2; ×2.
6. Left valve (MZ VIII Ml—1627/$_1$): *a* interior; *b* exterior. Rybnica 2; ×2.

Lasaeokellya cestasensis (COSSMANN and PEYROT)

7. Right valve (MZ VIII Ml—1624/$_1$): *a* exterior; *b* interior. Rybnica 1; ×8.
8. Left valve, exterior (MZ VIII Ml—1624/$_2$); Nawodzice; ×12.

Tridonta (*Nicania*) *waeli* (GLIBERT)

9. Right valve (MZ VIII Ml—1629/$_2$): *a* exterior; *b* interior. Rybnica 1; ×8.
10. Left valve (MZ VIII Ml—1629/$_1$): *a* interior; *b* exterior. Rybnica 1; ×8.

Gastrochaena (*Gastrochaena*) *lata* DOLLFUS and DAUTZENBERG

11. Right valve (MZ VIII Ml—1673/$_1$): *a* exterior; *b* interior. Rybnica 2; ×6.
12. Left valve (MZ VIII Ml—1673/$_2$): *a* interior; *b* exterior. Rybnica 2; ×6.

PLATE 10

Acanthocardia (*Acanthocardia*) *paucicostata* (SOWERBY)

1. Left valve (MZ VIII Ml—1631/$_2$): *a* exterior; *b* interior. Nawodzice; ×4.
2. Right valve (MZ VIII Ml—1631/$_7$): *a* interior; *b* exterior. Rybnica 2; ×3.

Parvicardium minimum (PHILIPPI)

3. Right valve (MZ VIII Ml—1633/$_1$): *a* interior; *b* exterior. Rybnica 2; ×8.
5. Left valve, exterior (MZ VIII Ml—1633/$_2$); Rybnica 2; ×8.

Acanthocardia (*Acanthocardia*) *turonica* (HÖRNES)

5. Left valve, exterior (MZ VIII Ml—1632/$_2$); Rybnica 2; ×1.
6. Right valve (MZ VIII Ml—1632/$_5$): *a* exterior; *b* interior. Rybnica 2; ×6.

7. Right valve, exterior (MZ VIII Ml—1632/3); Rybnica 2; ×1.
8. Left valve (MZ VIII Ml—1632/4): *a* interior; *b* exterior. Rybnica 2; ×6.
9. Right valve, exterior (MZ VIII Ml—1632/1); Nawodzice, ×1.

PLATE 11

Laevicardium (*Laevicardium*) *dingdense* (LEHMANN)

1. Left valve (MZ VIII Ml—1635/3): *a* interior; *b* exterior. Rybnica 2; ×1.
2. Right valve, exterior (MZ VIII Ml—1635/2); Rybnica 2; ×1.
3. Right valve, exterior (MZ VIII Ml—1635/4); Rybnica 2; ×6.
4. Right valve (MZ VIII Ml—1635/1): *a* exterior; *b* interior. Rybnica 2; ×1.
5. Left valve, exterior (MZ VIII Ml—1635/5); Rybnica 2; ×5.
6. Left valve, exterior (MZ VIII Ml—1635/6); Rybnica 2; ×12.

Plagiocardium (*Papillicardium*) *sonense* (COSSMANN)

7. Right valve (MZ VIII Ml—1634/3): *a* exterior; *b* interior. Rybnica 1; ×8.
8. Left valve, exterior (MZ VIII Ml—1634/5); Rybnica 1; ×20.
9. Left valve, exterior (MZ VIII Ml—1634/1); Rybnica 1; ×4.
10. Left valve, interior (MZ VIII Ml—1634/2); Rybnica 1; ×5.
11. Left valve, exterior (MZ VIII Ml—1634/4); Rybnica 1; ×8.

Cerastoderma obsoleta (EICHWALD)

12. Right valve (MZ VIII Ml—1636/3): *a* exterior; *b* interior. Rybnica 1; ×8.
13. Right valve, exterior (MZ VIII Ml—1636/1); Rybnica 2; ×4.
14. Right valve, exterior (MZ VIII Ml—1636/4); Rybnica 2; ×15.
15. Left valve (MZ VIII Ml—1636/2): *a* interior; *b* exterior. Rybnica 2; ×8.

PLATE 12

Cerastoderma praeplicata (HILBER)

1. Right valve (MZ VIII Ml—1637/1): *a* interior; *b* exterior. Rybnica 2; ×3.
2. Left valve (MZ VIII Ml—1637/4): *a* interior, ×4; *b* exterior, ×3. Rybnica 2.
3. Left valve, exterior (MZ VIII Ml—1637/6); Nawodzice; ×8.
4. Left valve, exterior (MZ VIII Ml—1637/5); Nawodzice; ×3.
5. Right valve, exterior (MZ VIII Ml—1637/3); Rybnica 2; ×3.

Cerastoderma plicata (EICHWALD)

6. Left valve (MZ VIII Ml—1638/1): *a* interior; *b* exterior. Nawodzice; ×12.

Mactra (*Sarmatimactra*) *eichwaldi* LASKAREW

7. Left valve (MZ VIII Ml—1639/2): *a* exterior; *b* interior. Rybnica 2; ×2.5.
8. Right valve (MZ VIII Ml—1639/1): *a* interior; *b* exterior. Rybnica 2; ×2.

Lutraria (*Lutraria*) *lutraria* (LINNÉ)

9. Left valve (MZ VIII Ml—1640/1): *a* exterior; *b* interior. Rybnica 2; ×1.
10. Fragment of the right valve, interior (MZ VIII Ml—1640/2); Rybnica 2; ×1.

Ensis ensis (LINNÉ)

11. Left valve, exterior (MZ VIII Ml—1645/1); Rybnica 1; ×1.

Eastonia rugosa (HELBLING)

12. Fragment of the right valve (MZ VIII Ml—1641/1): *a* exterior; *b* interior. Rybnica 2; ×2.

Cultellus (*Cultellus*) *tenuis* (PHILIPPI)

13. Left valve, exterior (MZ VIII Ml—1644/1); Rybnica 2; ×2.

PLATE 13

Donax (*Paradonax*) *transversa* DESHAYES

1. Left valve, exterior (MZ VIII Ml—1651/4); Rybnica 2; ×4.
2. Right valve, exterior (MZ VIII Ml—1651/3); Rybnica 2; ×4.
4. Right valve (MZ VIII Ml—1651/1): *a* interior; *b* exterior. Rybnica 2; ×4.
6. Left valve, exterior (MZ VIII Ml—1651/2); Rybnica 2; ×4.
7. Left valve, interior (MZ VIII Ml—1651/5); Rybnica 2; ×7.

Tellina (*Moerella*) *donacina* LINNÉ

3. Left valve (MZ VIII Ml—1647/2): *a* exterior; *b* interior. Nawodzice; ×8.
5. Right valve (MZ VIII Ml—1647/1): *a* interior; *b* exterior. Nawodzice; ×8.

Ervilia podolica (EICHWALD)

8. Right valve, exterior (MZ VIII Ml—1642/6); Rybnica 1; ×4.
9. Right valve, interior (MZ VIII Ml—1642/4); Rybnica 1; ×4.
10. Right valve, exterior (MZ VIII Ml—1642/3); Rybnica 1; ×4.
12. Left valve (MZ VIII Ml—1642/1): *a* exterior; *b* interior. Rybnica 2; ×3.
14. Right valve (MZ VIII Ml—1642/2): *a* interior; *b* exterior. Rybnica 1; ×4.

Ervilia pusilla (PHILIPPI)

11. Left valve (MZ VIII Ml—1643/1): *a* exterior; *b* interior. Rybnica 2; ×3.
13. Right valve (MZ VIII Ml—1643/2): *a* interior; *b* exterior. Rybnica 2; ×3.

Donax (*Paradonax*) *intermedia* HÖRNES

15. Right valve, exterior (MZ VIII Ml—1652/3): Nawodzice; ×12.
16. Right valve (MZ VIII Ml—1652/1): *a* interior; *b* exterior. Rybnica 2; ×4.
17. Left valve, interior (MZ VIII Ml—1652/2); Rybnica 2; ×8.

Alveinus nitidus (REUSS)

18. Left valve (MZ VIII Ml—1656/2): *a* exterior; *b* interior. Nawodzice; ×12.
19. Right valve (MZ VIII Ml—1656/1): *a* interior; *b* exterior. Nawodzice; ×12.

PLATE 14

Cultellus (*Cultellus*) *tenuis* (PHILIPPI)

1. Fragment of the left valve (MZ VIII Ml—1644/2): *a* exterior; *b* interior. Rybnica 2; ×4.

Gastrana fragilis (LINNÉ)

2. Right valve (MZ VIII Ml—1650/3): *a* interior; *b* exterior. Rybnica 2; ×2.

Tellina (*Oudardia*) *compressa* BROCCHI

3. Right valve (MZ VIII Ml—1648/1): *a* interior; *b* exterior. Nawodzice; ×2.

Congeria sandbergeri ANDRUSSOV

4. Right valve (MZ VIII Ml—1655/2): *a* exterior; *b* interior. Nawodzice; ×4.
5. Left valve (MZ VIII Ml—1655/1): *a* interior; *b* exterior. Nawodzice; ×4.

Coralliophaga (*Coralliophaga*) *lithophagella* (LAMARCK)

6. Left valve (MZ VIII Ml—1657/1): *a* exterior; *b* interior. Rybnica 2; ×3.

Gouldia (*Gouldia*) *minima* (MONTAGU)

7. Left valve (MZ VIII Ml—1663/1): *a* exterior; *b* interior. Rybnica 2; ×8.

Venus (*Ventricoloidea*) *libella* de RAYNEVAL, VAN den HECKE and PONZI

8. Right valve (MZ VIII Ml—1661/1): *a* exterior, ×4; *b* interior, ×5; Nawodzice.
9. Left valve (MZ VIII Ml—1661/2): *a* interior; *b* exterior. Nawodzice; ×8.

Glossus (*Glossus*) *humanus* (LINNÉ)

10. Anterior view of the shell (MZ VIII Ml—1659/1); Rybnica 1; ×1.
11. Right valve (MZ VIII Ml—1659/2): *a* exterior; *b* interior. Rybnica 2; ×1.

PLATE 15

Gastrana fragilis (LINNÉ)

1. Left valve (MZ VIII Ml—1650/1): *a* interior; *b* exterior. Rybnica 2; ×1.
2. Left valve, exterior (MZ VIII Ml—1650/2); Nawodzice; ×2.

Venus (*Ventricoloidea*) *multilamella* (LAMARCK)

3. Right valve, exterior (MZ VIII Ml—1660/6); Rybnica 2; ×1.
4. Right valve (MZ VIII Ml—1660/4): *a* exterior; *b* interior. Rybnica 2; ×1.
5. Shell (MZ VIII Ml—1660/1): *a* left side view; *b* dorsal view. Rybnica 2; ×1.
6. Left valve (MZ VIII Ml—1660/5): *a* interior; *b* exterior. Rybnica 2; ×1.
7. Right valve, exterior (MZ VIII Ml—1660/3); Rybnica 2; ×1.
8. Left valve, exterior (MZ VIII Ml—1660/2); Rybnica: 2; ×1.

Pitar (*Pitar*) *rudis* POLI

9. Right valve (MZ VIII Ml—1664/2): *a* exterior; *b* interior. Rybnica 2; ×4.
11. Left valve (MZ VIII Ml—1664/1): *a* interior; *b* exterior. Rybnica 2; ×2.

Hiatella (*Hiatella*) *arctica* (LINNÉ)

10. Right valve (MZ VIII Ml—1674/2): *a* exterior; *b* interior. Rybnica 2; ×3.
12. Right valve (MZ VIII Ml—1674/1): *a* exterior; *b* interior. Rybnica 2; ×2.

Callista (*Callista*) *cobrina* (CONRAD)

13. Left valve (MZ VIII Ml—1666/2): *a* interior; *b* exterior. Rybnica 2; ×4.
14. Right valve, interior (MZ VIII Ml—1666/1); Rybnica 2; ×4.

Clavagella sp.

15. Siphonal collar (MZ VIII Ml—1684/1); Nawodzice; ×1.

PLATE 16

Circomphalus subplicatus (d'ORBIGNY)

1. Right valve, exterior (MZ VIII Ml—1662/1); Rybnica 1; ×1.
2. Right valve, interior (MZ VIII Ml—1662/8); Rybnica 1; ×1.
3. Right valve (MZ VIII Ml—1662/7): *a* exterior; *b* interior. Rybnica 2; ×2.
6. Left valve, interior (MZ VIII Ml—1662/4); Nawodzice; ×1.
7. Right valve, exterior (MZ VIII Ml—1662/6); Nawodzice; ×1.
8. Right valve, exterior (MZ VIII Ml—1662/2); Rybnica 2; ×1.
9. Left valve, exterior (MZ VIII Ml—1662/9); Rybnica 2; ×2.

Asthenothaerus desmoulinsi (COSSMANN and PEYROT)

4. Left valve (MZ VIII Ml—1683/1): *a* exterior; *b* interior. Nawodzice; ×12.

Thradia (*Thracia*) *ventricosa* PHILIPPI

5. Shell, view from the right valve (MZ VIII Ml—1682/1); Rybnica 2; ×1.

Timoclea (*Timoclea*) *sobieskii* (HILBER)

10. Left valve (MZ VIII Ml—1670/2): *a* interior; *b* exterior. Nawodzice; ×12.
12. Right valve (MZ VIII Ml—1670/1): *a* exterior; *b* interior. Rybnica 1; ×12.

Callista (*Callista*) *italica* (DEFRANCE)

11. Dorsal view of the shell (MZ VIII Ml—1665/3); Nawodzice; ×1.

Corbula (*Varicorbula*) *gibba* (OLIVI)

13. Left valve (MZ VIII Ml—1672/1): *a* exterior; *b* interior. Rybnica 2; ×4.
14. Right valve, interior (MZ VIII Ml—1672/3); Rybnica 2; ×3.
15. Shell, view from the right valve (MZ VIII Ml—1672/4); Rybnica 2; ×4.

PLATE 17

Tapes (*Tapes*) *vitalianus* (d'ORBIGNY)

1. Left valve (MZ VIII Ml—1668/1): *a* exterior, ×6; *b* interior, ×5. Nawodzice.
4. Right valve, exterior (MZ VIII Ml—1668/2); Nawodzice; ×12.

Irus (*Irus*) *irus* (LINNÉ)

2. Left valve (MZ VIII Ml—1669/1): *a* exterior, ×6; *b* interior, ×5. Nawodzice.
3. Left valve (MZ VIII Ml—1669/2): *a* exterior, ×6; *b* interior, ×5. Rybnica 2.

Jouannetia (*Jouannetia*) *semicaudata* des MOULINS

5. Right valve (MZ VIII Ml—1681/1): *a* exterior; *b* interior; *c* — exterior. Rybnica 1; ×8.

Martesia sp.

6. Left valve (MZ VIII Ml—1679/1): *a* interior; *b* exterior. Rybnica 2; ×4.

Panopea (*Panopea*) *menardi* (DESHAYES)

7. Dorsal view of the shell (MZ VIII Ml—1675/2); Nawodzice; ×1.

Callista (*Callista*) *italica* (DEFRANCE)

8. Left valve, interior (MZ VIII Ml—1665/2); Nawodzice; ×1.
9. Right valve (MZ VIII Ml—1665/1): *a* exterior; *b* interior. Rybnica 2; ×1.

PLATE 18

Zirlona? sp.

1. Left valve (MZ VIII Ml—1678/1): *a* interior; *b* exterior. Rybnica 2; ×3.

Corbula (*Varicorbula*) *gibba* (OLIVI)

2. Right valve, exterior (MZ VIII Ml—1672/6); Nawodzice; ×4.
3. Left valve, exterior (MZ VIII Ml—1672/5); Nawodzice; ×4.

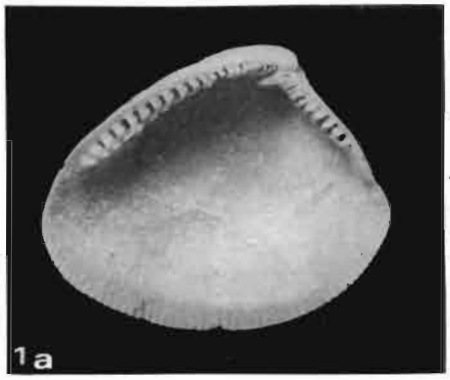
6. Shell, view from the left valve (MZ VIII Ml—1672/4); Rybnica 2; ×4.
8. Right valve, exterior (MZ VIII Ml—1672/2); Rybnica 2; ×4.
10. Right valve, exterior (MZ VIII Ml—1672/3); Rybnica 2; ×4.

Thracia (*Thracia*) *ventricosa* PHILIPPI

5. Shell, view from the right valve (MZ VIII Ml—1682/2); Rybnica 2; ×2.

Panopea (*Panopea*) *menardi* (DESHAYES)

4. Right valve, interior (MZ VIII Ml—1675/3); Nawodzice; ×1.
7. Left valve, interior (MZ VIII Ml—1675/1); Nawodzice; ×1.
9. Shell, view from the left valve (MZ VIII Ml—1675/4); Nawodzice; ×1.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1b

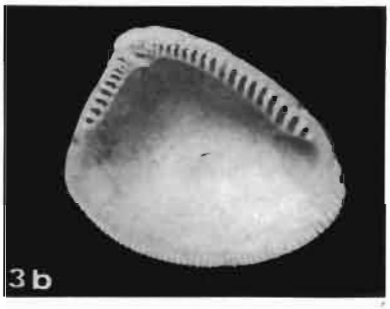

2a


2b


3a


4


5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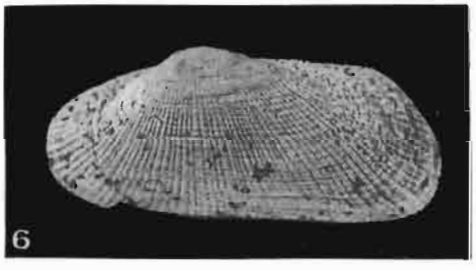
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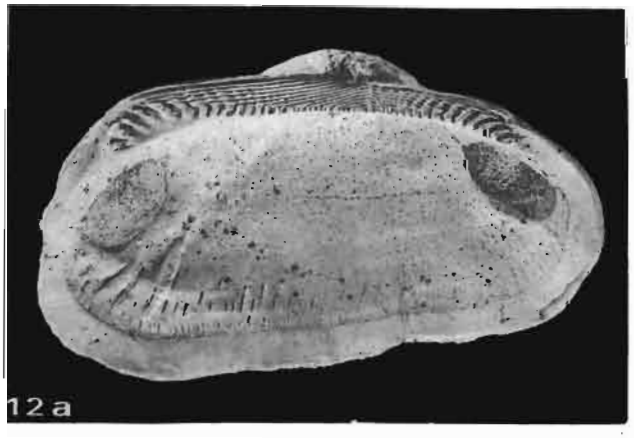
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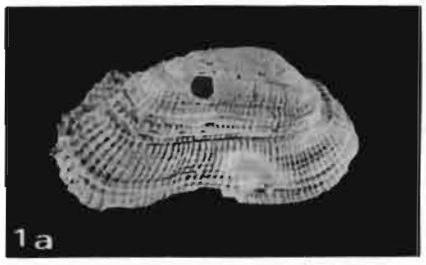
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9b


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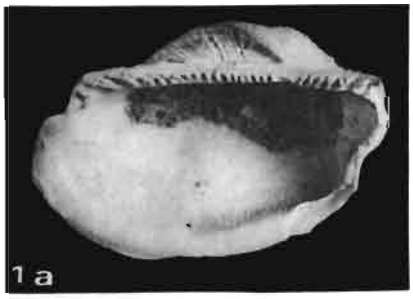
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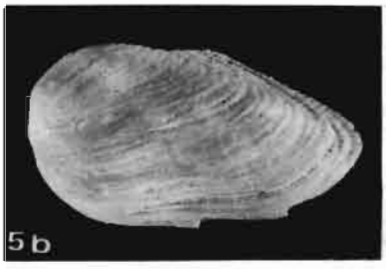
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9


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8 b


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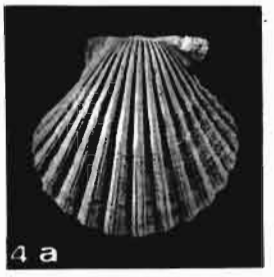
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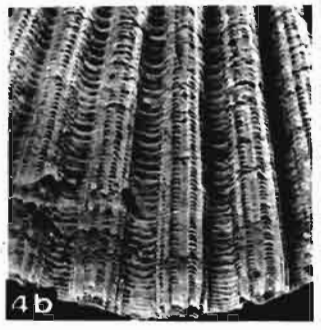
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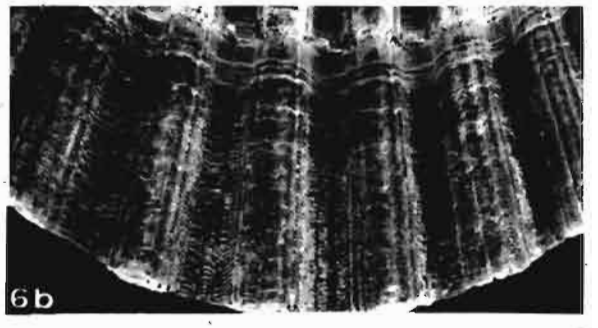
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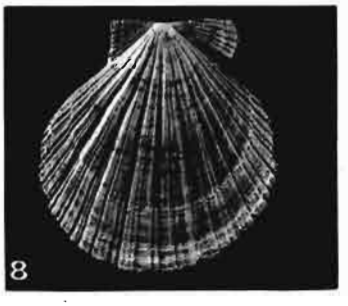
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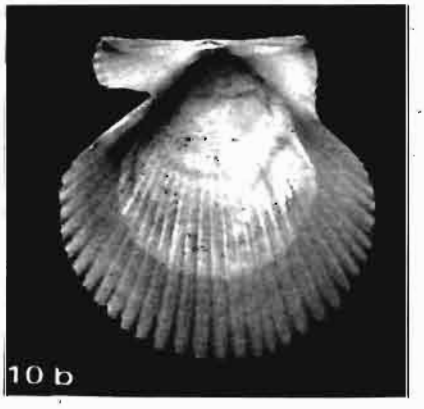
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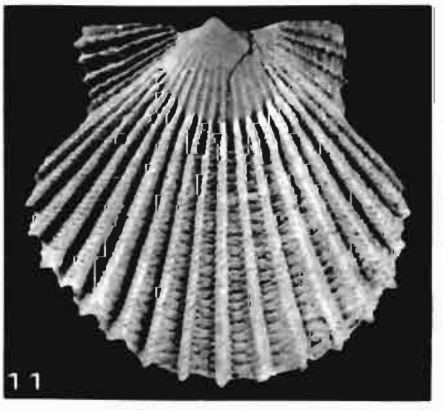
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2


3


1b


4


5a


6


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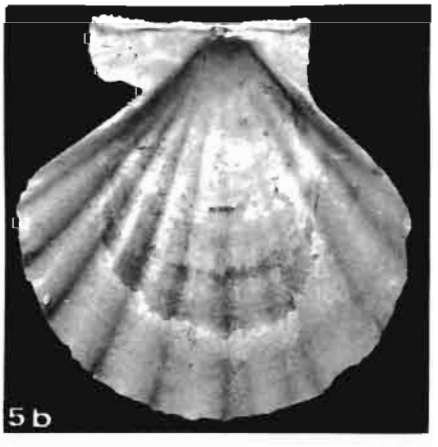
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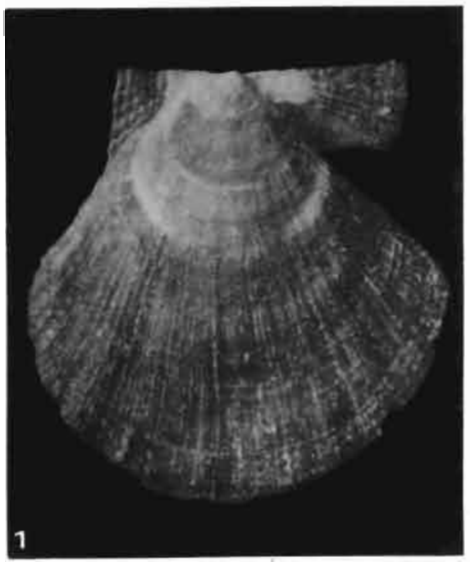
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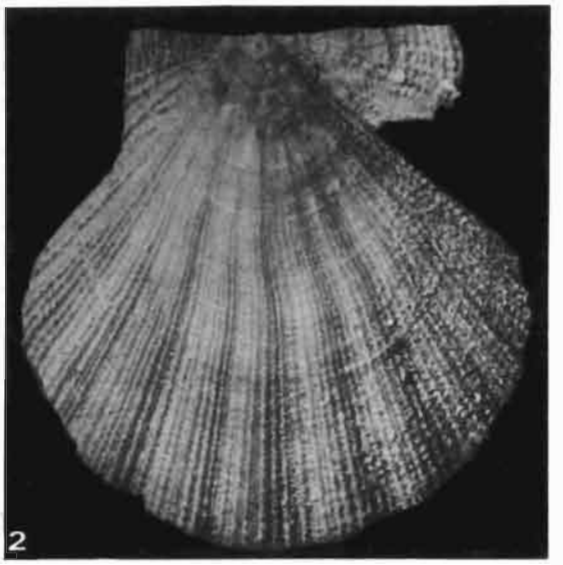
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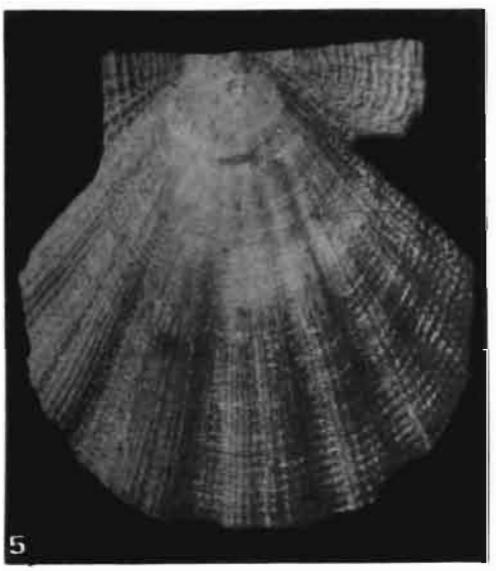
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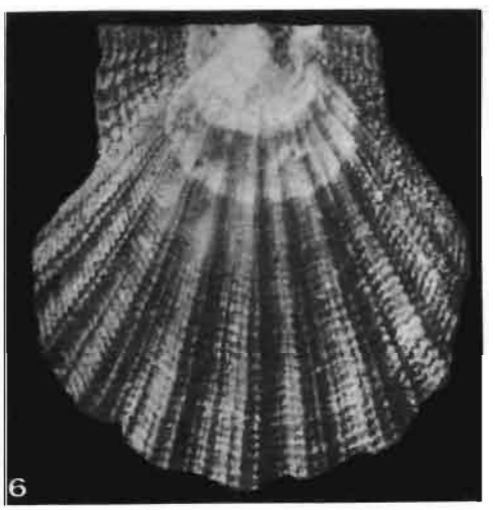
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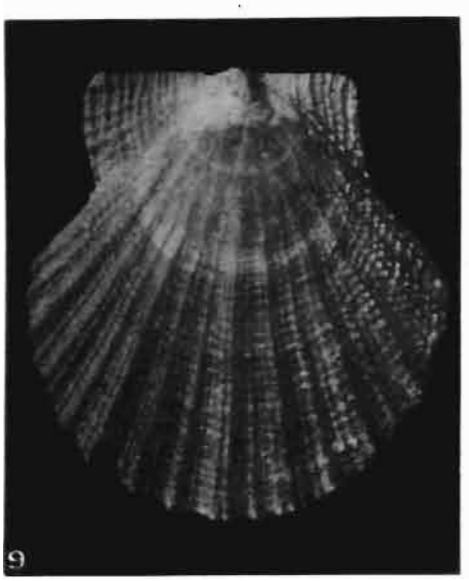
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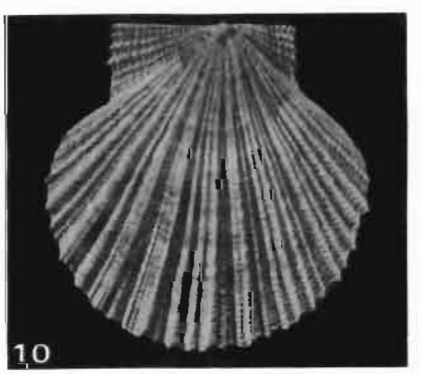
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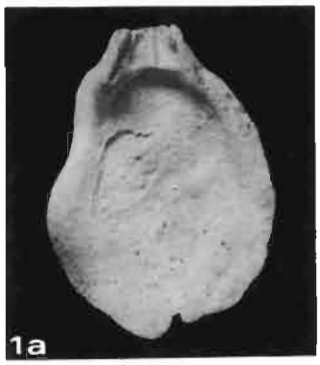
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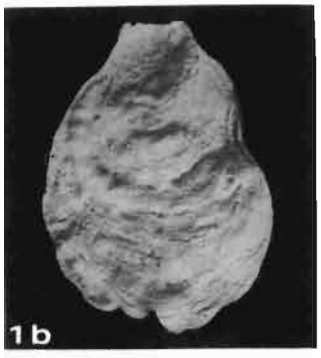
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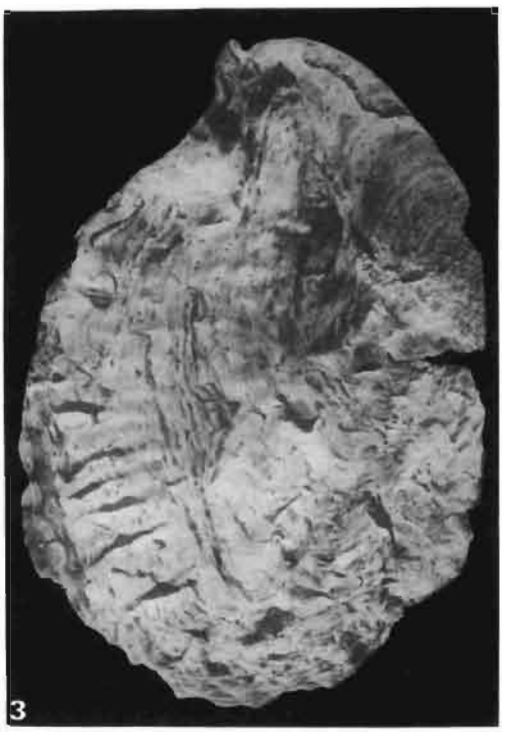
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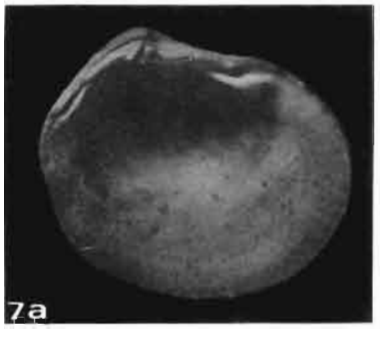
6a


6b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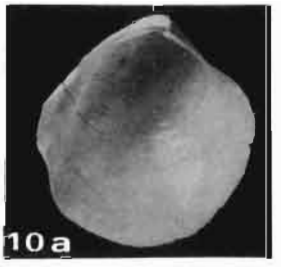
7b


8a


8b


9a


9b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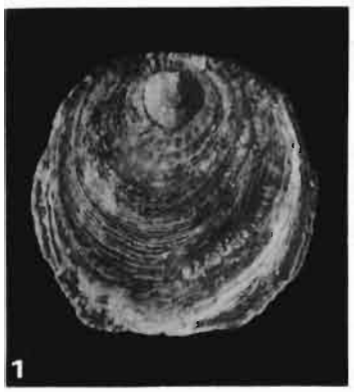
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2b


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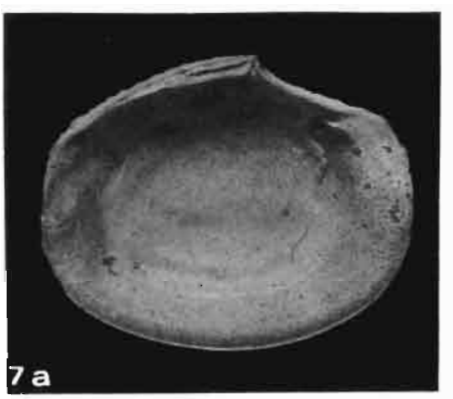
4


5


6a


6b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7b


8a


8b


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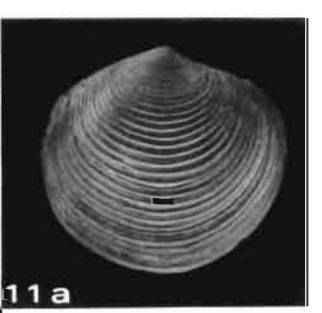
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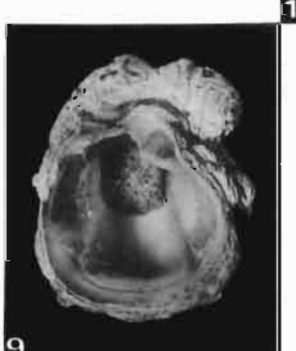
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12


13


1a


1b


2a


2b


3a


3b


4a

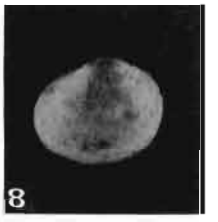

4b


5a


5b


7a


7b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6a


6b


9a

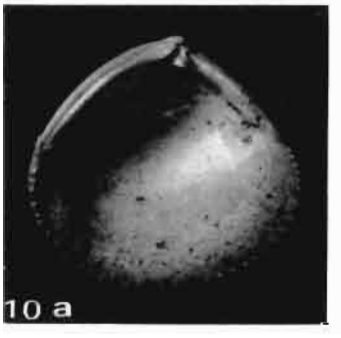

9b


11a


11b


12a


12b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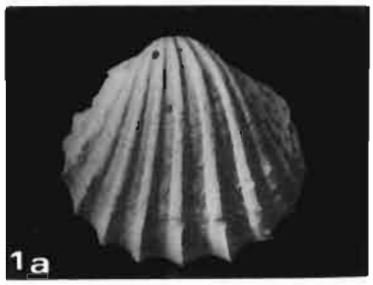
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1b


3a


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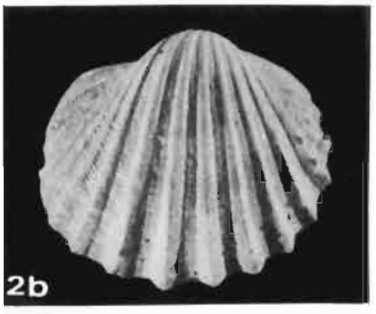
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3b


6a


6b


7


8a


8b


9


1a

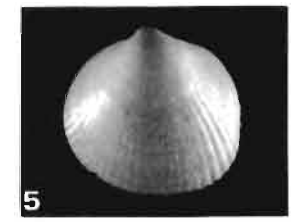

1b


2


3


4 a


4b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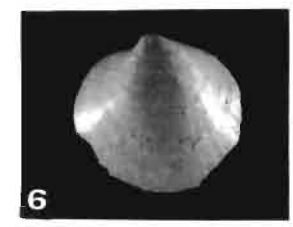
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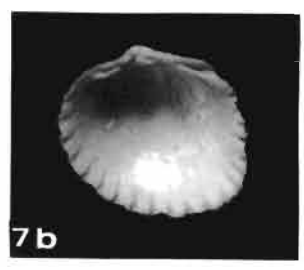
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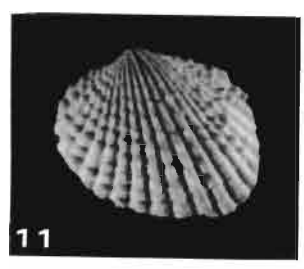
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12 a


12 b


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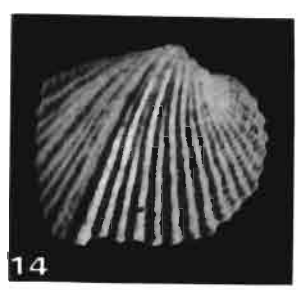

14


15 a


15b


1a


1b


2a


3


4


5


2b


6a


6b


7a


7b


9a


8a

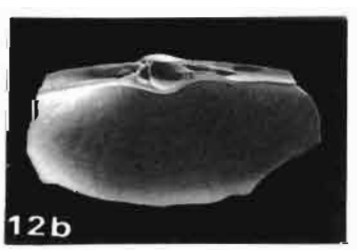

8b


9b


10


11


12a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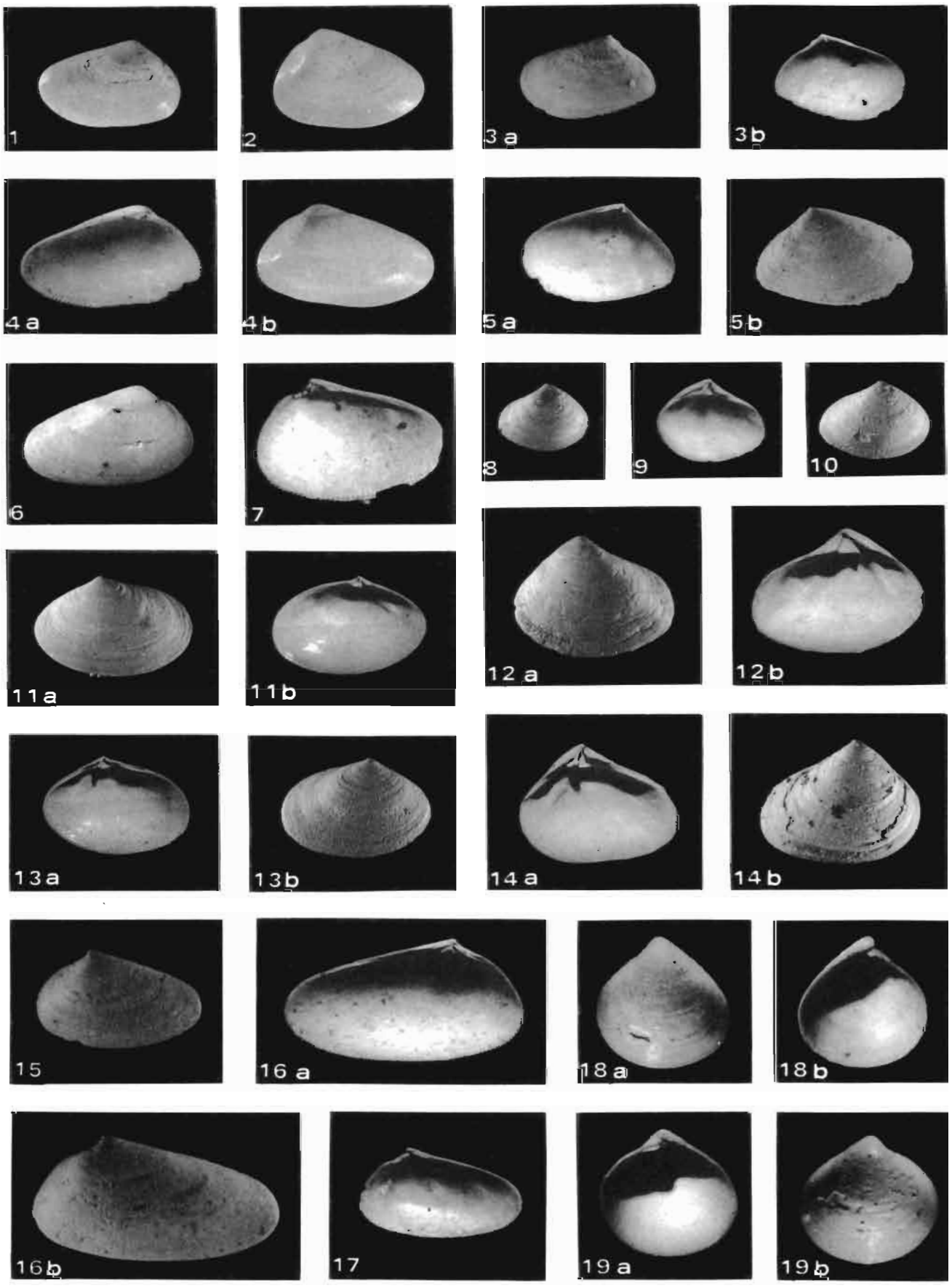
1
2
3 a
3 b
4 a
4 b
5 a
5 b
6
7
8
9
10
11 a
11 b
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13 b
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14 b
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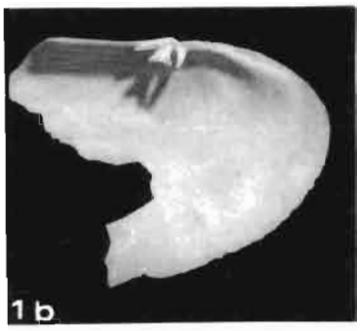
16 a
18 a
18 b
16 b
17
19 a
19 b


1a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4b


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5b


6a


6b


8a

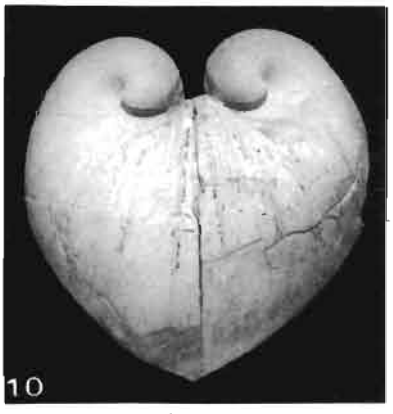

8b


7a


7b


9a


9b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11a


11b


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1b


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4b


5a


5b


6a


6b


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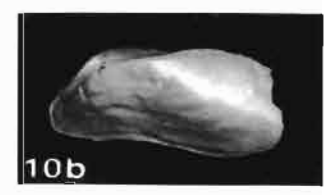
9a


9b


10a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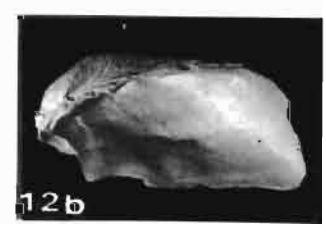
11b


12a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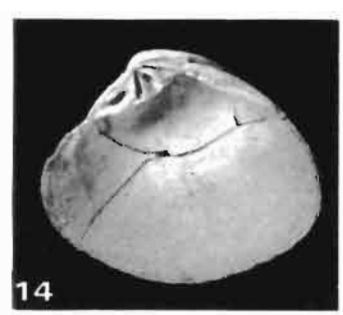
13a


13b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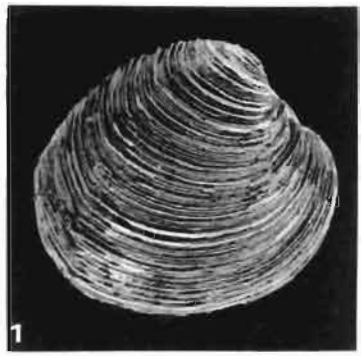
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3a

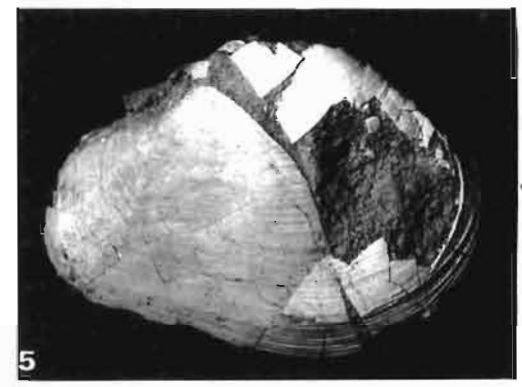

3b


4a


4b


6


7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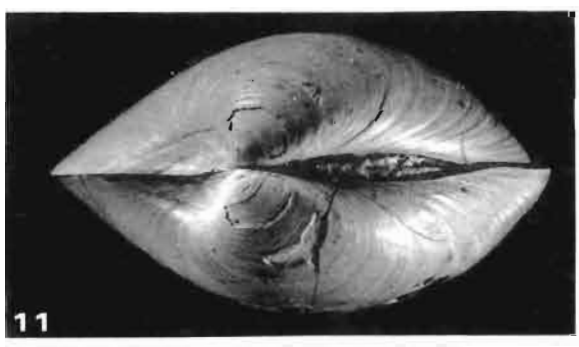
10a


10b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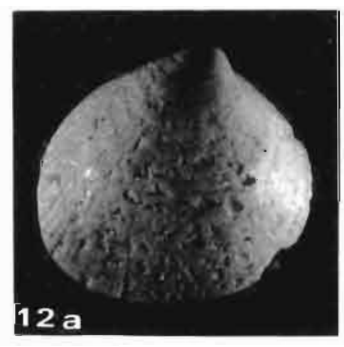

12a


12b


13a

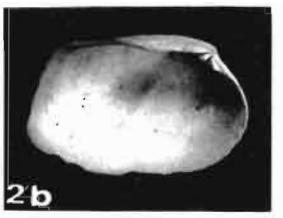

13b


14


15


1a


2a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3a


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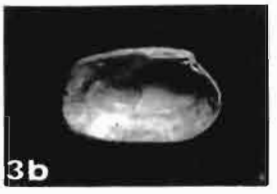
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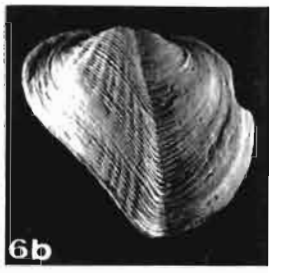
1b


4


5a


6a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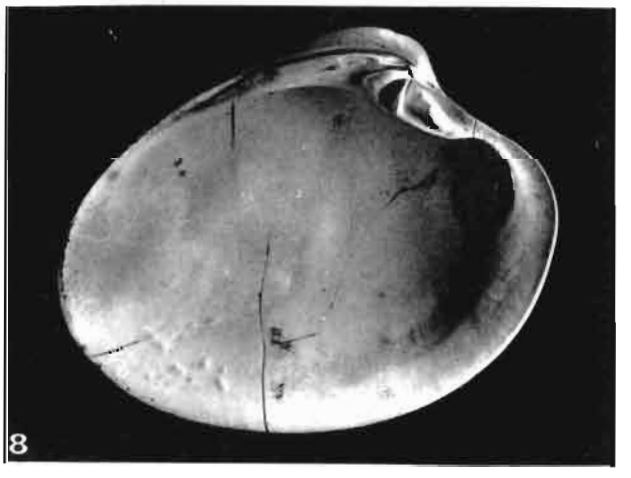
5b


5c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9a


9b


1a


1b


2


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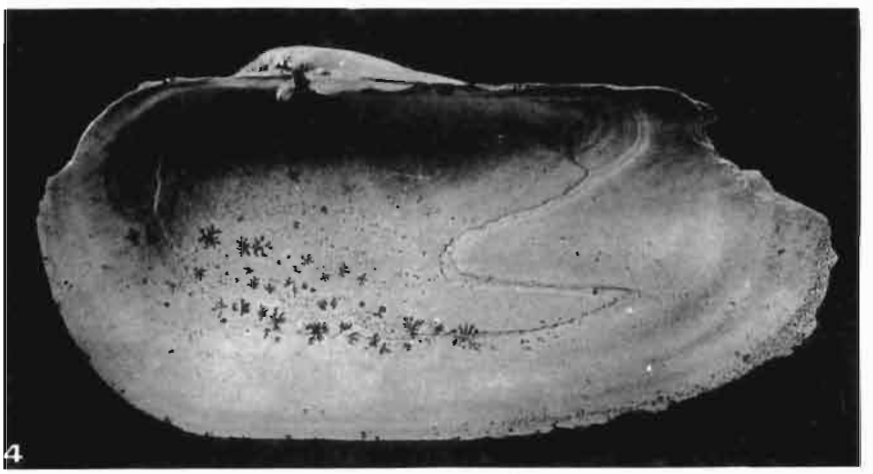
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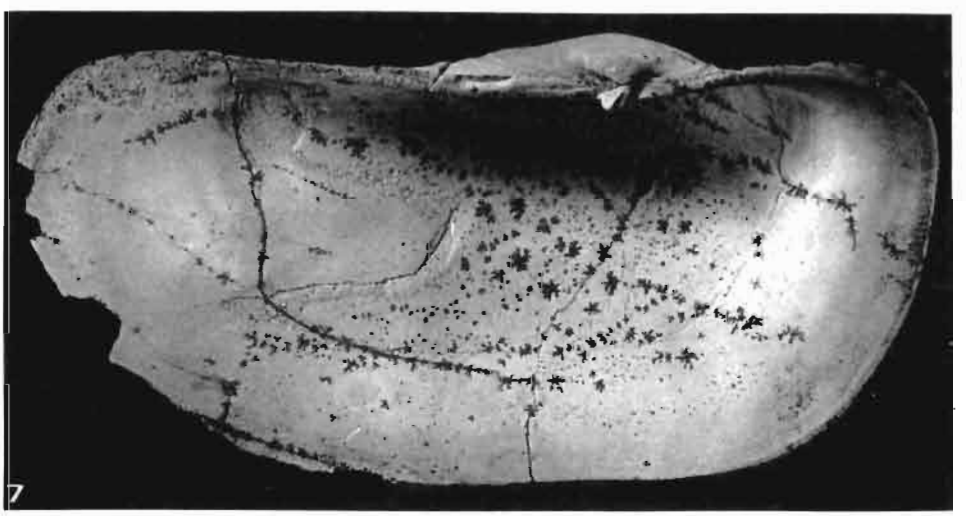
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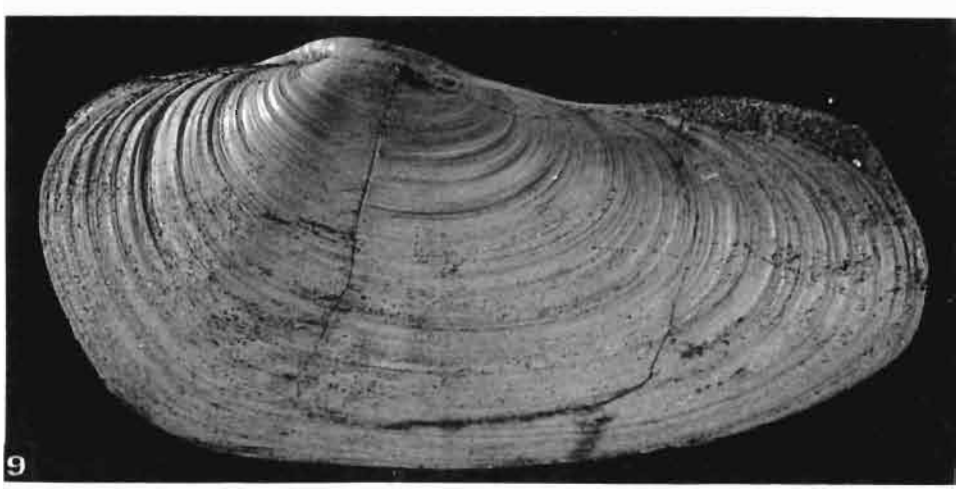
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10