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LOWER TORTONIAN GASTROPODS  
FROM KORYTNICA, POLAND. PART 1

(ŚLIMAKI DOLNOTORTOŃSKIE Z KORYTNICY. CZĘŚĆ I)

BY

WAŁAW BAŁUK

(WITH 5 TEXT-FIGURES AND 21 PLATES)



WARSZAWA — KRAKÓW 1975

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ACADÉMIE POLONAISE DES SCIENCES  
INSTITUT DE PALÉOZOOLOGIE

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## ABSTRACT

A very rich gastropod assemblage occurring in the Lower Tortonian Pleurotoma clays of the environs of Korytnica in Holy Cross Mountains, Southern Poland is the subject of the monograph, whose the present volume constitute Part I. In the introduction the author makes know the geological situation of the locality, the history of so far conducted studies on the gastropod assemblage from Korytnica, as well as the characteristics and the present state of knowledge of other faunal groups accompanying gastropods, along with a brief description of the Miocene marine bay (Korytnica Bay) in which the assemblage discussed lived. The systematic part contains palaeontological descriptions of 178 species or subspecies of prosobranch gastropods of the order Archacogastropoda and four superfamilies of the order Caenogastropoda, that is, Littorinacea, Rissoacea, Cerithiacea and Scalacea. In the described material, eighteen species are new, viz.: *Acmaea (Tectura) friedbergi* sp. n., *Gibbula (Colliculus) sanctacrucensis* sp. n., *Euchelus fragilis* sp. n., *?Skenea tenuis* sp. n., *Daronia hungarica* sp. n., *Circulus frequens* sp. n., *Collonia minutula* sp. n., *Cingula (Ceratia) friedbergi* sp. n., *Turboella (Turboella) conoidea* sp. n., *Alvania (Alvania) tenuicostata* sp. n., *Alvania (Alvania) alta* sp. n., *Alvania (Taramellia) kowalewskii* sp. n., *Tornus belgicus varius* sp. n., *Parastrophia radwanskii* sp. n., *Hemicerithium (Hemicerithium) subcostatum* sp. n., *Cerithiopsis (Krachia) korytnicensis* sgen. n., sp. n., *Scala (Clathrus) oligocostata* sp. n. and *Acrilla (Acrilla) laticostata* sp. n. The next parts will present the descriptions of remaining gastropods, as well as detailed characteristics of the entire assemblage and its life environment. They will also contain a comparison of the gastropod assemblage from Korytnica with those from localities from the Miocene of Europe and Recent seas.

## INTRODUCTION

### GENERAL REMARKS

In the Miocene, the area of Southern Poland north of the Carpathians and south of the Polish Jura, Holy Cross Mts and Lublin Upland was flooded by the sea (Text-fig. 1B). A rich variety of problems involved in this transgression has recently been presented by RADWAŃSKI (1964, 1968, 1969, 1970, 1973), who showed (1969) that the Miocene sea, transgressing onto the southern slopes of the Holy Cross Mts, mostly composed of the Triassic and Jurassic limestones, formed in this area three bays, that is, west-to-east, the Korytnica, Chmielnik and Pierzchnica bays (Text-fig. 1C). Excellently preserved remnants of littoral structures allowed him for a relatively accurate reconstruction of the shoreline.

In the western part of the Korytnica Bay, RADWAŃSKI (1969) distinguished a not very extensive basin of Korytnica (Text-fig. 2), connected with the rest of the bay only by narrow straits. At present various deposits formed in the Miocene sea are exposed in this area. They cover a morphologically varying surface of the Jurassic limestones (Text-fig. 3). The lowermost part of the Miocene deposits of the Korytnica basin consists of cream-colored, yellow or nearly white silts and clays known in literature as the Pleurotoma clays or Korytnica clays. Their estimated thickness amounts to 30 to 40 m, and they are overlain by very fine-grained sands

with marly sandstone intercalations called the *Heterostegina* sands. In the northern part of the Korytnica basin, in the environs of Chomentów and Jawor (Text-fig. 3, sections A-A' and B-B'), the lithothamnian limestones occur in the uppermost part of the profile. On the other hand, these limestones are lacking in the southern part of the basin, near Korytnica and Karsy (Text-fig. 3, section C-C'), where they most likely were not deposited at all (RADWAŃSKI, 1969).

In southern Poland, the Miocene transgression was of a relatively short duration and limited to the Tortonian only (although the views were previously expressed that it started somewhat earlier, in the Helvetian and persisted till the Sarmatian). In a recently suggested, new stratigraphic division of the Miocene of the Paratethys (already applied also to the Miocene of Poland by KRACH, KUCIŃSKI & ŁUCZKOWSKA, 1971), the Badenian stage corresponds to the Vienna Tortonian. The stratigraphic position of the Korytnica sequence is usually determined as the lower part of the Lower Tortonian (= Lower Badenian), i.e., the Lower Opolian (the sublithothamnian and lithothamnian-heterosteginean zones, according to KRACH, 1962a). Since in the Lower Opolian the Korytnica basin was completely filled with deposits and the sea withdrew there from (RADWAŃSKI, 1969), no higher stratigraphic members are here recorded. In the remaining, more open part of the Korytnica Bay, the sedimentation continued (RADWAŃSKI, 1969), as shown by preserved deposits till the Upper Opolian (according to KRACH, 1962a, the supralithothamnian zone).

The *Pleurotoma* clays of the environs of Korytnica (a village about 24 km SSW of Kielce, see Text-fig. 1B) are a deposit abounding in fossils. The wealth variety of fossils (discussed below) predominantly of gastropods, being the subject of the present paper, make Korytnica one of the most famous Miocene faunal localities in Europe. These clays are exposed at the surface in several places of the Korytnica basin (dotted areas in Text-fig. 2). Although no natural sections are here recorded, which was observed already by MURCHISON (1845), these clays are easily accessible since they lie close under the soil. The fossils are also embedded in the soil and the shells may be collected literally on the ground surface when walking through the crop fields. The largest area of clay outcrops, suitable for collecting fossils, is situated NE of the village of Korytnica. At first, it stretches as a narrow zone (not more than 100 m wide) east of a fieldroad running from the village (beside the church, northwards) more or less conforming to the contour line of 240 m. Then, it extends into a large spot situated north of Mt. Łysa. Another larger region, in which clays occur on the surface, is located NW of a small village Karsy. Here, it stretches for about 0.5 km, beginning with the skirt of forest, between contour lines 250 and 260. Also noteworthy to the collectors is a small patch of clays south of the Korytnica-Lipa fieldroad (in Text-fig. 3 south of the village Jawor). The Korytnica clays are also exposed in the northern part of the basin, in the environs of Chomentów (two patches straddling the Chomentów-Korytnica highroad), where fossils are, however, less frequent and not so varied as at Korytnica or Karsy. Fossils are recorded in the entire sequence of the Korytnica clays, but they are most abundant and variable in its uppermost part (the last three meters).

#### PREVIOUS INVESTIGATIONS OF THE GASTROPOD ASSEMBLAGE FROM THE KORYTZNICA CLAYS

The exceptionally great abundance, variability and excellent state of preservation of gastropod shells occurring in the Korytnica clays cause that they have for a long time now been the object of investigation. The discovery of this locality is ascribed (KOWALEWSKI, 1930)





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 — Palaeogeographical map of the westernmost part of the southern slopes of the Holy Cross Mts depicting the particular bays and location of the Korytnica Basin (cf. Text-fig. 2): 1 Paleozoic substrate, 2 Mesozoic substrate (the map modified after RADWAŃSKI 1969, 1970).

to ZEUSCHNER who collected fossils, but not describing passed them to other researchers. The accurate date of this discovery is hardly determinable, but it occurred not later than in the 1820's, since in PUSCH's work (1837), with the first paleontological descriptions and illustrations of the Korytnica shells, the remarks on a specimen of *Turritella* also give information (PUSCH, 1837, p. 105) on his having that specimen "already for ten years". Due

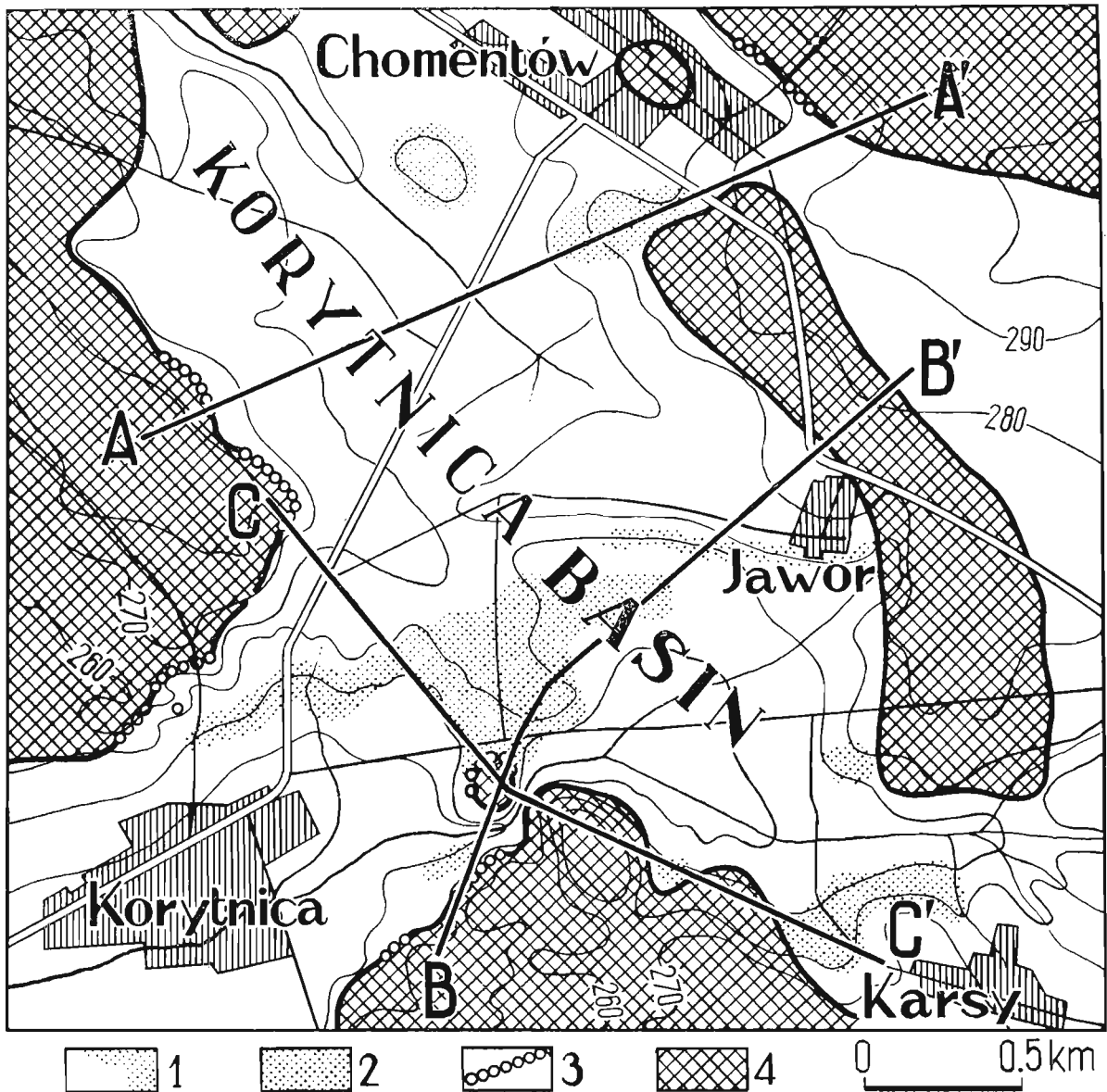


Fig. 2

Locality map of outcrops of the Korytnica clays (see Text-fig. 1 C), and paleogeographical situation of the region during the Lower Tortonian time (see RADWAŃSKI, 1969; BAŁUK 1971, 1972): 1 marine areas of the Korytnica Basin during the Lower Tortonian transgression, 2 present-day outcrops of the Korytnica clays situated beneath the overlying Tortonian deposits and Quaternary cover — the area of collecting of the investigated gastropods, 3 preserved fragments of the Lower Tortonian littoral structures, 4 land (or island) areas along the Lower Tortonian seashores. A-A', B-B' and C-C' — line of cross-sections presented in Text-fig. 3.

to the lack of illustrations and on account of old terminology, the present writer failed to identify a few (see also KOWALEWSKI, 1930, p. 2) of 66 species of gastropods mentioned by PUSCH (1837) from Korytnica, while of those illustrated by him (PUSCH, 1837) two are fairly enigmatic, namely the species described as *Pyrula bulbus* DEFRANCE and *Fusus sublaevis* PUSCH. Although

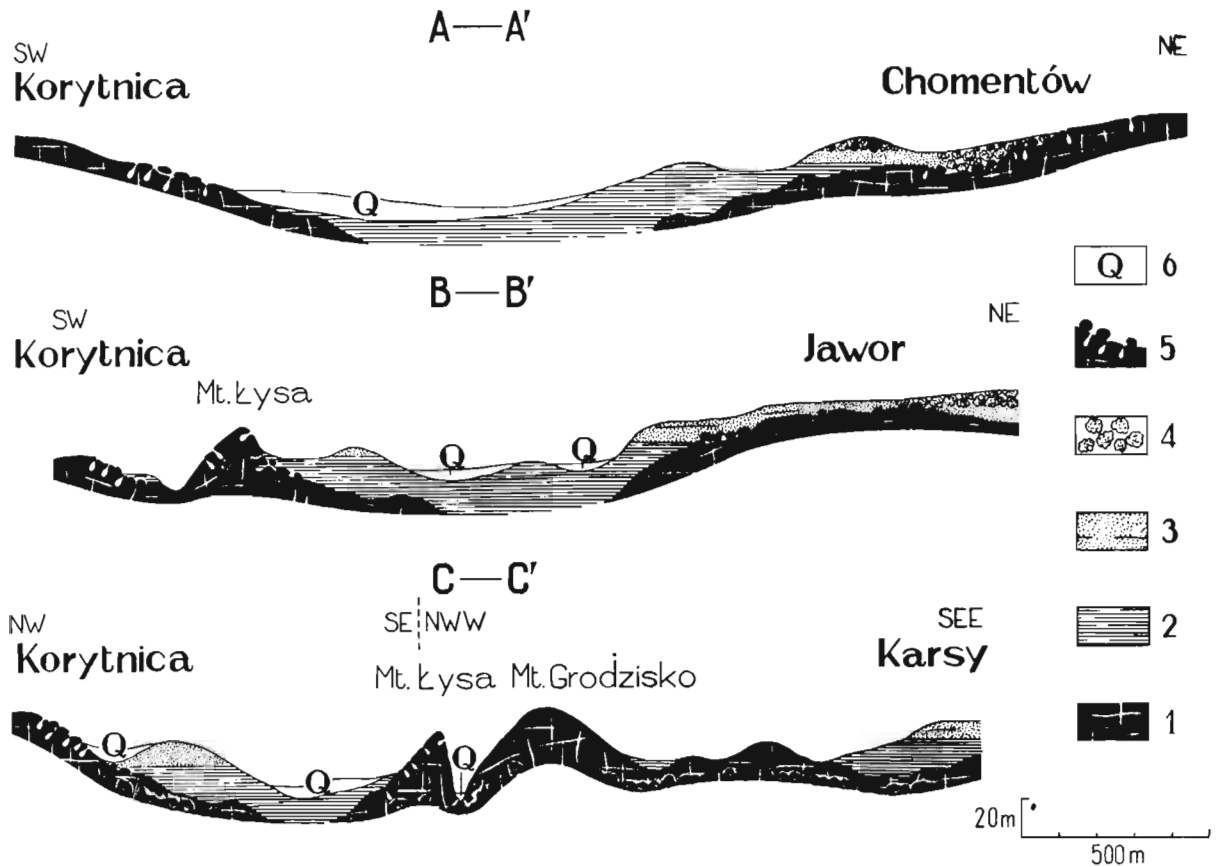


Fig. 3

Cross-sections through the Korytnica Basin (cf. Text-fig. 2): 1 Jurassic substrate (Oxfordian-Kimmeridgian limestones), 2 Korytnica clays, 3 marly sands, 4 lithothamnian limestones, 5 preserved patches of the Lower Tortonian littoral structures (abrasion surfaces, rubbles), 6 Quaternary cover.

the latter species was identified by KOWALEWSKI (1930) as *Fusus hoessi* PARTSCH, this view is not satisfactory. Elaborating the Korytnica gastropods, PUSCH (1838) described several new species. Some of them as, e.g., *Cerithium zeuschneri* PUSCH or *Sveltia inermis* (PUSCH) are generally acknowledged and mentioned from many Miocene localities in Europe. Some others, not accepted by later investigators (probably on account of imperfect illustrations and inaccurate descriptions), should be treated as *nomina oblita*. Here belong *Cancellaria acutangula* FAUJAS var. *polonica* PUSCH (1837, p. 128, Pl. 11, Fig. 17) = *Trigonostoma puschi* R. HOERNES & AUINGER, *Pleurotoma tuberculata* PUSCH (1837, p. 143, Pl. 12, Fig. 2) = *Asthenotoma heckeli* (HÖRNES) and *Ricinula echinulata* PUSCH (1837, p. 140, Pl. 11, Fig. 27) = *Purpura haemastomoides* R. HOERNES & AUINGER.

Some years after the appearance of PUSCH's (1837) work, Korytnica was visited by the famous English geologist, Sir RODERICK IMPEY MURCHISON on his way to Russia. Afterwards, he published (MURCHISON, 1845) a brief but quite accurate description of the environs of Korytnica, along with a list of the fossils (the list of gastropods determined by DESHAYES and MORRIS included 32 species).

Later mentions of Korytnica fossils are to be found in three classical monographs. Thus, EICHWALD (1853) mentions from Korytnica 36 gastropod species and HÖRNES (1856) — 71

species (only two of them *Buccinum incrassatum* MULLER and *Buccinum coloratum* EICHWALD, could not be identified by the present writer with any of the species he found). Finally, R. HOERNES & AUINGER (1879) present, for comparative purposes, the illustrations of two species of Korytnica.

The vicinity of Korytnica and fossils which occur there became in turn the subject of investigation by KONTKIEWICZ (1882) who published a list of fossils including 63 gastropod species. Four of KONTKIEWICZ's (1882) species, that is, *Buccinum philippi* MICHELOTTI, *Buccinum coloratum* EICHWALD, *Cancellaria cancellata* LINNAEUS and *Pleurotoma concatenata* GRATELOUP have not been identified by the present writer with any he found himself.

The early 20th century is marked as a period of FRIEDBERG's studies on Poland's Miocene fauna, including of course that from Korytnica. In the monograph entitled "Mollusca Miocena Poloniae" (FRIEDBERG 1911-1913, 1923, 1928a), he described 135 gastropod species from Korytnica, coming from his own collection, from ZEUSCHNER's old collection and from KOWALEWSKI's collection. In his later works, FRIEDBERG (1931, 1938) supplemented this list with further 39 species. Of the species described by FRIEDBERG (1911-1928a), the present writer has so far failed to find the following four: *Calliostoma korytnicensis* FRIEDBERG, *Bivetia subcancellata* (d'ORBIGNY), *Sveltia lyrata* (BROCCHI) and *Merica callosa* (PARTSCH). All of them are extremely rare in the Korytnica clays and have so far been by one specimen each.

Many years of work were devoted to the studies on the Korytnica fauna by KOWALEWSKI, whose paper (KOWALEWSKI, 1930) contains brief descriptions of 183 species or subspecies of gastropods, either collected by himself or given by his predecessors. Unfortunately, this work is devoid of illustrations and just for this reason is not cited by the authors of successive palaeontological works. After the publication of 1930, KOWALEWSKI continued collecting Korytnica fossils, also by washing considerable amounts of clays. Unfortunately, the obtained material was mostly destroyed during World War II and thus the results of KOWALEWSKI's studies have never been published.

In addition to the works, dealing with the entire assemblage of gastropods, there also appeared a paper (BAŁUK & JAKUBOWSKI, 1968) on to the aberrant bivalved gastropod, *Berthelinia krachi* BAŁUK & JAKUBOWSKI found in the uppermost part of the Korytnica clays.

The present monograph, whose Part I is now being presented to the readers, is based on the writer's new collection (housed at the Paleontological Laboratory of the Warsaw University). It is considerably richer than those collected by the writer's predecessors. For, if the total number of gastropod species from Korytnica, presented in earlier works, amounts to about 200 (the number underterminable accurately on account of either various presentations of some species, or difficulty in identifying some others), the writer's collection contains nearly three times as many species or subspecies. This part of the monograph gives descriptions of 178 species of prosobranch gastropods of the order Archaeogastropoda THIELE and of four superfamilies of the order Caenogastropoda COX, that is, the Littorinacea, Rissoacea, Cerithiacea and Scalacea. The writer's collection contains many species so far unknown from Korytnica, including new ones. This collection was formed by the systematic collecting, several times a year (since 1966), of fossils which appeared on the surface of soil after each ploughing and other field works of local farmers. Small specimens were collected from siftings. A total of 40 samples from various localities in which clays occur were washed. Samples varied in size, the smallest weighing at least 20 kg. In some localities, marked by particularly abundant and variable fauna, the samples weighed between five and ten tons. Even in such bulky samples, some of the rarest species were represented by single specimens only. In addition, the deposit contained in all larger shells was washed out by the writer at the laboratory. This operation



yielded specimens of many small species having fragile shells, which after trapping, together with deposit, into large shells were thus less exposed to destruction.

During his investigation of the fauna from Korytnica, the writer also had an opportunity to study the existing collections, that is, W. FRIEDBERG's collection housed at the Polish Academy of Sciences, Geological Laboratory in Cracow, K. KOWALEWSKI's collection at the Museum of the Geological Survey in Warsaw, and the collection of the Museum of the Earth in Warsaw. He also had at this disposal a collection of gastropods of the genus *Turritella*, kept in the Paleontological Laboratory of the Warsaw University, whose specimens had been collected by J. STANOWSKI, MSc for his graduate paper entitled "The genus *Turritella* LAMARCK from the Miocene of Korytnica" (unpublished). In some cases, specimens from the above-mentioned collections are described in the present paper.

### THE ACCOMPANYING FAUNA

The gastropods are undoubtedly the predominant and most variable element of the assemblages from the Pleurotoma clays of Korytnica. They are, however, accompanied by the representatives of all the most important phyla of fauna, having a mineral skeleton, that is, the protozoans, sponges, coelenterates, annelids, brachiopods, bryozoans, arthropods, other mollusks, echinoderms and vertebrates.

Protozoans are represented by an exceptionally abundant foraminiferal assemblage, so far not elaborated paleontologically. The foraminifers from the Korytnica clays were dealt with, but for stratigraphic purposes, by ŁUCZKOWSKA (1958) and ALEXANDROWICZ (1959). In addition, two species were mentioned by KOWALEWSKI (1930). Part of this assemblage (the Miliolidae) has recently been included in a monograph (ŁUCZKOWSKA, 1974) of the Polish Miocene Miliolidae. The genus *Inaequalina* was subjected to a separate description (ŁUCZKOWSKA, 1971) and the genus itself was established on the Korytnica specimens. The presence of sponges in the Korytnica basin is indicated by frequently occurring borings, ascribed by RADWAŃSKI (1964, 1969, 1970) to *Cliona celata* GRANT and *Cliona vastifica* HANCOCK. They are observed in limestone boulders and pebbles in the littoral zone and in thick shells of pelecypods and gastropods. Boring of *Cliona* sp. have previously been recorded from Korytnica by KOWALEWSKI (1930).

Corals are rather rare fossils in the Korytnica clays, but locally, e.g., in the littoral zone near Mt. Łysa, they are relatively frequent in clays abounding in oyster debris. The corals are represented by both solitary and colonial forms. Due to their sizeable dimensions, they are easily seen and, therefore, they were recorded by most investigators (PUSCH, 1837; EICHWALD, 1853; KONTKIEWICZ, 1882; FRIEDBERG, 1928; KOWALEWSKI, 1930; BAŁUK & RADWAŃSKI, 1967; BAŁUK, 1971, 1972). A fairly detailed description of the Korytnica corals is included in DEMBIŃSKA-RÓŻKOWSKA's (1932) monograph of the Miocene corals of Poland. This authoress described from Korytnica basin 25 species and subspecies.

Annelids are represented by sedentary polychaetes, including both the forms secreting calcareous tubes and those living in borings. Particularly abundant are the tubes of *Ditrupa cornea* LINNAEUS, previously recorded from Korytnica by DEMBIŃSKA (1924) and KOWALEWSKI (1930). Fragmentary tubes of *Serpula quinquesignata* REUSS, *Serpula circumlobata* (BOETTGER), *Serpula septemcarinata* (BOETTGER) and *Serpula semicostata* (BOETTGER), species never mentioned before from this locality, are also rather frequent in the littoral zone near Mt. Łysa.

In addition, the presence of borings ascribed by RADWAŃSKI (1964, 1969, 1970) to *Polydora ciiliata* (JOHNSTON), *Polydora hoplura* (CLAPARÈDE) and *Potamilla reniformis* (O. F. MÜLLER) is frequently observed in limestone pebbles and boulders, as well as in corals and gastropod shells.

The bryozoans are not frequent in the Korytnica clays, except for the littoral zone near Mt. Łysa, where they occur more numerously. This group of fossils from Korytnica has not so far been elaborated. Four species of the genus *Cellaria* ELLIS & SOLANDER are mentioned by MAŁECKI (1972) and one by KOWALEWSKI (1930). Yet rarer are the shells of brachiopods, the specimens of *Megathyris* (near Mt. Łysa only) being very unique and those of the genus *Cistella* somewhat more frequent; none of these genera has ever been recorded before from Korytnica. KOWALEWSKI (1930) mentions only two specimens of *Terebratula* cf. *grandis* BLUMENBACH, whereas *Lingula* cf. *suessi* DREGER, mentioned by FRIEDBERG (1930) comes from sands overlaying clays at Chomentów (similar shells of *Lingula* were fairly frequently observed by the writer in identical sands at Korytnica).

Arthropods are represented in the Korytnica clays by ostracods, crabs and cirripeds. Relatively rich assemblages of ostracods and crabs (preserved as isolated claws) have not so far been elaborated paleontologically. KOWALEWSKI (1930) records the presence of an ostracods species and isolated claws. The assemblage of cirripeds, very numerous and variable, includes species of the genera *Scalpellum* LEACH, *Conchoderma* OLFERS, *Verruca* SCHUMACHER, *Chthamalus* RANZANI, *Acasta* LEACH, *Balanus* DA COSTA, *Creusia* LEACH. Except for *Conchoderma*, thus far unknown in a fossil state, the rest were mentioned previously from this locality (BAŁUK & RADWAŃSKI, 1967; RADWAŃSKI, 1969; BAŁUK, 1971, 1972). Only the species *Creusia sanctacrucensis* BAŁUK & RADWAŃSKI, living in the coralla of *Tarbellastraea reussiana* MILNE-EDWARD & HAIME, was elaborated in detail. In addition to all these cirripeds, the occurrence of borings *Zapfella pattei* SAINT-SEINE, attributable to acrothroracican barnacles, was found by RADWAŃSKI (1964, 1969, 1970) in the boulders in one of the littoral rubbles. The cirripeds occurring in the Korytnica clays are mostly preserved as isolated plates, except for *Creusia* more frequently met with as complete shells and *Verruca* which, in addition to plates, may also be recognized on characteristic etchings made by animals when attached to the substrate. A lot of such etching are observable on shells of the gastropod *Lemintina arenaria* (see Pl. XIV, Fig. 14).

Other, non-gastropod mollusks are among the main faunal elements of the Korytnica clays. They are represented by chitons, scaphopods, pelecypods and cephalopods. The assemblage of chitons, recently elaborated by the writer (BAŁUK, 1971), includes fifteen species and is the richest in all the Miocene localities of Europe. The valves of pelecypods, the same as the shells of gastropods, are the most conspicuous fossils at Korytnica. Although they are represented by a smaller number of species, they probably surpass in the number of specimens all the remaining groups counted together. For, one of the pelecypod species, that is, *Corbula gibba* OLIVI, occurs here in billions. Much the same as gastropods, pelecypods were recorded or described from Korytnica by PUSCH (1837), MURCHISON (1845), EICHWALD (1853), KONTKIEWICZ (1882), KOWALEWSKI (1930) and FRIEDBERG (1934—1936, 1938). The boring pelecypods have recently been dealt with by RADWAŃSKI (1964, 1969, 1970) who described from Korytnica the borings (in boulders, shells of other mollusks, or corals) of such forms as *Gastrochaena dubia* (PENNANT), *Aspidopholas* sp., *Jouannetia semicaudata* (DES MOULINS), *Petricola* sp., *Lithophaga* sp. He also recorded the occurrence of the species *Sphenia anatina* (BASTEROT) domiciled in empty borings of the abovementioned pelecypods. At present, an assemblage of the Korytnica pelecypods is the subject of Dr. G. JAKUBOWSKI's studies, who already

presented (JAKUBOWSKI, 1972) the results on the ontogenetic development of six species therefrom.

Many scaphopods were recorded from Korytnica by PUSCH (1837), EICHWALD (1853), HÖRNES (1856), KONTKIEWICZ (1882), FRIEDBERG (1928*a, b*) and KOWALEWSKI (1930). An assemblage of these mollusks, including thirteen species and, therefore, one of the richest in the European Miocene, has recently been studied by the present writer (BALUK, 1972). And, finally, the cephalopods which are the rarest mollusks ever met with in the Korytnica clays. They are represented by the genus *Sepia*, so far unknown from this locality, where they occur as fragmentarily preserved cuttlebones. Their state of preservation is similar to that in the Miocene deposits of the Vienna Basin (see SCHAFFER, 1958).

The echinoderms are represented in the Korytnica clays by crinoids, ophiuroids, starfish, echinoids. However, they are as a rule preserved as disseminated skeletal elements and only some of the echinoids occur as complete shells. The Korytnica echinoderms have not so far been the subject of any palaeontological elaboration. The only report of the plates of the starfish *Astropecten* sp. and fragmentarily preserved echinoids *Spatangus* sp. is given by KOWALEWSKI (1930). Complete echinoid shells are among the rarities. Mostly, these are the representatives of the genus *Echinocyamus* PHELSUM (abundant in overlaying sands) and indeterminate small regular echinoids of the superorder Echinacea. The remnants of ophiuroids and freeliving crinoids have so far been recorded from this locality. The former are an exceptional rarity, the latter, somewhat more frequent, occur as fragmentary calices, brachial plates and cirralia of *Discometra* sp. and *Antedon* sp.

The remain of fish, not a rarity at Korytnica, occur as otoliths, teeth and fragments of bones, mostly vertebrae. If the otoliths are already fairly well known, the remaining elements have not so far been elaborated. Otoliths were formerly dealt with by FRIEDBERG (1924), CHAINE & DUVERGIER (1928) and recently by ŚMIGIELSKA (1966) who presented, in her paper on the Polish Miocene otoliths, 16 species from the Korytnica clays. The occurrence of teeth, including both those of Elasmobranchii and Teleostei, was stated by KOWALEWSKI (1930) who recorded three species. However, they are much more diversified and require a separate elaboration.

As follows from the above review, strongly varying fossils abound in the Korytnica clays, but the degree of their recognition is as yet by far insufficient. However, we can hope that soon the results will be published of studies now being undertaken by several specialists who are concerned with such groups as corals, brachiopods, bryozoans, pelecypods and cephalopods.

## CHARACTERISTICS OF THE KORYTNICA BASIN

The geological observations, along with the accurately examined fossils, enable the presentation of tentative characteristics of the Korytnica basin as it was during the sedimentation of clays. This problem will be discussed in detail at the end of the present monograph, after the description of the entire gastropod assemblage.

The Korytnica basin was small in area (about five to seven sq km), connected with the remaining open part of the bay by several narrow straits and, therefore, its water was relatively calm although not devoid of waving and tides. The area involved by the sea was formerly a valley with a fairly variable morphology, which caused a varying course of its shoreline marked by a considerable number of islets, submarine ridges and small bays. Fairly steep shores were built of the Jurassic limestones. As a result of abrasion processes, the littoral rubbles were formed (RADWAŃSKI, 1969) which stretched along the coast, the fragmentary remnant of which have

been preserved in morphology until now (Text-figs 2 and 3). The occurrence of many borings left over by animals characteristic of the littoral zone such as sponges, polychaetes, pelecypods, cirripeds, is observed in all the littoral structures (RADWAŃSKI, 1964, 1969). Outside the littoral zone, the seafloor was clayey or silty, as shown by the deposits preserved, with sporadically dispersed pebbles. Locally, it was probably abundantly overgrown with seaweeds which supplied food to numerous herbivorous animals, as it was discussed for e.g. bivalved gastropods, *Berthelinia*, the recent representatives of which graze only on seaweeds of the genus *Caulerpa* (see BAŁUK & JAKUBOWSKI, 1968). The depth of the basin was undoubtedly variable, smaller



Fig. 4

General view of the shoreline part of the Korytnica Basin (the photo taken perpendicularly to the cross-section *B-B'* — cf. Text-fig. 2). *J* Jurassic substrate (Kimmeridgian limestones), *M* Korytnica clays, *Q* Quaternary cover.

Phot. A. Radwański

near the shore and somewhat larger of the coast. It also gradually decreased during the sedimentation. Both the composition of assemblages and synecological analysis of the organic communities induced RADWAŃSKI (1969) to estimate the depth of the basin as amounting at first to 40 to 60 m (at most 70 m) and decreasing at the end of the sedimentation of the Korytnica clays to a mere few meters or only slightly more than 10 m. Such a small depth is indicated by the occurrence of the animals that dwell at present only very shallow waters, viz. primarily the cirripeds *Creusia* (comp. BAŁUK & RADWAŃSKI, 1967) and bivalved gastropods *Berthelinia* (comp. BAŁUK & JAKUBOWSKI, 1968). Recent representatives of these genera live at depth not exceeding two fathoms. Likewise, several chitons (comp. BAŁUK, 1971), many gastropods and corals are very shallow-marine forms. Deep-water species have not been found among such other animals as, e.g., foraminifers (ŁUCZKOWSKA, 1958) or fish (ŚMIGIELSKA, 1966).



The salinity of water in the Korytnica basin was undoubtedly normal, as the presence of colonial corals or echinoderms precludes any considerably lower degree of salinity. In such places, however, as isolated small bays or mouths of creeks, the salinity might drop somewhat lower, as indicated by the presence of a few gastropods, which more frequently live under lower-salinity conditions (*Terebralia*, *Pirenella*, *Nassa*). Water temperature was probably high; the writer has already stated (BALUK, 1971) that it might reach 25° to 28°C, more than in the present-day Mediterranean Sea. The occurrence of many pronouncedly stenothermal animals, at present typical of the sea of subtropical zone, determines the necessity of assuming such a high

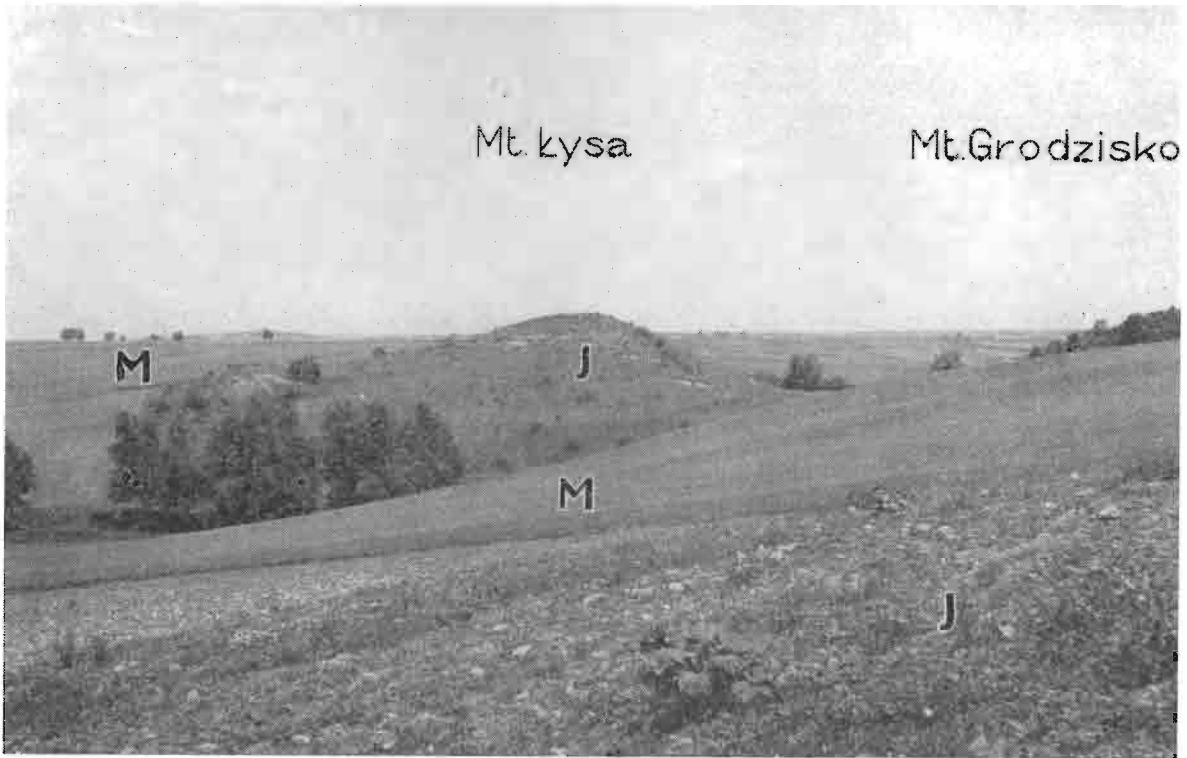


Fig. 5

The same part of the Korytnica Basin as presented in the preceding photo (Text-fig. 4), but taken from the south along the cross-section *B-B'*. *J* and *M* the same as in Text-fig. 4.

Phot. A. Radwański

mean temperature of water. The cirripeds *Creusia* and bivalved gastropods *Berthelina*, mentioned above, belong to precisely such animals. Likewise, the chitons of the genera *Cryptoplant* and *Craspedochiton* (comp. BALUK, 1971), and some gastropods, e.g., the genus *Parastrophia*, found here for the first time, live only in warm seas.

As follows from the presented characteristics, the Korytnica basin offered conditions unusually favorable to the development of organic life. Consequently, its faunal assemblage is extremely rich and variable, and includes many representatives of the diversified animal kingdom.

Many valuable, frequently unique specimens were given to the writer by Professor W. KRACH, Professor H. MAKOWSKI, Docent A. RADWAŃSKI, Dr. G. JAKUBOWSKI, J. DZIK,

MSc., A. ELŻANOWSKI, MSc., A. PIOTROWSKI, MSc, and J. STANOWSKI, MSc. The writer's thanks are once again extended to all these persons.

All the photographs of specimens published in the present monograph were taken by Mrs. B. DROZD, MSc. at the Institute of Geology of the Warsaw University, to whom the writer extends his most sincere thanks. The photographs are so arranged in plates that all the views (where more than one) of a specimen are shown on a common, black background and marked by a common number.

# SYSTEMATIC DESCRIPTIONS

Subclass PROSOBRANCHIA MILNE-EDWARDS, 1848  
Order ARCHAEOGASTROPODA THIELE, 1925  
Superfamily PLEUROTOMARIACEA SWAINSON, 1840  
Family SCISSURELLIDAE GRAY, 1847  
Genus SCISSURELLA D'ORBIGNY, 1824  
Subgenus SCISSURELLA (SCISSURELLA)  
**Scissurella (Scissurella) transylvanica** REUSS, 1860

(Pl. 1, Figs 1-3)

1860. *Scissurella transylvanica* m. sp. n.; A. E. REUSS, pp. 266-267, Pl. 7, Fig. 6.  
?1860. *Scissurella depressa* m. sp. n.; A. E. REUSS, pp. 267-268, Pl. 7, Fig. 7.  
?1917. *Scissurella (Schismope) Terquemi* (DESHAYES); M. COSSMANN & A. PEYROT, pp. 70-71, Pl. 3, Figs 10-14.  
1938. *Scissurella transilvanica* REUSS; W. FRIEDBERG, pp. 45-46 Text-fig. 8.  
1966. *Scissurella terquemi* (DESHAYES); J. KÓKAY, p. 29, Pl. 1, Fig. 1.

**Material.** — Forty specimens.

**Dimensions.** — Maximum height 1.2 mm, maximum width 1.5 mm.

**Description.** — Shell very small, thin-walled, shaped like a thick disc with a more or less projecting spire. Protoconch formed, on the whole, by a smooth whorl distinctly separated from the rest of shell. Teleoconch reaching  $2\frac{1}{2}$  whorls, the first of them rounded in outline, the rest having fairly distinct carinae in their upper parts. Above the carina, the whorl is slightly convex or nearly flat. A narrow, through-like depression runs just below the carina. Below this depression and on the base of shell, the whorl is convex. Ornamentation strongly variable. It consists of very thin axial ribs, 14 to 16 of them on the early and 16 to 22 on the last whorl, along with many, closely spaced spiral stripes developed on the surface of the whorl. A selenizone, mostly bordered by two thin and narrow lists, is situated on the carina. It appears at the near end of the second whorl of teleoconch, with an anal slit occurring at its extension near the aperture. In one of the specimens, a fusion of the slit has been observed which occurred as the terminal sector of the last whorl was formed and which resulted in the formation of an elongate trema. Aperture, usually destroyed, is relatively large and roundish in outline. Both lips thin and sharp. Umbilicus open, deep, but variable in width and usually having a more prominent spiral stripe which runs along its periphery.

**Remarks.** — An exceptionally strong variability is observed among the specimens found. It is expressed in a varying degree of the projection of spire above the last whorl, a varying prominence of ornamentation (an uninterrupted transition may be observed from specimens with strong ribs to nearly smooth ones) and a dissimilarity of the umbilicus. This variability makes the identification of the specimens from Korytnica very difficult, who seem, however, to be unquestionably conspecific with those of *Scissurella (Scissurella) transylvanica* REUSS, described from Rudoltice, Czechoslovakia (REUSS, 1860), as well as from Borki Wielkie, Podolia and Szuszkowce, Volhynia, USSR (FRIEDBERG, 1938). Besides *S. (S.) transylvanica*, REUSS (1860) described another species from Rudoltice, that is, *S. (S.) depressa* REUSS, which primarily differs in an almost flat apical part of shell. In view of the considerable variability observed among the specimens from Korytnica, separating *S. (S.) depressa* as a different species is probably incorrect. The specimens from Korytnica clays also include those rather similar to *S. (S.) terquemi* DESHAYES, a species known from the Miocene of Aquitanie (COSSMANN & PEYROT, 1917). The differences in the look of their tests observed between *S. (S.) transylvanica* and *S. (S.) terquemi* are only a symptom of specific variability. From the Miocene Vienna-type deposits *S. terquemi* was mentioned from Yugoslavia (KOCHANSKY, 1944) and Hungary (KÓKAY, 1966).

*S. (S.) transylvanica* has not so far been known from Korytnica. In the Miocene of Poland, it was recorded from Małoszów (KRACH, 1947).

## Family HALIOTIDAE RAFINESQUE, 1815

### Genus HALIOTIS LINNAEUS, 1758

#### Subgenus HALIOTIS (SULCULUS) H. & A. ADAMS, 1854

#### *Haliotis (Sulculus)* sp.

(Pl. I, Figs 4-5)

**Material.** — Seven very young specimens.

**Dimensions.** — The largest, incomplete specimen, composed of about 2½ whorls is about 8 mm long.

**Remarks.** — Only a few, very young specimens, were found by the present writer in the Korytnica clays. Except for a specimen shown in Pl. I, Fig. 5, all of them are shells in which only the first two tremata are developed. The specific identification of these specimens is impossible. The only specimen with the fragmentary third whorl preserved has an ornamentation most resembling that of *H. monilifera* BONELLI (SACCO, 1877, Pl. I, Figs 9-14), but it is insufficient for a sure identification.

The shells of a gastropod of the genus *Haliotis* have not so far been known from Korytnica. Only *H. volhynica* EICHWALD from Łychów, Węglin and Węglinek (KRACH, 1962*b*; BIELECKA, 1967) are known from the Miocene of Poland.

## Superfamily FISSURELLACEA FLEMING, 1822

## Family FISSURELLIDAE FLEMING, 1822

## Genus EMARGINULA LAMARCK, 1801

**Emarginula clathrataeformis** EICHWALD, 1850

(Pl. I, Fig. 6)

1831. *Emarginula fenestrella* nov.; F. DUBOIS DE MONTPEREUX, p. 47, Pl. 3, Figs 40-41.  
 1853. *Emarginula clathrataeformis* m.; E. EICHWALD, p. 140, Pl. 6, Fig. 15.  
 1938. *Emarginula clathrataeformis* EICHW.; W. FRIEDBERG, pp. 46-47, Text-fig. 9.  
 ?1970. *Emarginula clathrataeformis* EICHW.; G. RADO & R. MUTIU, p. 147, Pl. 4, Fig. 2.

**Material.** — Five incomplete specimens.

**Description.** — Shell small, thin-walled, shaped like a low cone with oval outline of its base and its apex strongly deflected posteriorly. Protoconch helical, consisting of about one and one-third whorl turned posteriorly and distinctly separated from a conical teleoconch. About 18 fairly prominent radial ribs, with considerably smaller secondary ribs between them, make up the ornamentation of shell. In addition, there occur fairly thin concentric ribs, distinct only in the intervals between radial ribs. Projecting, spiny nodes are developed at intersections of every second (or, less frequently, third) concentric rib with the main, radial ribs. Selenizone riblike, but conspicuously projecting over the ridges of ribs.

**Remarks.** — The specimens here assigned, although incompletely preserved, are undoubtedly conspecific with those of *Emarginula clathrataeformis* EICHWALD, described by EICHWALD (1853) and FRIEDBERG (1938), as well as with those of *E. fenestrella* DUBOIS, described by DUBOIS DE MONTPEREUX (1831) from Podolia. Unfortunately, however, as the result of HÖRNES's mistake, the name *E. clathrataeformis* EICHWALD was also used for determining quite different species. Neither the species from Potzleinsdorf, Vienna Basin (HÖRNES, 1856, Pl. 50, Fig. 25), nor those from Varpalota, Hungary (STRAUSZ, 1954, Pl. 9, Fig. 182; 1966, Pl. 76, Fig. 6), nor those from Pontlevoy, Loire Basin, France (GLIBERT, 1949, Pl. 1, Fig. 6) belong to *E. clathrataeformis*. The name *E. fenestrella* introduced by DUBOIS de MONTPEREUX (1831) has never been subsequently used, and it should therefore be regarded as *nomen oblitum*.

*E. clathrataeformis* EICHWALD has not so far been mentioned from the Miocene of Poland. It was described by FRIEDBERG (1938) from Volhynia and Podolia.

**Emarginula subclathrata** d'ORBIGNY, 1852

(Pl. I, Fig. 11)

1856. *Emarginula clathrataeformis* EICHW.; M. HÖRNES, pp. 645-646, Pl. 50, Fig. 25.  
 1917. *Emarginula subclathrata* d'ORBIGNY; M. COSSMANN & A. PEYROT, pp. 57-58, Pl. 2, Figs 76-79.  
 1954. *Emarginula subclathrata* d'ORB.; I. CSEPREGHY-MEZNERICS, p. 10, Pl. 1, Fig. 3.  
 1954. *Emarginula clathrataeformis* EICHW.; L. STRAUZ, p. 8, Pl. 9, Fig. 182.  
 1966. *Emarginula clathrataeformis* EICHWALD; L. STRAUZ, p. 30, Pl. 76, Fig. 6.

**Material.** — Three incomplete specimens.

**Dimensions.** — The largest specimen is 6.5 mm long, 4.5 mm wide and 2.2 mm high.

**Description.** — Shell medium-sized, not very thin-walled, shaped like a low, conical calpac with its apex strongly deflected posteriorly. Protoconch very small, consisting of about one smooth, helical, posteriorly deflected whorl, fairly distinctly separated from a calpac-like teleoconch. Many radial and concentric ribs make up the ornamentation. Of radial ribs, 20 to 24 are more strongly developed (the main ones), with secondary and tertiary (sometimes, even incipient quaternary) ribs occurring between them. The secondary ribs are frequently almost equal in thickness to the main ones. A total number of radial ribs in the specimen illustrated (Pl. I, Fig. 11), amounts to 72. Concentric ribs, at first very thin, become gradually stronger, but never as strong as radial ones. Selenizone almost not projecting at all above the crests of ribs and having transverse lamellae not very strongly concentrated (32 in the specimen illustrated). Anal slit longer than one-third of selenizone.

**Remarks.** — The specimen described above, although incomplete but well preserved, are assigned by the writer to *Emarginula subclathrata* d'ORBIGNY. They can be considered without reservation as conspecific with those from Potzleinsdorf near Vienna (HÖRNES, 1856), from Varpalota (STRAUSZ, 1954, 1966) and Mátraverebély (CSEPREGHY-MEZNERICS, 1954) in Hungary and from Aquitaine, France (COSSMANN & PEYROT, 1917). The Austrian and Hungarian specimens mentioned above were variously determined. A unique and exceptionally large specimen from Potzleinsdorf was assigned by HÖRNES (1856) to *E. clathrataeformis* EICHWALD. However, the erroneous nature of this assignment is beyond any doubt, since *E. clathrataeformis* EICHWALD considerably differs from HÖRNES's specimen in both the shape and ornamentation of shell (see DUBOIS, 1831; EICHWALD, 1853; FRIEDBERG, 1938). Following HÖRNES's example, STRAUZ (1954, 1966) also assigned the specimens from Varpalota to *E. clathrataeformis* EICHWALD, while those from Mátraverebély were assigned by CSEPREGHY-MEZNERICS (1954) to *E. subclathrata* d'ORBIGNY on the basis of the priority of d'ORBIGNY's name only (in fact erroneously, since EICHWALD's name was first used before 1852<sup>1</sup>). Thus, both STRAUZ (1954, 1966), although not without certain doubts, and CSEPREGHY-MEZNERICS (1954) considered *E. subclathrata* d'ORBIGNY as a synonym of *E. clathrataeformis* EICHWALD. In FRIEDBERG's (1938) opinion, the two species under study pronouncedly differ from each other, but all the same he assigns the specimen from Potzleinsdorf to the synonymy of *E. clathrataeformis* (sic!).

*E. subclathrata* d'ORBIGNY has not so far been known from the Miocene of Poland.

### ***Emarginula chemnitzii* MICHELOTTI, 1847**

(Pl. I, Figs 7-9)

1897. *Emarginula chemnitzii* MICHT.; F. SACCO, p. 14, Pl. 2, Figs 14-16.

1907. *Emarginula chemnitzii* MICHTI; O. BOETTGER, p. 199, No. 671.

1949. *Emarginula clathrataeformis* EICHW.; M. GLIBERT, pp. 18-20, Pl. 1, Fig. 6.

**Material.** — Five incomplete specimens and many fragments.

**Dimensions.** — The largest specimen (Pl. I, Fig. 8) was probably about 9 mm long, 6 mm wide and 4 mm high.

<sup>1</sup>The classical monograph by EICHWALD, entitled *Lethaea Rossica*, was also published in Russian language, and its third volume appeared in 1850. This date therefore is to be recommended as the date of erection of all the species introduced in the third volume of *Lethaea Rossica*.

**Description.** — Shell medium-sized, not very thick-walled, shaped like a conical calpac with its base oval in outline and apex deflected posteriorly. Protoconch helical, consisting of about one smooth whorl fairly distinctly separated from a calpac-like teleoconch. Ornamentation prominent, consisting of radial and concentric ribs. Radial ribs appear nearly from the very apex, numbering 19–22, and, subsequently, at various distances from the apex, secondary and still later tertiary ribs are developed between them. Some of the secondary ribs reach the thickness of the main ones, the tertiary being always very thin. Concentric ribs, at first thin, gradually become thicker and thicker. Roundish nodes are developed at intersections of concentric and all radial ribs. Selenizone considerably projecting over the crests of ribs, its lateral walls looking like fairly thin and narrow lists.

**Remarks.** — The specimens presented seem to be identical with those of *Emarginula chemnitzii* MICHELOTTI described by SACCO (1897) from Northern Italy and those from the Loire Basin, assigned by GLIBERT (1949) to *E. clathrataeformis* EICHWALD. This assignment is erroneous since *E. clathrataeformis* EICHWALD differs from *E. chemnitzii* MICHELOTTI in a quite different ornamentation and shell size (see EICHWALD, 1853; FRIEDBERG, 1938). However, *E. chemnitzii* MICHELOTTI is placed by GLIBERT (1949) in the synonymy. From the Vienna-type Miocene deposits, *E. chemnitzii* is mentioned from Kostej and Bujtur, Rumunia (BOETTGER, 1907), but the specimens from these localities have not been illustrated.

*E. chemnitzii* MICHELOTTI has not so far been known from the Miocene of Poland.

### *Emarginula squammata* GRATELOUP, 1837

(Pl. I, Fig. 10)

1917. *Emarginula squamata* GRATELOUP; M. COSSMANN & A. PEYROT, pp. 58-60, Pl. 2, Figs 80-82.

**Material.** — Four incomplete specimens.

**Dimensions.** — The largest specimen (Pl. I, Fig. 10) was probably about 8 mm long, 5 mm wide and 3 mm high.

**Description.** — Shell medium-sized, fairly thin-walled, shaped like a conical calpac with its base oval in outline and apex strongly deflected posteriorly. Protoconch helical, consisting of about one smooth whorl, fairly distinctly separated from a calpac-like teleoconch. Shell more convex near the apex than on the periphery. Ornamentation of the younger part of shell fine, gradually becoming more and more conspicuous. It consists of radial ribs, numbering 20, with secondary ribs, later developed between them. Main ribs thin, at first low, gradually becoming higher and higher and taking a listlike shape. The same is the case of concentric ribs which are listlike on the periphery of shell. Spiny nodes, particularly robust on the periphery of shell are developed at the intersections of the ribs of the two systems. The margin of its base internally crenate. Selenizone fairly narrow, only slightly raised above the ridges of ribs.

**Remarks.** — The assignment of the species presented above to *Emarginula squammata* GRATELOUP does not arouse any major doubts. They are very similar in shell shape and ornamentation to the specimens from Saucats, Aquitaine (COSSMANN & PEYROT, 1917). A smaller number of main radial ribs (20) in the specimen from Korytnica as compared to 24 of that from Saucats makes up the only difference.

*E. squammata* GRATELOUP has not so far been known from the Miocene of Poland and mentioned from any locality of the Vienna-type Miocene deposits.

Genus **SCUTUS** MONTFORT, 1810**Scutus bellardii** (MICHELOTTI, 1847)

(Pl. II, Fig. 11)

1856. *Scutum Bellardii* MIGHT.; M. HÖRNES, pp. 647-648, Pl. 50, Fig. 23.1897. *Scutum Bellardii* (MIGHT) *et var.*; F. SACCO, pp. 16-18, Pl. 2, Figs 39-43.1917. *Scutum Bellardii* (MICHELOTTI); M. COSSMANN & A. PEYROT, pp. 65-66, Pl. 3, Figs 4-6.**Material.** — Four incomplete juvenile specimens.**Dimensions.** — The largest specimen (Pl. II, Fig. 11) was about 8 mm long, 3.5 mm wide and 1.2 mm high.**Description.** — Shell medium-sized, fairly thin-walled, shaped like a slightly convex shield rounded posteriorly and slightly truncate anteriorly. Protoconch very small, helical, composed of about one whorl coiled approximately in the symmetry plane of shell. Its delimitation from teleoconch fairly distinct. The younger part of teleoconch strongly convex, with protoconch situated on its posterior margin since the growth of shell is at first insignificant posteriorly and fairly strong anteriorly. When teleoconch reaches about 2.5 mm in width, the two growths become considerably equalized (consequently, protoconch "withdraws" from the posterior edge) and shell grows over its entire periphery nearly in the same plane. The outer surface of shell smooth, with growth lines only marked on it. In a more external part of shell, they look like concentric wrinkles. A very slight sinous notch is marked in the trace of growth lines in the part which corresponds to the anterior margin.**Remarks.** — Despite the fact that the specimens found are incomplete shells of juvenile individuals, their identification is unquestionable. The specimen illustrated (Pl. II, Fig. 11) very accurately conforms with the juvenile part of a specimen from Merignac, Aquitaine (COSSMANN & PEYROT, 1917, Pl. 3, Figs 4-5).*Scutus bellardii* (MICHELOTTI) has not been so far known from the Miocene of Poland.Genus **DIODORA** GRAY, 1821Subgenus **DIODORA (DIODORA)****Diodora (Diodora) graeca** (LINNAEUS, 1758)

(Pl. I, Figs 12-14)

1853. *Fissurella nodosa* m.; E. EICHWALD, p. 138, Pl. 6, Fig. 16.1856. *Fissurella Graeca* LINN.; M. HÖRNES, pp. 642-644, Pl. 50, Fig. 27.1897. *Fissurella italica* var. *parvulina* SACC.; F. SACCO, p. 10, Pl. 1, Figs 33-35.1917. *Fissurella (Lucapina) italica* DEFANCE var. *sallomacensis* nov. var.; M. COSSMANN & A. PEYROT, p. 51, Pl. 2, Figs 63-64.1928a. *Fissurella graeca* L.; W. FRIEDBERG, pp. 527-528, Pl. 34, Figs 3-5.1952. *Diodora apertura* MONTAGU; M. GLIBERT, pp. 6-7, Pl. 1, Fig. 2.1954. *Diodora graeca* (LINNÉ); I. CSEPREGHY-MEZNERICS, p. 11, Pl. 1, Fig. 4.1954. *Fissurella (Glyphis) graeca* L.; L. STRAUZ, p. 7, Pl. 9, Fig. 184.1960. *Diodora (Diodora) graeca* (LINNAEUS); E. KOJUMDGIEVA, pp. 84-85, Pl. 28, Fig. 10.1961. *Fissurella graeca* L.; N. FLOREI, p. 680, Pl. 6, Fig. 37.



1966. *Fissurella (Diodora) graeca* LINNÉ; L. STRAUZ, p. 29, Pl. 76, Figs 7-14.

1967. *Fissurella graeca* L.; M. BIELECKA, p. 132, Pl. 5, Fig. 4.

1970. *Fissurella (Diodora) graeca* L.; G. RADO & R. MUTIU, p. 147, Pl. 4, Fig. 1.

**Material.** — Eighty, mostly juvenile specimens.

**Dimensions.** — The largest incomplete specimen (Pl. I, Fig. 14) was about 18 mm long, 13 mm wide and 7 mm high.

**Description.** — Shell medium-sized, fairly thick-walled, shaped like conical calpac with its base oval in outline and with an opening on apex. Protoconch (preserved in juvenile specimens only) helical, consisting of about one smooth whorl facing posteriorly and fairly distinctly separated from a calpac-like teleoconch. Opening shaped like the figure 8, in juvenile specimens situated subcentrally, in adults—following a stronger growth of shell in the posterior part—situated nearer the anterior margin. The inclination of the slopes of shell irregular, steeper anteriorly. Shell ornamentation prominent, formed by numerous radial and concentric ribs. Radial ribs appear near the apex, their number amounting here from 18 to 20. Later on, there appear secondary and, in adults, also tertiary ribs. The difference in rib thickness gradually diminishes but is always distinct. Concentric ribs, at first fairly thin, gradually become thicker. Roundish nodes are formed at the intersections of both ribbing systems. The periphery of shell internally crenulate. Opening internally rimmed by a roller-like callus, rounded anteriorly and truncate posteriorly.

**Remarks.** — The specimens described belong to the Miocene species *Diodora (Diodora) graeca* (LINNAEUS) and do not differ at all from those from other localities. Characteristically, the Korytnica clays contain only juvenile specimens, much the same as in the environs of Kostej and Lapugy, Rumania.

*D. (D.) graeca* (LINNAEUS) was mentioned from Korytnica by FRIEDBERG (1928*a*, 1938) and KOWALEWSKI (1930). In the Miocene of Poland, this species was recorded from Małoszów (KRACH, 1947), Rybnica (KOWALEWSKI, 1950), Nawodzice (BALUK & RADWAŃSKI, 1968), Łychów, Węglin and Węglinek (KRACH, 1962*b*; BIELECKA, 1967) and Babica (FRIEDBERG, 1938).

### ***Diodora (Diodora) ornata* (REUSS, 1860)**

(Pl. I, Figs 15-16)

1860. *Cemoria ornata* m. n. sp.; A. E. REUSS, p. 261, Pl. 7, Fig. 5.

**Material.** — Two specimens.

**Dimensions.** — The larger specimen is about 2.8 mm long, 2.0 mm wide and 1.2 mm high.

**Description.** — Shell small, not very thin-walled, shaped like a conical calpac with its base oval in outline and with opening on apex. Protoconch helical, consisting of about one smooth whorl turned posteriorly and fairly distinctly separated from a calpac-like teleoconch. Trema 8-shaped in outline, internally rimmed by a roller-like callus rounded anteriorly and truncate posteriorly. A short (almost equal in length to trema) but a very typical selenizone runs anteriorly over the outer surface of shell in extension of trema. Ornamentation formed by radial and concentric ribs. The number of radial ribs running from apex amounts to 21 or 22, with secondary ribs occurring between them. Near apex, concentric ribs are very fine and more

outer ones thicker. Roundish nodes are developed at the intersections of both ribbing systems. Shell periphery internally crenulate. Except for callus none other shelly elements occur on the inner side.

**Remarks.** — The identification of the specimens described above is very difficult. The presence of selenizone causes that shells resemble in their outer look the genus *Puncturella* LOWE, 1827 (= *Cemoria* LEACH, 1852), but the lack on the inner side of a shelly plate and the occurrence of a typical callus near trema indicate that these shells belong to the genus *Diodora* GRAY, 1821. The shells, found in the Korytnica clays, are very similar to *D. (D.) graeca* (LINNAEUS), but differ in the presence of selenizone, in apex more deflected posteriorly (together with protoconch) and in a more convex (“hunch-backed”) posterior slope. They are likely to be conspecific with species described by REUSS (1860) from Rudoltice, Czechoslovakia under the name *Cemoria ornata* REUSS. However, no illustration showing the interior of shell was presented by this author.

*D. (D.) ornata* (REUSS) has not so far been known from the Miocene of Poland.

### Genus **FISSURELLIDEA** d'ORBIGNY, 1841

#### Subgenus **FISSURELLIDEA (FISSURELLIDEA)**

#### **Fissurellidea (Fissurellidea) clypeata** (GRATELOUP, 1827)

(Pl. II, Figs 12-16)

1856. *Fissurella clypeata* GRAT.; M. HÖRNES, p. 644, Pl. 50, Fig. 26.  
 1897. *Fissurellidea clypeata* (GRAT.); F. SACCO, p. 12, Pl. 1, Fig. 48.  
 1897. *Fissurellidea clypeata* var. *tapina* (DE GREG.); F. SACCO, p. 12 Pl. 1, Figs 49-50.  
 1917. *Fissurellidea (Pupilia) clypeata* (GRATELOUP); M. COSSMANN & A. PEYROT, pp. 52-54, Pl. 2, Figs 67-73.  
 1917. *Fissurellidea (Pupilia) clypeata* (GRATELOUP) mut. *tapina* DE GREGORIO; M. COSSMANN & A. PEYROT, pp. 54-55, Pl. 2, Figs 74-75.  
 1949. *Fissurellidea clypeata* GRATELOUP; M. GLIBERT, pp. 29-30, Pl. 1, Fig. 13.  
 1954. *Fissurellidea (Papillaea) clypeata tapina* DE GREG.; I. CSEPREGHY-MEZNERICS, p. 11, Pl. 1, Fig. 11.  
 1954. *Fissurella (Fissurellidea) clypeata* GRAT.; L. STRAUZ, p. 7, Pl. 9, Fig. 185.  
 1960. *Fissurellidea clypeata* var. *tapina* (GREGORIO); E. KOJUMDIEVA, p. 85, Pl. 28, Fig. 11.  
 1961. *Fissurellidae (Papillaea) clypeata* GRATELOUP; J. MARINESCU, p. 515, Pl. 1, Fig. 1.  
 1966. *Fissurella (Fissurellidea) clypeata* GRATELOUP; L. STRAUZ, p. 28, Pl. 76, Figs 17-19.

**Material.** — A hundred and thirty mostly juvenile specimens.

**Dimensions.** — The largest specimen (Pl. II, Fig. 16) is about 12.5 mm long, 6.5 mm wide and 2.6 mm high.

**Description.** — Shell medium-sized, thin-walled, shaped like a very low, conical calpac with its base suboval but considerably elongate in outline and a relatively large trema on apex. Shell the widest somewhat posteriorly of apex. Protoconch preserved only in juvenile specimens, spirally coiled approximately in the plane of symmetry of shell, consisting of about one smooth and lustrous whorl deflected posteriorly. Its boundary with a calpac-like teleoconch very distinct. The inclination of shell slopes variable, near apex always larger than on periphery. In addition, in juvenile specimens slope is always steeper and consequently such shells are relatively higher. At the base, shell periphery situated in different planes but both anteriorly and posteriorly upturned. Trema oval, internally rimmed by callus. In juvenile specimens, trema is formed in the anterior part of protoconch and adjoins it, in older ones increases by the resorption

of shell. On the outer surface of shell ornamentation poorly developed. In juvenile specimens, this surface is provided with very fine and very closely spaced striae, in older ones slight, sometimes hardly visible and not very regular radial ribs are developed. Traces of coloration preserved in many specimens. These are mostly more or less regular, continuous, broken or radially bifurcating pink bands against a light background, less frequently small pink spots against a light background or vice-versa white spots against a pink background.

**Remarks.** — The specimens presented do not differ at all from shells described from various localities under the name *Fissurellidea clypeata tapina* (DE GREGORIO). In the writer's opinion, there is no sufficient basis for separating this subspecies and, therefore, the same as STRAUZ (1966), he assigns them to *F. clypeata* (GRATELOUP).

This species has not so far been known from Korytnica. In the Miocene of Poland, it is mentioned from Małoszów (KRACH, 1947).

## Superfamily PATELLACEA RAFINESQUE, 1815

### Family ACMAEIDAE CARPENTER, 1857

#### Genus ACMAEA ESCHSCHOLTZ, 1833

#### Subgenus ACMAEA (TECTURA) GRAY, 1847

#### *Acmaea* (*Tectura*) *friedbergi* sp. n.

(Pl. II, Figs 9-10)

1928a. *Tectura compressiuscula* EICHW.; W. FRIEDBERG, pp. 534-535, Pl. 35, Fig. 6.

*Holotype*: Pl. II, Fig. 10 (Z.PAL.U.W., No BkK-G 24).

*Type horizon*: Lower Tortonian (= Lower Badenian).

*Type locality*: Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.

*Derivation of the name*: in honour of the late Professor WILHELM FRIEDBERG.

**Diagnosis.** — Shell small, conical, its apex nearer the anterior margin, surface ornamented by slight radial ribs.

**Material.** — Sixteen specimens.

**Dimensions.** — The largest specimen 1.8 mm long, 1.5 mm wide and 0.7 mm high.

**Description.** — Shell small, thin-walled, shaped like a conical calpac with an oval base. Protoconch invisible. Apex eccentrically situated, somewhat nearer the anterior margin of shell and slightly deflected anteriorly. Anterior part more steeply sloping than posterior. Outer surface ornamented by many but very poorly marked radial ribs. Inner surface smooth, lustrous; muscle scar invisible.

**Remarks.** — Here assigned specimens from Korytnica may be considered conspecific with those described by FRIEDBERG (1928a) from Podolia under the name *Tectura compressiuscula* EICHWALD. Since the description and illustrations of *T. compressiuscula* EICHWALD concern other specimens of differently looking shells, which was also pointed out by FRIEDBERG (1928a), the writer does not assign the Korytnica specimens to *T. compressiuscula* but erects for them a new species called *A. (T.) friedbergi* sp. n. This species differs from *A. (T.) compress-*

*siuscula* (EICHWALD) in a lower shell and the presence of ornamentation in the form of radial ribs. *A.(T.) friedbergi* sp. n. is likely to include also the specimens from Varpalota, Hungary, determined by STRAUZ (1966) as *Acmaea* sp.

Superfamily TROCHACEA RAFINESQUE, 1815

Family TROCHIDAE RAFINESQUE, 1815

Genus EUCHELUS PHILIPPI, 1847

***Euchelus fragilis* sp. n.**

(Pl. V, Fig. 7)

*Holotype*: Pl. V, Fig. 7 (Z.PAL.U.W. No BkK-G 25).

*Type horizon*: Lower Tortonian (= Lower Badenian).

*Type locality*: Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.

*Derivation of the name*: *L. fragilis*, after a considerable fragility of its shell.

**Diagnosis.** — Shell conical, flattened at the apex, whorls ornamented by four spiral ribs and many, somewhat obliquely running, axial ribs.

**Material.** — Six more or less incomplete specimens.

**Dimensions.** — The largest specimen about 2.5 mm high and wide.

**Description.** — Shell small, not very thin-walled, very fragile, conical, with a flattened apex. Protoconch formed by a convex and smooth whorl, distinctly separated from the rest of shell. Teleoconch reaches a size of about four whorls separated from each other by deep sutures. The first whorl is coiled nearly in the same plane with protoconch, which does not project above it at all. It is convex, rounded in profile and without edges on periphery. Further whorls coiled trochospirally with a not very sharp edge developed on their periphery. Shell base slightly flattened. Shell ornamentation very distinct, appearing as early as on the boundary with protoconch. It consists of sharp, very thin, threadlike axial ribs (fifteen of them on each whorl) and very fine, closely spaced, spiral striae occurring only between axial ribs. Beginning with the second whorl, the axial ribs become more and more prominent, taking the form of narrow lists running somewhat obliquely. The number of these ribs on the later whorls of teleoconch amounts to about 25. Beginning with the second whorl, spiral striae are replaced by four spiral ribs, the lowermost of them being the strongest. Spinose nodes are developed at the intersections of axial and spiral ribs. The base of shell (strongly damaged in all specimens) is also provided with spiral ribs (five?), along with the extensions of axial ribs. The lowermost rib, situated on the periphery of umbilicus, is slightly tuberculate. Aperture destroyed in all specimens. Umbilicus open, fairly narrow and not very deep.

**Remarks.** — Within the gastropod assemblage of the Neogene of Europe, the writer does not know any species whose shells would be similar to those described above. *Monodonta pygmaea* COSSMANN & PEYROT from the Miocene of Aquitaine (see COSSMANN & PEYROT, 1917, Pl. 3, Figs 53-55) seems slightly similar, but its shells are considerably more thick-walled and devoid of umbilicus. The genus *Euchelus* PHILIPPI, 1847 has hitherto been known only from the Indo-Pacific Province (KNIGHT *et al.*, 1960). The specimens from Korytnica are more similar to those described by LADD (1966) as *E. (Vaceuchelus)* sp. A from the Eniwetok Atoll in the

Pacific and this induced the writer to assign them to the genus *Euchelus*. *Euchelus fragilis* sp. n. differs from the above mentioned *E. (V.)* sp. A in a slightly different degree of development of spiral ribs, in particular of the uppermost one, which in the Korytnica specimens is distinctly lower.

Genus **DILOMA** PHILIPPI, 1845

Subgenus **DILOMA (PAROXYSTELE)** SCHULTZ, 1969

**Diloma (Paroxysteles) amedei** (BRONGNIART, 1823)

(Pl. VI, Fig. 8)

1856. *Trochus patulus* BROCC.; M. HÖRNES, pp. 458-460, *partim*.

1912. *Trochus (Oxysteles) Amedei* BRONGN.; F. X. SCHAFFER, p. 171, Pl. 54, Figs 36-39.

**Material.** — One specimen.

**Dimensions.** — Height, 14 mm, width, 20 mm.

**Description.** — Shell medium-sized, fairly thick-walled, shaped like a low cone. Protoconch not preserved. Teleoconch consisting of six convex whorls separated from each other by deep sutures. A slight flattening may be observed only in the upper part of the third and fourth whorl. The last whorl is rounded on periphery and has a slightly flattened base. Ornamentation not very prominent, formed by many spiral ribs. Four of them appear half-way the second whorl, the uppermost one slightly withdrawn from the upper suture. Due to the development of secondary ribs which, however, rapidly reach the thickness of the main ones, their number increases to 14 on the last whorl. At the base, there also occur spiral ribs (ten of them) similar in thickness but flatter. Aperture very oblique, wide and quadrangular in outline. Outer lip on the margin rather thin, internally smooth. Inner lip near the posterior part of aperture has a sinuate notch and is provided on columella with an elongate and sharp tooth. Umbilicus filled with a large, semicircular callus. A not very deep furrow, terminating in slitlike orifice which penetrates under callus and reaches umbilicus, occurs between callus and base. Traces of coloration, in the form of light-brown spots irregularly spaced close to the upper suture, zig-zag lines on periphery and fine spots on base, are preserved on the shell.

**Remarks.** — It is not easy to identify this specimen. In shape and ornamentation it seems to be similar to those of *Diloma (Paroxysteles) amedei* (BRONGNIART) from Eggenburg, Vienna Basin (Schaffer, 1912). *D. (P.) amedei* (BRONGNIART) happens, however, to be treated by most researchers, following HÖRNES'S (1856) example, as a synonym of *D. (P.) orientalis* (COSSMANN & PEYROT). It seems, however, that the differences between these species, expressed in a lower shell and convex whorls in *D. (P.) amedei* (BRONGNIART) are sufficiently distinct to indicate a separate species. This opinion is shared by SCHULTZ (1969, 1971), who, after detailed studies on the subgenus *Diloma (Paroxysteles)* SCHULTZ, 1969 from the Neogene deposits of Europe, considers *D. (P.) amedei* (BRONGNIART) and *D. (P.) orientalis* (COSSMANN & PEYROT) as separate species and even distinguishes subspecies within their range. However, the detailed results of SCHULTZ'S studies have not so far been published. The specimen from Korytnica is also similar in shape to *D. (P.) burdigalensis* (COSSMANN & PEYROT), but differs from it in a slightly different ornamentation, that is, its ribs are not differentiated distinctly and visibly into main and secondary ones as is the case in the specimens from Aquitaine (COSSMANN & PEYROT, 1917, Pl. 3, Figs 66-69).

*D. (P.) amedei* (BRONGNIART) has not so far been known from the Miocene of Poland.

**Diloma (Paroxysteles) orientalis** (COSSMANN & PEYROT, 1917)

(Pl. VI, Fig. 9)

1853. *Trochus patulus* BROCCH.; E. EICHWALD, pp. 216-218, Pl. 9, Fig. 5.  
 1856. *Trochus patulus* BROCC.; M. HÖRNES, pp. 458-460, Pl. 45, Fig. 14.  
 1928a. *Oxysteles orientalis* COSSM. & PEYR.; W. FRIEDBERG, pp. 516-518, Pl. 33, Figs 4-7.  
 1960. *Oxysteles orientalis* COSSMANN & PEYROT; E. KOJUMDGIEVA, p. 87, Pl. 29, Fig. 1.  
 1961. *Oxysteles orientalis* COSM. & PEYR.; N. FLOREI, p. 680, Pl. 6, Fig. 36.  
 1961. *Diloma (Oxysteles) orientalis* (COSSMANN & PEYROT); L. HINCULOV, p. 119, Pl. 27, Figs 1-5.  
 1969. *Oxysteles orientalis* COSSMANN & PEYROT; M. A. ATANACKOVIĆ, p. 191, Pl. 8, Fig. 1.  
 1970. *Oxysteles orientalis* COSSMANN & PEYROT; W. BAŁUK, p. 117, Pl. 8, Fig. 7.  
 1971a. *Oxysteles orientalis* COSSMANN & PEYROT; M. EREMJA, p. 65, Pl. 6, Fig. 9.

**Material.** — One specimen.

**Dimensions.** — Height, 15 mm, width, 18 mm.

**Description.** — Shell medium-sized, fairly thick-walled, shaped like a cone somewhat tierlike in outline. Protoconch not preserved. Teleoconch consisting of about six and a half whorls, of which the early ones are slightly convex and the rest nearly flat. On periphery the last whorl is rounded and at the base somewhat flattened. Ornamentation consists of not very prominent spiral ribs. At first, there are four of them, later, following the formation of secondary ribs, their number increases to reach eleven on the last whorl. Ten strongly flattened spiral ribs run over the base. Aperture destroyed. Umbilicus filled with a prominent, semicircular callus, on whose rim there occurs a furrow extended to form a slitlike aperture penetrating under callus and reaching umbilicus.

**Remarks.** — The specimen under study may be assigned without major doubts to the *Diloma (Paroxysteles) orientalis* (COSSMANN & PEYROT) common in Miocene deposits. It considerably resembles those described by FRIEDBERG (1928a) from Podolia and Volhynia, in particular that from Zborów (FRIEDBERG, 1928a, Pl. 33, Fig. 7). As compared with *D. (P.) amedei* (BRONGNIART), its shell is higher and tierlike in outline, and its whorls are flatter.

*D. (P.) orientalis* (COSSMANN & PEYROT) has not so far been known from Korytnica. In the Miocene of Poland it was recorded from Gaszowice (KRACH, 1939), Gliwice Stare (KRACH, 1954), Nawodzice (BAŁUK & RADWAŃSKI, 1968), Łychów, Węglinek and Mniszek (KRACH, 1962b; BIELECKA, 1967), environs of Józefów (AREŃ, 1962), Bogucice (FRIEDBERG, 1928a, 1938; LISZKA, 1933), Niskowa (FRIEDBERG, 1928a, 1938; SKOCZYLAŚÓWNA, 1930; BAŁUK, 1970), Skoczów (KRACH, 1974) and Babica (FRIEDBERG, 1928a).

Genus **GIBBULA** RISSO, 1826

Subgenus **GIBBULA (GIBBULA)**

**Gibbula (Gibbula) buchi** (DUBOIS, 1831)

(Pl. IV, Figs 4-7)

1831. *Trochus Buchi* nov.; F. DUBOIS DE MONTPEREUX, pp. 39-40, Pl. 3, Figs 9-11.  
 1856. *Trochus fanulum* GMEL.; M. HÖRNES, pp. 446-447, *partim. Excl. fig.*  
 1882. *Trochus Buchi* DU BOIS; V. HILBER, pp. 10-11, Pl. 1, Fig. 22.  
 1928a. *Gibbula Buchi* DUB.; W. FRIEDBERG, pp. 480-482, Pl. 30, Figs 8-14.

1954. *Gibbula buchi* DUB.; L. STRAUZ, p. 8, Pl. 6, Fig. 137.

1954. *Gibbula (Forskalea) buchi* DUBOIS; I. CSEPREGHY-MEZNERICS, p. 13, Pl. 1, Fig. 12.

1966. *Gibbula buchi* DUBOIS; L. STRAUZ, p. 37, Pl. 53, Figs 4-9.

**Material.** — Eighty specimens.

**Dimensions.** — The largest specimen is 8.0 mm high and 9.0 mm wide.

**Description.** — Shell medium-sized, fairly thick-walled, shaped like a cone distinctly tierlike in outline and with an apical angle of about 70°. Protoconch probably consisting of one and a half whorls, but no distinct boundary with teleoconch is visible even on excellently preserved specimens. As a whole, shell reaches  $7\frac{1}{2}$  whorls. The early one and a half whorls are convex and quite smooth. Further are distinctly and variably ornamentated. At first, there appear five delicate spiral ribs and one prominent, sharp spiral rib which runs at the bottom of whorl on its periphery. Beginning with the third whorl, two spiral furrows appear between them one over the lower rib and the other between three upper and two middle ribs. The upper ribs become considerably more robust on later whorls, with secondary ribs appearing between them. In addition, a row of robust tubercles is developed in this part of whorl, resulting in a terlike outline of shell. The number of tubercles on the last whorl amounts to 11 to 14. Smaller, but more numerous (25 to 28 on the last whorl) tubercles are also developed on the middle ribs. Finally, the lower rib, forming the margin, also becomes more robust and crenulate. In addition to spiral ornamentation, the whorls also display, at first numerous and thin and further on less regular oblique ribs, particularly strongly developed in the two furrows mentioned above. Shell base flattened. Prominent, nearly quite smooth spiral striae (nine to eleven of them), separated by deep grooves in which sharp growth lines are marked, run towards the base. Outer lip sharp on edge, smooth inside, without lists. Inner lip slightly introverted towards umbilicus, with a distinct fold on columella. Umbilicus open, sharply separated from base, fairly narrow but very deep.

**Remarks.** — It is beyond any doubt that the specimens here presented do not differ from those of *Gibbula buchi* (DUBOIS) described by HILBER (1882) from Podhorce and by CSEPREGHY-MEZNERICS (1954) from Mátraverebély, Hungary. As compared to specimens of this species from other localities, the Korytnica ones display smaller or larger differences in the size, shape and ornamentation. It seems, however, that all these differences should be treated as a symptom of a considerable specific variability, probably related with different facial conditions in particular localities. The correctness of this hypothesis is indicated by the fact that there is a surprisingly small variability among the specimens coming from one and the same locality, including Korytnica. The view on a considerable variability of the species in question has already been noted by HÖRNES (1856) who, however, treated this species too broadly. Maybe, here also belong *Gibbula (Forskalia) fanulum cingulifera* (BRONN), mentioned, but unfortunately not illustrated, by BOETTGER (1907) from Kosteĵ, Rumania. This assumption is, however, founded by the writer only on considerable analogies occurring between the gastropods from Korytnica and Kosteĵ, as *G. (F.) fanulum cingulifera* from the Miocene of Northern Italy (SACCO, 1896, Pl. 3, Fig. 43) is certainly a different species. A species also similar to the Korytnica specimens is probably *Gibbula pseudomagus* (d'ORBIGNY) from the Miocene of Aquitaine (see COSSMANN & PEYROT, 1917, Pl. 3, Figs 63-66), but it has a differently developed ornamentation of the middle part of whorls. The assignment of *G. buchi* (DUBOIS) to a proper subgenus poses a separate problem. CSEPREGHY-MEZNERICS (1954) and SIEBER (1958) assign it to *Gibbula (Forskaelena)* IREDALE, 1918. This view seems to the present writer to be incorrect and he assigns this species to *Gibbula*

(*Gibbula*) RISSO, 1826, for the specimens from Korytnica resemble to a considerably larger degree *Gibbula (Gibbula) magus* (LINNAEUS), which is a type species of *Gibbula (Gibbula)*, rather than *Gibbula (Forskaelena) fanulum* (GMELIN) being a type species of *Gibbula (Forskaelena)*.

*G. (G.) buchi* (DUBOIS) has not so far been known from Korytnica. In the Miocene deposits of Poland it was recorded, on the other hand, from Bogucice (FRIEDBERG, 1928*a*; LISZKA, 1933), environs of Józefów (AREŃ, 1962) and — with certain doubts — from Węglin and Trzydnik (KRACH, 1950*b*; 1962*b*).

### ***Gibbula (Gibbula) podhorcensis* (FRIEDBERG, 1928)**

(Pl. III, Figs 2-3)

1928*a*. *Pseudonina* (?) *podhorcensis* FRIEDB.; W. FRIEDBERG, pp. 519-520, Pl. 33, Fig. 9.

**Material.** — Forty-five specimens.

**Dimensions.** — The largest specimen (Pl. II, Fig. 3) is 4.2 mm high and 5.1 mm wide.

**Description.** — Shell small, not very thick-walled, shaped like a low cone conspicuously tierlike in outline, with an apical angle of 120° to 125°. Protoconch formed by an incomplete whorl, only slightly separated from others. Teleoconch reaching four whorls, the first of them convex, further ones angularly bent as the result of a sharp edge developed in their upper part. Another, also sharp edge occurs on periphery. Above the upper edge, whorls are flat, slightly sloping in a tierlike manner and between the edges somewhat concave. Shell base convex. Ornamentation delicate, formed by thin, spiral striae, usually appearing not earlier than half-way the third whorl of teleoconch. Earlier whorls nearly quite smooth, except for poorly visible growth lines. At first few, spiral striae increase their number later as new ones appear, and reach about ten each above the upper edge and between edges and 22 to 25 on the base. Aperture wide, oblique, oval in outline. Outer lip not very thick, sharp on the edge, smooth inside. Inner lip relatively thick, slightly turned down towards umbilicus. Columellar fold rather large. Umbilicus open, deep but not very wide (in juvenile specimens relatively wider), distinctly separated, with a shallow troughlike depression running on its periphery. Traces of coloration are preserved in most specimens in the form of fairly wide, light-brown, regularly spaced and axially running bands.

**Remarks.** — The conspecificity of here presented specimens with a shell described by FRIEDBERG (1928*a*) as *Pseudonina* (?) *podhorcensis* FRIEDBERG does not arouse doubts. Having at his disposal only one specimen from Podhorce, Podolia, that author was not sure as to the generic assignment of this form. Adult specimens, recently found at Korytnica, allow the present writer to assign this species to the genus *Gibbula* RISSO. At the first glance, the species under study is similar to both *Gibbula biangulata* (EICHWALD) and to specimens from Korytnica described below as *Gibbula* cf. *varia* (LINNAEUS), but differs from them so distinctly that its separation is fully justified. From the former of the two species mentioned above it differs in the lack of prominent spiral ribs along the edges and in a more obtuse apical angle (see FRIEDBERG, 1928*a*, Pl. 30, Fig. 20) and from the latter in a quite different development of early whorls of teleoconch and in a different type of the ornamentation of base.

This species has not so far been known from the Miocene of Poland.



***Gibbula (Gibbula) cf. varia* (LINNAEUS, 1766)**

(Pl. III, Fig. 1)

1965. *Gibbula (Gibbula) varia* (L.); G. RUGGIERI & GRECO, p. 52, Pl. 4, Fig. 4.**Material.** — Seven juvenile or incomplete specimens.**Dimensions.** — The largest specimens is about 4 mm high and about 4.5 mm wide.

**Description.** — Shell small (?), not very thick-walled, shaped like a low cone tierlike in outline. Protoconch formed by about one, convex, smooth and lustrous whorl. Teleoconch in the largest of all specimens found consists of about four and one-third whorls, of which two early ones are convex, and the rest of them provided in the upper part with a rounded edge. Another, much sharper edge runs on the periphery of shell. Between the edges whorls are slightly concave. Shell base strongly convex. Ornamentation formed by inconspicuous spiral striae separated from each other by narrow and shallow grooves. At first four to five, later on, resulting from the development of secondary ones, the number of striae increases to 16. In addition, relatively prominent axial ribs occur on the first whorl of teleoconch and consequently this part of shell has a distinctly criss-cross surface. In a further part of teleoconch, ribs rapidly fade out, replaced by thin and closely spaced striae conformable with growth lines. Shell base provided with many (about fifteen) delicate spiral grooves. Aperture not preserved in any of the specimens. Umbilicus open, distinctly separated from base, not very wide, but deep, with a troughlike depression marked on its periphery.

**Remarks.** — Due to the scarcity of material, the identification of the specimens described is not certain. The shells of the Recent species *Gibbula (Gibbula) varia* (LINNAEUS) do not differ in general outline from those found at Korytnica, but are considerably larger. It is beyond any doubt that the specimens determined as *C. (C.) cf. varia* are different than all other species of the genus *Gibbula* RISSO presented by the writer in this paper. They are similar to *Gibbula (Gibbula) podhorcensis* (FRIEDBERG), but differ from them so conspicuously in a different development of upper edge and ornamentation on the early part of teleoconch that their separation is beyond argument.

Four juvenile specimens of *Gibbula (Phorculellus) aff. varia* (L.) are mentioned from Kosteĵ by BOETTGER (1907) who maintains that they are separate from the rest of the local species. Unfortunately, his specimens are not illustrated.

This species has not so far been known from the Miocene of Poland.

***Gibbula (Gibbula) mimula* BOETTGER, 1907**

(Pl. IV, Fig. 6)

1907. *Gibbula (Phorculellus) mimula* n. sp.; O. BOETTGER, p. 180, No. 622.1934. *Gibbula (Colliculus) mimula* (BOETTGER); A. ZILCH, p. 201, Pl. 2, Fig. 30.1970. *Gibbula dzieduszyckii* FRIEDBERG; W. BAŁUK, p. 117, Pl. 8, Fig. 6.**Material.** — One specimen.**Dimensions.** — Height, 5.2 mm, width, 6.5 mm.

**Description.** — Shell medium-sized, fairly thick-walled, shaped like a low cone tierlike in outline and with an apical angle of 100°. Protoconch probably formed by one and a half

smooth and convex whorl; its boundary with teleoconch indistinct. Teleoconch formed by four and a half whorls, the first of them convex, the rest angularly bent as the result of the development of a sharp edge in their upper part. Above the edge, whorls are flat, horizontal or only gently sloping, while below it they are very steep. Another, not so sharp edge occurs on the periphery of the last whorl. Between the edges, the whorl is flat, not concave. Shell base slightly convex. Ornamentation consists of many spiral striae varying in thickness. At first, there are four of them, all uniformly thin. Then, their number considerably increases and some of them grow thicker, in particular the rib running along the lower edge and two others between edges. Ten, almost equally wide spiral ribs, each of them divided by a shallow groove into two parts (one of them even into three parts), run at the base. Aperture quadrangular in outline, obliquely situated. Outer lip sharp on the edge, smooth inside. Inner lip considerably thicker posteriorly, slightly turned down towards umbilicus and provided with a relatively robust columellar tooth. Umbilicus open, roundish, rather narrow but very deep, with a flat roller developed inside. The specimen bears traces of brown coloration in the form of white spots.

**Remarks.** — The assignment of the specimen described to *Gibbula (Gibbula) mimula* BOETTGER is beyond doubt. Compared with the lectotype of the species (see ZILCH, 1934), it does not display any essential differences, except for the fact that its lower edge is visible on the last whorl only, while in the lectotype also on the last but one. In addition, the specimen from Korytnica is more advanced in growth, its shell being larger by nearly a complete whorl.

This species has not so far been known from Korytnica and mentioned from any other Miocene locality in Poland, although it occurs at Niskowa. Quite similar a specimen, but somewhat larger and having less developed lower edge, has previously been assigned erroneously by the writer (BALUK, 1970) to *Gibbula dzieduszyckii* FRIEDBERG.

#### Subgenus **GIBBULA (COLLICULUS)** MONTEROSATO, 1888

##### **Gibbula (Colliculus) pseudangulata** BOETTGER, 1907

(Pl. III, Figs 4-7)

1856. *Monodonta angulata* E. H. W.; M. HÖRNES, p. 439, Pl. 44, Figs 9-10.

1907. *Gibbula (Colliculus) pseudangulata* n. sp.; O. BOETTGER, p. 181, No. 627.

1928a. *Gibbula affinis* EICHW. var. *pseudangulata* BOETTGER; W. FRIEDBERG, pp. 491-492, *partim, excl. figs.*

1934. *Gibbula (Colliculus) pseudangulata* BOETTGER; A. ZILCH, p. 201, Pl. 2, Fig. 27.

1970. *Gibbula affinis pseudangulata* (BOETTGER). W. BALUK, p. 117, Pl. 8, Fig. 5.

**Material.** — Ninety specimens.

**Dimensions.** — The largest complete specimen is 7.5 mm high and 6.5 mm wide. Another, preserved only as two later whorls, reaches a width of 7.2 mm.

**Description.** — Shell medium-sized, fairly thick-walled, shaped like a low cone with an apical angle amounting mostly to 80° to 85° (75° and 93° recorded as exceptions). Protoconch formed by a convex and quite smooth whorl. Teleoconch reaching to six whorls, of which the early ones are more convex than the later. A slight concavity is marked in the lower part of middle whorls. Periphery always provided with a more or less sharp edge. Shell base slightly convex. Ornamentation formed by many, rather thin, spiral ribs. Four of them appear at first, the lowermost one running along the edge. Secondary ribs start developing with the second whorl of teleoconch, two of them above the upper cardinal rib, one each above the middle ribs

and, less frequently, also one above the lower rib which, however, always splits in two. Secondary ribs rapidly reach the thickness of main ones, so that on two or three later whorls there run nine (less frequently ten) almost identical ribs. On later whorls of few specimens some, or even all, ribs are divided by a shallow, longitudinal groove, into two unequal parts. Shell base is also provided with many (10 to 13) spiral ribs, sometimes varying in thickness. Over the entire shell, oblique, closely spaced and thin growth lines run in grooves between ribs. Aperture quadrangular, obliquely oriented. Outer lip thin on edge, close behind it thickened inside and provided with poorly visible lists. Inner lip slightly turned down towards umbilicus and provided with a fairly robust columellar fold. Umbilicus open, deep, but not very wide. In some specimens, traces of coloration are preserved in the form of wide brown streaks stretching from suture to suture and fine spots on the edge and base.

**Remarks.** — The conspecificity of the specimens described with those described by HÖRNES (1856) and BOETTGER (1907) is beyond any doubt. The only exception is a specimen whose apical angle reaches  $93^\circ$  and, in this respect, considerably departs from the rest of them. In other characters, this specimen seems, however, not to differ from them and, therefore, the writer does not distinguish it as a separate species. Similar specimens were described by earlier authors, under the name *Trochus angulatus* EICHWALD, but, as shown later (see FRIEDBERG, 1928a, pp. 488 and 491), this name had previously been used for other shells. FRIEDBERG (1928a, 1938) believed that *Gibbula pseudangulata* BOETTGER is very closely related to *Gibbula affinis* (EICHWALD) and treated it only as a subspecies of the latter. The present writer disagrees with this view and considers *Gibbula (Colliculus) pseudangulata* BOETTGER as a separate species.

*Gibbula (Colliculus) pseudangulata* BOETTGER has not so far been known from Korytnica. It is a species frequently met with in other Miocene localities of Poland. In view, however, of a variable understanding of this species, it is difficult to decide which of the recordings concern specimens analogous to those from Korytnica. Indubitably conspecific with the Korytnica specimens are those from Niskowa (FRIEDBERG, 1928a, 1938; SKOCZYLAŚÓWNA, 1930; BALUK, 1970).

#### ***Gibbula (Colliculus) subscalata* (BOETTGER, 1907)**

(Pl. IV, Fig. 7)

1907. *Gibbula (Phorculellus) subscalata* n. sp.; O. BOETTGER, p. 180, No. 624.

1934. *Gibbula (Colliculus) subscalata* (BOETTGER); A. ZILCH, pp. 201-202, Pl. 2, Fig. 31.

**Material.** — Forty-five specimens.

**Dimensions.** — The largest specimen (Pl. IV, Fig. 7) is 5.0 mm high and 4.8 mm wide.

**Description.** — Shell small, relatively thin-walled, very fragile, conical, tierlike in outline and with an apical angle of about  $56^\circ$  to  $88^\circ$ . Protoconch formed by somewhat more than one smooth and convex whorl. Teleoconch reaching five and a quarter whorls, the first or the first two of which are convex and further one provided in the upper part with a sharp edge. Above the edge shell is flat and nearly horizontal — only very slightly convex, very steep. On later (fourth or fifth) whorls, this edge gradually fades out. Another, also sharp edge runs on periphery. Shell base slightly convex. Ornamentation consisting of spiral ribs and oblique, thin and sharp striae running in conformity with growth lines. Ribs at first very delicate. Three of them appear at first and later on their number increases to six or seven. The first or the two first of them are the least developed and run above the upper edge. Further ones uniform in

thickness and regularly spaced. The last rib, running along the peripheral edge, is the thickest and divided by a shallow, longitudinal groove into two parts (very rarely into three parts). Shell base is also provided with spiral ribs (eight to ten in all), of which only two or three, situated near umbilicus, are distinctly narrower. Sharp growth lines are especially strongly developed in intercostal spaces. Aperture obliquely oriented, distinctly quadrangular in outline. Outer lip smooth inside, inner — thin, arcuate, bent towards umbilicus. Columellar fold very slightly marked. Umbilicus distinctly separated from base, almost completely open, rather wide and very deep, with a troughlike depression marked on periphery. Part of specimens bear traces of shell coloration in the form of light-brown streaks running axially and nearly regularly spaced (usually, five of them on one whorl), as well as many small spots on the peripheral edge and on base.

**Remarks.** — Here assigned specimens are in a complete conformity with the shells of *Gibbula (Colliculus) subscalata* (BOETTGER) from Kosteĵ, Rumania. The largest of the Korytnica specimens is, however, by one and a half whorl larger than the lectotype of this species (see ZILCH, 1934) and its upper edge has already nearly completely faded out and, consequently, the outline of shell may seem to be slightly different.

*Gibbula (Colliculus) subscalata* (BOETTGER) has not so far been known from the Miocene of Poland.

### ***Gibbula (Colliculus) sanctacrucensis* sp. n.**

(Pl. III, Figs 9-10)

*Holotype:* Pl. III, Fig. 10 (Z.PAL.U.W., No BkK-G 41).

*Type horizon:* Lower Tortonian (= Lower Badenian).

*Type locality:* Korytnica, 24 SSW of Kielce, southern slopes of the Holy Cross Mts.

*Derivation of the name:* *sanctacrucensis*, after a Latin name of the Holy Cross Mts.

**Diagnosis.** — Shell whorls provided with four (the last one — with five) robust, finely granulated spiral ribs separated from each other by thin secondary ribs.

**Material.** — Fifty specimens.

**Dimensions.** — The largest, incomplete (having a damaged aperture, Pl. III, Fig. 9) specimen is 5.9 mm high and about 6.2 mm wide.

**Description.** — Shell medium-sized, fairly thick-walled, shaped like a low, dumpy cone with an apical angle of 83° to 87°. Protoconch formed by one, almost complete, strongly convex whorl, fairly distinctly separated from the rest of shell. Teleoconch reaching five slightly convex whorls, of which the last one is provided on periphery with a slightly developed edge. Shell base slightly flattened. Ornamentation consisting of prominent, spiral ribs, irregular in thickness. Three of them appear just behind the boundary with protoconch, the middle one being the thickest. On the second whorl of teleoconch, above the upper rib, there develops one more rib and on further whorls, a secondary rib (very rarely two) appears between the two ribs described above. A robust rib, usually split in two by a longitudinal groove, also runs along the edge. Main ribs are usually densely and finely crenate or, sometimes, ornamented by closely spaced grains. Eight to nine almost identical spiral ribs, separated by shallow grooves, occur at the base of shell. Aperture quadrangular, obliquely oriented. Outer lip thick, smooth inside, inner turned towards umbilicus. Columellar fold scarcely visible. Umbilicus open, deep, but rather

narrow. Most specimens bear traces of a characteristic coloration, that is, light-colored bands (four to six on each whorl), axially running against a brown background and usually fairly regularly spaced. As seen adapically, they form bands radially diverging over all whorls (Pl. III, Fig. 10).

**Remarks.** — In the writer's opinion, the specimens described cannot be assigned to any of so far known species. Presumably, similar specimens were found at Kostež and Lapuž, Rumania and identified by BOETTGER (1901) as *Gibbula (Colliculus) adansoni* (PAYRADEAU). Unfortunately, they were not illustrated and their identification was considered even by BOETTGER (1901, p. 165) himself as uncertain. The specimens from Korytnica, although slightly resembling *Gibbula adansoni* (PAYRADEAU) (see RUGGIERI & GRECO, 1965, Pl. 3, Fig. 6), display considerable differences, primarily in their more prominent and granulated spiral ribs.

### Genus **JUJUBINUS** MONTEROSATO, 1884

#### Subgenus **JUJUBINUS (JUJUBINUS)**

#### **Jujubinus (Jujubinus) turricula hoernesiana** SACCO, 1896

(Pl. IV, Figs 2-3)

1853. *Trochus turricula* m.; E. EICHWALD, pp. 229-230, *partim*, *excl. fig.*

1856. *Trochus turricula* EICHW.; M. HÖRNES, pp. 451-452, Pl. 45, Fig. 6, *partim*.

1896. *Jujubinus turricula* var. *hoernesiana* SACC.; F. SACCO, p. 48.

1907. *Calliostoma (Jujubinus) turricula* (EICHW.) var. *hoernesiana* SACCO; O. BOETTGER, p. 184, No. 633.

1938. *Calliostoma trigonum* EICHW.; W. FRIEDBERG, p. 54, *partim*.

**Material.** — Eighty specimens.

**Dimensions.**— The largest specimen is 5.5 mm high and 4.0 mm wide.

**Description.** — Shell small or medium-sized, not very thick-walled, conical, with an apical angle of 60° to 62°. Protoconch formed by a strongly convex whorl. Teleoconch reaching six whorls, of which only the first two are slightly convex, the rest nearly flat. A sharp edge runs on periphery. Base of shell strongly flattened. Ornamentation appears gradually on the first whorl of teleoconch. First, there develop three smooth, spiral ribs between which thin secondary ribs, rapidly reaching the thickness of main ones, appear on the second whorl. Beginning with the third whorl, shell surface has six ribs, as there appears a previously invisible rib situated on the edge of whorl. The last-named rib is usually thicker than the remaining ones and split in two by a narrow groove on later whorls. The occurrence of one more rib was observed in three specimens as an exception. This additional rib develops either as another secondary rib below the upper main one, or by splitting the middle main rib in two. Beginning with the second or third whorl, all ribs are finely granulated, their rows of grains arranged in oblique rows running parallel to growth lines. Shell base is also provided with spiral ribs (eight to thirteen of them), varying in width and separated by grooves, on whose bottom closely spaced growth lines are distinctly marked. Aperture obliquely oriented, trapezoid in outline. Outer lip on periphery sharp, inside provided with indistinct lists. Inner lip thin, with a small columellar fold.

**Remarks.** — The identification of the specimens presented above is rather difficult. The writer believes them to be conspecific with a specimen from Steinabrunn, Vienna Basin, described by HÖRNES (1856, Pl. 45, Fig. 6), which is only slightly larger (by about one whorl). Since

HÖRNES's specimens differ from the holotype of *Jujubinus turricula* (EICHWALD), they were, quite correctly, separated by SACCO (1896) as a new subspecies.

*J. turricula hoernesiana* SACCO has not so far been mentioned from the Miocene of Poland. The writer had an opportunity, however, to reveal that an identical juvenile specimen was found at Korytnica by FRIEDBERG (1938) and identified as *Callistoma trigonum* (EICHWALD). This identification is erroneous, since the ornamentation of adult whorls of the specimens from Korytnica here discussed is quite different than that of *C. trigonum* (see HÖRNES, 1856, Pl. 45, Fig. 9; STRAUSZ, 1966, Pl. 13, Fig. 8).

### ***Jujubinus (Jujubinus) turricula turricula* (EICHWALD, 1850)**

(Pl. IV, Fig. 1)

1853. *Trochus turricula* m.; E. EICHWALD, pp. 229-230, Pl. 9, Fig. 18, *partim*.

1917. *Callistoma (Strigosella) turricula* (EICHWALD); M. COSSMANN & A. PEYROT, pp. 158-160, Figs 19-21, *non* Figs 16-18.

1928a. *Callistoma turricula* EICHW.; W. FRIEDBERG, pp. 507-508, Pl. 32, Figs 5-7.

**Material.** — One specimen.

**Dimensions.** — Height 7.2 mm, width 4.8 mm.

**Description.** — Shell medium-sized, fairly thick-walled, conical, with an apical angle of 55°. Protoconch poorly preserved, probably formed by one whorl. Teleoconch reaching six and a half whorls, the first two of which slightly convex, the rest nearly flat. A distinct edge, below which, on the base, shell is flattened, runs on periphery. Ornamentation appears gradually on the first whorl. At first, two smooth spiral ribs are developed, followed by thin, secondary ribs, which are formed over both of them and under the lower one and which rapidly reach their thickness. From the end of the second whorl, there run five almost identical ribs, only the first and last of them being somewhat thicker. Roundish tubercles arranged in oblique rows parallel to growth lines are gradually formed on all ribs. Ten nearly completely smooth, spiral ribs run at the base, with sharp growth lines marked in grooves between them. Aperture oblique, square in outline. Outer lip on edge sharp, inside just behind edge, provided with a roller-like swelling. Inner lip not very thick, with a strongly developed columellar fold. Umbilicus lacking. Traces of coloration in the form of longitudinal brown bands, axially running over whorls (Pl. IV, Fig. 1) and fine spots on base, are preserved on shell.

**Remarks.** — The specimen presented, although very similar to those of *J. (J.) turricula hoernesiana* SACCO, differs from them to such an extent that the writer decided to assign it to a nominal subspecies. It seems to be in complete conformity with a specimen illustrated by EICHWALD (1853, Pl. 9, Fig. 18). Comparing specimens of the two subspecies from Korytnica one can draw the conclusion that the fundamental difference is expressed in slightly larger dimensions of whorls in *J. (J.) turricula turricula* (EICHWALD), increasing just from protoconch. In addition, slightly different is the ornamentation consisting of five spiral, tuberculate ribs.

*J. (J.) turricula turricula* (EICHWALD) has not so far been known from Korytnica. In the Miocene of Poland, it was recorded from Babica (FRIEDBERG, 1928a), Wielki Potok, Zdziechowice and Węglinek (KRACH, 1962b), environs of Modliborzyce (AREŃ, 1962) and Bogucice (LISZKA, 1933; FRIEDBERG, 1938).

Subgenus **JUJUBINUS (STRIGOSELLA) SACCO, 1896****Jujubinus (Strigosella) celinae (ANDRZEJOWSKI, 1833)**

(Pl. IV, Figs 11-15)

1831. *Trochus turgidulus* BROCC.; F. DUBOIS DE MONTPEREUX, p. 40, Pl. 2, Figs 29-30.  
 1833. *Trochus Celinae* m.; A. ANDRZEJOWSKI, p. 443, Pl. 13, Fig. 1.  
 1856. *Trochus Celinae* ANDRZ.; M. HÖRNES, pp. 450-451, Pl. 45, Fig. 4.  
 1928a. *Calliostoma subturriculoides*? SINZ.; W. FRIEDBERG, pp. 503-504, Pl. 31, Fig. 21.  
 1928a. *Calliostoma Celinae* ANDRZ.; W. FRIEDBERG, pp. 508-509, *partim, excl. fig.*  
 1956. *Calliostoma puberum* (EICHWALD); I. CSEPREGHY-MEZNERICS, p. 377, Pl. 1, Figs 1-2 (*excl. synonym.*).  
 1966. *Calliostoma puberum* EICHWALD; L. STRAUZ, p. 34, Pl. 13, Fig. 4.  
 1970. *Calliostoma subturriculoides* (SINZOW); W. BAŁUK, p. 117, Pl. 8, Fig. 8.

**Material.** — Thirty specimens.

**Dimensions.** — The largest, completely preserved specimen (Pl. IV, Fig. 13) is 10.2 mm high, and 6.0 mm wide, another, less slender, resp. 7.5 mm, and 5.5 mm.

**Description.** — Shell medium-sized, fairly thick-walled, conical, with an apical angle of 60° to 70°. Protoconch formed by about one, strongly convex whorl. Teleoconch reaching about six and a half whorls, the early one of which are usually more convex than the later. A more or less sharp edge runs on periphery. Shell base slightly convex. Ornamentation delicate, specifically and variably developed. Three to four thin spiral striae appear in the first whorl of teleoconch, on the second their number increases to about ten as the result of the appearance of secondary striae. Further on, usually at the beginning of the third whorl, all of them disappear and the surface becomes almost quite smooth. Beginning with the fourth or fifth whorl, there appear, first at the beginning of whorl, thin spiral grooves, which stretch up to the end, gradually becoming deeper and deeper. The presence of these grooves, 14 to 20 of them, causes that the later whorls seem to be spirally ribbed. Many (12 to 15), not very prominent spiral ribs run at the base of shell. Aperture obliquely oriented, square in outline. Outer lip partly covering a narrow and shallow umbilicus. Columellar fold very poorly developed. Traces of coloration, that is, many small white spots, frequently C-shaped, arranged in narrow spiral rows (usually, three per whorl) and on periphery short alternately white and brown sectors, occurring against an irregularly light-brown background, are preserved on most specimens.

**Remarks.** — In view of earlier investigators' divergent opinions, resulting, on the one hand, from a not very accurate illustration of the holotype (see ANDRZEJOWSKI, 1833, Pl. 3, Fig. 1) and, on the other, from a presumably considerable variability of this species, a proper identification of the specimens here presented is rather difficult. The specimens from Korytnica seem to be conspecific with those described by FRIEDBERG (1928a) under the name *Calliostoma subturriculoides* (?) (SINZOW). They came from Szuszkowce, Volhynia. Identical specimens were described from the same locality by DUBOIS (1831) under the name *Trochus turgidulus* BROCCHI, which, according to later investigators' unanimous opinion, is a misnomer. It seems that the description of the species *Jujubinus (Strigosella) celinae* (ANDRZEJOWSKI) concerns precisely such specimens, although, as mentioned above, the illustration is not very accurate. This opinion is shared by HÖRNES (1856), while FRIEDBERG (1928a) assigns to this species somewhat different specimens, devoid of a distinct umbilicus and having slightly different ornamentation. Very similar specimens, if somewhat larger than those from Korytnica, were described from the Miocene of Szob, Hungary, by CSEPREGHY-MEZNERICS (1956) who called them *Calliostoma puberum*

(EICHWALD). The species under study is also cited from Szob by HÖRNES (1856), who treats *Trochus puber* EICHWALD as a synonym of *Trochus celinae* ANDRZEJOWSKI.

*J. (S.) celinae* (ANDRZEJOWSKI) has not so far been known from Korytnica. In the Miocene of Poland it also occurs at Łychów, Węglin and Mniszek (KRACH, 1962*b*) and at Niskowa (FRIEDBERG, 1928*a*, 1938; BAŁUK, 1970).

### **Jujubinus (Strigosella) vexans (BOETTGER, 1907)**

(Pl. IV, Figs 8-10)

1907. *Calliostoma (Strigosella) vexans* n. sp.; O. BOETTGER, p. 185, No. 636.

1934. *Cantharidus (Jujubinus) vexans* (BOETTGER); A. ZILCH, p. 202, Pl. 2, Fig. 34.

**Material.** — Six specimens.

**Dimensions.** — The largest specimen (Pl. IV, Fig. 8) is 4.0 mm high and 3.2 mm wide.

**Description.** — Shell small, not very thick-walled, conical, with an apical angle of about 65°. Protoconch formed by a smooth and strongly convex whorl. Teleoconch reaching five whorls, the first of them convex, the rest nearly flat. A very distinct edge runs on periphery. Shell base flattened. Ornamentation very delicate, formed by not very prominent spiral ribs separated by shallow grooves. Four ribs appear just behind the protoconch. On the second whorl of teleoconch each of them gradually splits in two, so that eight ribs run on later whorls. Nine ribs occur in a specimen devoid of early whorls. A rib situated on the edge is always slightly wider. Obliquely running growth lines cause that all ribs are delicate and crenate. Shell base is also provided with spiral ribs, ten to thirteen in all. Aperture obliquely oriented, square in outline. Outer lip quite smooth inside, inner devoid of columellar fold. Umbilicus, hidden to a considerable extent by inner lip, narrow but rather deep. Traces of coloration, in the form of not very regular white and brown, axially running streaks and regular, short, alternately white and brown sectors on a rib running along the edge, are frequently preserved on shells.

**Remarks.** — The assignment of the specimens described above to the species *Jujubinus (Strigosella) vexans* (BOETTGER) does not arouse doubts. They do not almost differ from the holotype of this species (see ZILCH, 1934). The only slight difference consists in eight to eleven spiral ribs on whorls (BOETTGER, 1907), observed in specimens from Kostej and Lapugy.

*Jujubinus (Strigosella) vexans* (BOETTGER) has not so far been known from the Miocene of Poland. It is a rare species, whose occurrence was found, outside Korytnica, only in the environ of Kostej and Lapugy, Rumania.

### Genus **CLANCULUS** MONTFORT, 1810

#### Subgenus **CLANCULUS (CLANCULOPSIS)** MONTEROSATO, 1879

#### **Clanculus (Clanculopsis) cf. cruciatus** (LINNAEUS, 1766)

(Pl. V, Fig. 8)

1882. *Clanculus cruciatus* (LINNE) et var.; E. BUCQUOY, PH. DAUTZENBERG & G. DOLLFUS, pp. 411-413, Pl. 50, Figs 5-12.

1965. *Clanculus (Clanculopsis) cruciatus* (L.); G. RUGGIERI & A. GRECO, p. 52, Pl. 4, Fig. 11.

?1966. *Gibbula pseudaraonis* STRAUZ; L. STRAUZ, p. 36, Pl. 52, Figs 17-20.



**Material.** — Eight, only juvenile specimens.

**Dimensions.** — The largest specimen (Pl. V, Fig. 8) is 3.0 mm high and 3.5 mm wide.

**Description.** — Shell not very thick-walled, low, conical. Protoconch formed by an incomplete whorl distinctly separated from others. Teleoconch, in the largest specimen, consists of three and two-thirds slightly convex whorls. A not very sharp edge runs along periphery. Shell base slightly flattened. Ornamentation very distinct. Two smooth spiral ribs appear on the first whorl of teleoconch. Further on, secondary ribs develop halfway the second whorl, three of them above the upper main rib and one each below all main ribs. Secondary ribs rapidly transform into rows of fine tubercles and later on (halfway the third whorl), the same happens to main ribs. All rows of tubercles become gradually more and more prominent, except for one of the secondary rows of tubercles which disappears. One more row, running along the edge and invisible on juvenile whorls, appears on the last whorl. Thus, the last whorl has seven rows of tubercles only slightly varying in width, as these differences between them gradually disappear. Shell base provided with many (nine to ten) spiral ribs whose ridges are also slightly crenate. Aperture quadrangular in outline, with two columellar folds slightly marked on the outer lip. Umbilicus deep, but rather narrow. Traces of coloration in the form of a uniform light-brown color and white bands axially running against such a background on two early whorls of teleoconch, are preserved on the specimens.

**Remarks.** — The material available, although well preserved but represented by juvenile specimens only, does not allow the writer for an accurate determination of the species. He assumes, however, to have here to do with *Clanculus (Clanculopsis) cruciatus* (LINNAEUS), contemporarily common in the Mediterranean Sea (see BUCQUOY, DAUTZENBERG & DOLLFUS, 1882), but also known in fossil state.

In the writer's opinion, a unique, single specimen, found at Varpalota and described by STRAUSZ (1966) as *Gibbula pseudaraonis* STRAUSZ is also conspecific with the Korytnica specimens. Conformable seem to be not only the shape and ornamentation, but also the development of aperture. If larger than from Korytnica, this is also a juvenile specimen, and, therefore, it cannot have such an aperture as those characteristic of adult forms of the subgenus *Clanculopsis* MONTEROSATO.

This species has not so far been mentioned from the Miocene of Poland.

## Family TURBINIDAE RAFINESQUE, 1815

### Genus ASTRAEA RÖDING, 1798

#### Subgenus ASTRAEA (BOLMA) RISSO, 1826

#### *Astraea (Bolma) meynardi* (MICHELOTTI, 1847)

(Pl. VI, Figs 5-7)

1856. *Turbo rugosus* LINN.; M. HÖRNES, pp. 432-434, Pl. 44, Fig. 2.  
 1896. *Bolma Meynardi* (MICHT.); F. SACCO, pp. 11-12, Pl. 1, Fig. 23.  
 1917. *Bolma Meynardi* (MICHELOTTI); M. COSSMANN & A. PEYROT, pp. 180-182, Pl. 5, Figs 55-60.  
 1928a. *Bolma Meynardi* MICHT.; W. FRIEDBERG, pp. 469-470, Pl. 29, Fig. 11.  
 1930. *Bolma Meynardi* MICHT.; K. KOWALEWSKI, p. 150.

1936. *Astraea (Bolma) meynardi* MICHELOTTI; L. BOGSCH, p. 68, Pl. 2, Figs 10-11.  
 1938. *Turbo Meynardi* MICHELOTTI; V. STCHEPINSKY, p. 53, Pl. 5, Fig. 1.  
 1966. *Turbo (Bolma) rugosus meynardi* MICHELOTTI; L. STRAUZ, pp. 42-44, Text-fig. 26.

**Material.** — Seven shells and six opercula.

**Dimensions.** — The largest shell is 35 mm high and 39 mm wide; the largest operculum — 17.5 mm long, 14.5 mm wide and 5.3 mm thick.

**Description.** — Shell large, pronouncedly thick-walled, shaped like a low, dumpy cone. Protoconch (preserved in one specimen only) very small, consisting of one whorl. Teleoconch reaching about six and a half whorls, the first flat and horizontal, the next two convex in the upper and slightly concave in the lower part and the rest of them convex. Spiny tubercles horizontally arranged in a spiral row develop in the lower part of early whorls. Beginning with the fifth whorls, the row of spiny tubercles shifts to the middle part of whorls as the result of a gradually changing manner of shell coiling. The early whorls of teleoconch are smooth, but beginning with the third whorl fine grains, arranged in four to six spiral rows start to develop on them. Further on, beginning with the fifth whorl, stronger and stronger, robust axial ribs, which are short as they stretch only from the suture to the spiny row, appear gradually. Their number varies between eleven and thirteen. Spiral rows of grains run up to the end, but their granulation fades out and they take a look of spiral ribs superposed on axial ribs. Below the row of spiny tubercles, there also run six to eight spiral ribs, thin and granulated ribs alternating thick ones provided with inconspicuous spines. Except for two uppermost ribs, they are visible on shell base only. Aperture oval, not preserved completely in any of our specimens. Inner lip robust, strongly turned down on base. In adult specimens, umbilicus completely covered, in juveniles open, rather deep and very narrow. Opercula (found detached, but probably belonging to this species) robust, *Turbo*-type, with outer surface convex, smooth, lustrous and inner surface flat with growth-lines visible.

**Remarks.** — Compared with specimens of *A. (B.) meynardi* (MICHELOTTI) described from other localities, those from Korytnica have a relatively less developed row of spiny tubercles. For this reason, the specimens from Korytnica are most closely related to those from the Vienna Basin (see HÖRNES, 1856). The varying length of spines is, however, a symptom of variability only, as the Korytnica specimens also differ in the length of spines.

*A. (B.) meynardi* has already been mentioned from Korytnica clays by PUSCH (1837), KONTKIEWICZ (1882), KOWALEWSKI (1930) and FRIEDBERG (1928*a*, 1938). Korytnica is the only locality of its occurrence in the Miocene of Poland.

### ***Astraea (Bolma) mehelyi* (BOETTGER, 1896)**

(Pl. VI, Figs 2-4)

1901. *Turbo (Bolma) mehelyi* BTGR.; O. BOETTGER, p. 164, No. 509.  
 1917. *Bolma granosa* (BORSON); M. COSSMANN & A. PEYROT, pp. 184-185, Pl. 6, Figs 9-11.  
 1928*a*. *Bolma perangulata* SACCO var. *spinosa* FRIEDB.; W. FRIEDBERG, pp. 471-472, Pl. 29, Figs 15-18.  
 1934. *Astraea (Bolma) mehelyi* (BOETTGER); A. ZILCH, p. 207, Pl. 4, Fig. 59.  
 1938. *Bolma* cf. *perangulata* SACCO; W. FRIEDBERG, p. 58.  
 1955. *Bolma perangulata* SACCO, var. *spinosa* FRIEDBERG; G. MOISESCU, pp. 278-279, Pl. 2, Fig. 7.  
 1960. *Bolma (Bolma) perangulata* var. *spinosa* FRIEDBERG; E. KOJUMDIEVA, p. 88, Pl. 29, Figs 4-5.  
 1961. *Astraea (Bolma) perangulata spinosa* FRIEDBERG; J. MARINESCU, p. 518, Pl. 1, Fig. 4.  
 1969. *Astraea (Bolma) perangulata spinosa* (BRN.); I. CSEPREGHY-MEZNERICS, p. 68, Pl. 1, Figs 4 and 10.

**Material.** — Sixty (mostly juvenile) shells and twenty-five opercula.

**Dimensions.** — The largest shell is 15.5 mm high and 21.5 mm wide, while the largest operculum is 6.5 mm long, 5.2 mm wide and 2.5 mm thick.

**Description.** — Shell medium-sized, rather thick-walled, very flatly conical. Protoconch very small, formed by one, smooth whorl, rounded in transverse section and sharply separated from teleoconch. Rarely preserved in specimens, it may be best observed in those whose teleoconch has not yet reached one full whorl. Teleoconch reaches five and two-thirds whorls. The early whorls are arranged nearly in the same plane, so that the first of them, together with protoconch, not only do not project above the next ones, but on the contrary are situated somewhat lower. All whorls are provided with two edges, developed as far as on the boundary with protoconch (the lower edge is visible on the last whorl only). Both edges are sharper on earlier whorls. On the first whorl, the upper edge is smooth, while beginning with the second it starts to develop more or less sharp spiny tubercles. Above the edge, the whorl is at first flat, horizontal and smooth and, later on, flat, sloping or slightly concave and ornamented. The ornamentation appears with the third whorl. A spiral row of fine tubercles is at first developed just below suture and then, there appear further (two to four) rows of finer tubercles and a shallow grooving on the spiny tubercles of edges. Beginning with the fifth whorl, this ornamentation, although more and more conspicuous, becomes less regular. The lower edge in juvenile specimens is smooth, but short and not very sharp spines start to develop on it beginning with the 3rd or 4th whorl. A rib parallel to them, on which tubercles or spines are also formed, appears halfway the fourth whorl. Shell base slightly convex, ornamented by four spiral rows of tubercles. Aperture roundish, obliquely oriented. Outer lip rather thick, smooth inside, inner lip robust and strongly turned down on base. Completely covered by outer lip, umbilicus invisible in adults. In juveniles (Pl. VI, Fig. 2) open, rather wide and deep (on another illustrated specimen — Pl. VI, — Fig. 3 — still partly covered).

**Remarks.** — It is beyond any doubt that the shells here presented are conspecific with specimens from Kostej and Lapugy, Rumania, described by BOETTGER (1896, 1901) under the name *B. mehelyi* BOETTGER, with those from Aquitaine identified by COSSMANN & PEYROT (1917) as *B. granosa* (BORSON) and, finally, with Podolian specimens, described by FRIEDBERG (1928a) as *B. perangulata spinosa* FRIEDBERG. The name used by COSSMANN & PEYROT (1917) seems to be a misnomer suitable for another gastropod (see GLIBERT, 1949, Pl. 4, Fig. 7). Under such circumstances, the name given by BOETTGER should be used as having priority to that of FRIEDBERG. However, most later authors used the latter. MOISESCU (1955) applied it even to the specimens from Lapugy, which the more confusing as she did not treat it as a synonym of *A. (B.) mehelyi*, since in her opinion they were not conspecific with the specimens from Kostej.

This specimen was mentioned from Korytnica by FRIEDBERG (1938). In the Miocene of Poland it has been known from Niechobrz (GOLĄB, 1932).

#### Subgenus *ASTRAEA* (*ORMASTRALIUM*) SACCO, 1896

##### *Astraea* (*Ormastraliium*) *carinata* (BORSON, 1821)

(Pl. VI, Fig. 1)

1856. *Turbo carinatus* BORSON; M. HÖRNES, p. 435, Pl. 44, Fig. 6.

1896. *Ormastraliium carinatum* BORS.; F. SACCO, p. 17-18, Pl. 2, Fig. 15.

1917. *Bolma* (*Ormastraliium*) *carinata* (BORSON); M. COSSMANN & A. PEYROT, pp. 186-187, Pl. 6, Figs 5-d.

- 1928a. *Bolma carinata* BORS.; W. FRIEDBERG, pp. 468-469, Pl. 29, Fig. 10.  
 1936. *Astraea (Bolma) carinata* BORSON; L. BOGSCH, p. 69, Pl. 2, Fig. 12.  
 1956. *Astraea (Astralium) carinata* BORS.; I. CSEPREGHY-MEZNERICS, p. 431, Pl. 1, Fig. 15.  
 1960. *Bolma (Ormastralium) carinata* BORSON; L. KOJUMDGIEVA, pp. 88-89, Pl. 29, Fig. 7.  
 1966. *Turbo (Bolma?) carinatus* BORSON; L. STRAUZ, p. 44, Pl. 53, Figs 10-12.

**Material.** — One specimen.

**Dimensions.** — Height, 14.5 mm, width, 20 mm.

**Description.** — Shell medium-sized, thick-walled, low-conical. Protoconch not preserved, teleoconch formed by four and one-third whorls. Two early whorls are flat, further ones slightly convex and provided on the periphery with a sharp edge, having short, spiny tubercles widely spaced on it. The presence of these nodes gives the shell a polygonal outline as seen apically. Shell base convex. Ornamentation as late as only on the third whorl in the form of spiral rows of fine, oval grains (the uppermost row being somewhat stronger) and a delicate, spiral grooving marked near the edge. Below the edge, there runs a spiral row of fine grains with a conspicuous spiral rib under it. Five granulated spiral ribs, the middle one of them the thickest, also occur on shell base. Aperture oval, outer lip on edge sharp, inside smooth, inner strongly turned down on base, almost completely covering umbilicus.

**Remarks.** — The identification of the specimen described is not completely certain. Most likely, it is a juvenile appearance typical of adult shells of *A.(O.) carinata* (BORSON), but quite accurately corresponds to a young part of the specimen from Saint-Jean de Marsacq in Aquitaine (see COSSMANN & PEYROT, 1917, Pl. 6, Fig. 7).

*A.(O.) carinata* (BORSON) was mentioned from the Korytnica clays (one specimen) by FRIEDBERG (1928a). As this specimen is lacking in FRIEDBERG's (see FRIEDBERG, 1938) collections, the present writer was unable to compare it with that found by himself. The species under study has not been known from any other Miocene locality in Poland.

#### Genus *COLLONIA* GRAY, 1850

#### *Collonia transsilvanica* BOETTGER, 1901

(Pl. V, Figs 13-14)

1901. *Collonia transsilvanica* n. sp.; O. BOETTGER, p. 163, No. 507.  
 1928a. *Collonia zboroviensis* FRIEDB.; W. FRIEDBERG, p. 519, Pl. 33, Fig. 8.  
 1934. *Collonia transsilvanica* BOETTGER; A. ZILCH, p. 206, Pl. 4, Fig. 53.  
 1966. *Collonia zboroviensis* FRIEDBERG; J. KÓKAY, p. 31, Pl. 1, Figs 10-11.

**Material.** — Twelve specimens.

**Dimensions.** — The largest specimen (Pl. V, Fig. 14) is 4.2 mm high and 4.7 mm wide.

**Description.** — Shell small, not very thick-walled, low-conical. Protoconch probably consisting of one smooth whorl, but its boundary with teleoconch is indistinct. Teleoconch reaching four whorls, three of which are convex, the fourth much larger, strongly convex, without any traces of any edge or bend. Ornamentation delicate, formed by many thin, spiral ribs. Three of them first appear on the first teleoconchal whorl. Beginning with the second whorl, the uppermost rib conspicuously deviates from suture and runs along a slightly marked edge. Thinner, secondary ribs, whose number gradually increases to reach seven to nine on the

last whorl, are developed above it. Similar secondary ribs (three to four of them) are developed between main ribs. One more main rib runs at the base, three or four secondary ones above it and to twelve below it. The differences between main and secondary ribs becomes gradually obliterated on the fourth whorl teleoconch and thus all of them are almost uniform in thickness. In addition, more or less distinct, short, slightly curved wrinkles radially diverging from the upper suture may be observed on the apical side. On the other hand, a tuberculate spiral cord runs on umbilical periphery, while granulation is also marked on the nearest spiral ribs. Aperture oval, slightly narrowed anteroposteriorly. Both lips fairly thick, not sharp on the edge, smooth inside. Inner lip forms posteriorly a robust fold turned outside. Umbilicus open, not very wide but very deep, with a strong spiral roller, situated in the extension of the fold mentioned above, running on its surface. Three thin spiral ribs occur above it.

**Remarks.** — The assignment of the specimens described to *C. transsilvanica* BOETTGER does not arouse any doubt. As compared with the lectotype (comp. ZILCH, 1934), the Korytnica specimens have a higher spire and more prominent ornamentation, but these minor differences may perhaps be explained by individual variability. The same differences occur between the specimens from Korytnica and from Zborów, the latter described by FRIEDBERG (1928a) as *C. zboroviensis* FRIEDBERG. In the writer's opinion, the separation of this species is not justified and *C. zboroviensis* should be considered as a synonym of *C. transsilvanica* BOETTGER.

*C. transsilvanica* has not so far been known from the Miocene of Poland.

### ***Collonia minutula* sp. n.**

(Pl. V, Fig. 12)

*Holotype:* Pl. V, Fig. 12 (Z.PAL.U.W., No BkK-G 63).

*Type horizon:* Lower Tortonian (= Lower Badenian).

*Type locality:* Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.

*Derivation of the name:* Lat. *minutula* — minute, after a small-sized shell.

**Diagnosis.** — On apical side, whorls ornamented by four wide, but flattened spiral ribs, the rest of the surface by many thin ribs.

**Material.** — Two specimens.

**Dimensions.** — The larger specimen (Pl. V, Fig. 12) is 0.9 mm high and 1.2 mm wide.

**Description.** — Shell small, not very thick-walled, ellipsoidal. Protoconch formed by an incomplete, convex and smooth whorl. Teleoconch reaching one and two-thirds convex whorls, apically slightly flattened, peripherally rounded, without edge. Ornamentation consisting of spiral ribs. Two or three of them appear on the boundary with protoconch, followed by one or two more which develop above the upper one of them, so that beginning halfway the first whorl there are four ribs, at first rather thin and then gradually extending, but, at the same time, flatter and flatter. Many, considerable thinner and more closely-spaced spiral ribs, whose number increases due to the appearance of ever new ones, so that at the end of teleoconch in the holotype it reaches 14, run on periphery and base. Aperture oval, elongate axially and anteroposteriorly narrowed. Both lips thin, smooth inside, the inner one slightly turned down towards umbilicus. Umbilicus open, very wide and fairly deep, sharply separated from base along a distinct bend, on which occurs a slightly crenate spiral rib, more strongly developed than others situated on base. Six more spiral ribs varying in thickness are also developed inside umbilicus.

**Remarks.** — The specimens here described differ clearly from those of *Collonia transsilvanica* BOETTGER in a larger protoconch (with the same number of whorls, that is, about one), less prominent spire and different type of ornamentation. Many similarities in a general structure of shell of the two species discussed allow us to consider them as representatives of one and the same genus. On the other hand, the specimens of *C. minutula* sp. n. are likely to be shells of juvenile individuals.

Genus **CIRSOCHILUS** COSSMANN, 1888

**Cirsochilus granulosus** (GRATELOUP, 1840)

(Pl. V, Fig. 6)

1901. *Collonia (Cirsochilus) globuliformis* n. sp.; O. BOETTGER, p. 163, No. 508.

1917. *Cirsochilus granulosus* (GRAT.); M. COSSMANN & A. PEYROT, pp. 172-174, Pl. 5, Figs 42-49.

1934. *Cirsochilus globuliformis* (BOETTGER); A. ZILCH, p. 206, Pl. 4, Fig. 57.

**Material.** — Thirty-two specimens.

**Dimensions.** — The largest, 2.6 mm high and 3.0 mm wide.

**Description.** — Shell small, relatively thick-walled, ellipsoidal. Protoconch formed by about one whorl slightly separated from the rest of shell and not projecting above the first teleoconchal whorl. Teleoconch reaching somewhat more than three, slightly convex whorls, rounded on periphery, without any edge. Shell base slightly flattened. Ornamentation distinct. A spiral row of fine granules appears in the upper part of the first whorl and below this row — three smooth spiral ribs. Granules gradually diminish to fade out near the end of the second whorl; instead of them two smooth ribs are developed. A sixth rib, completely covered on preceding whorls, appears on the last whorl. In its terminal part, shell is, therefore, ornamented by six very prominent, spiral ribs, of which only the two upper ones are somewhat less prominent. Between these ribs, there usually appear secondary ones (one to three between each pair of main ribs); less frequently, the intercostal space is only grooved. Four to six (mostly five) rather thin spiral ribs run at the base of shell. One or two last ribs are sometimes tuberculate, while radial wrinkles are developed on the margin of umbilicus. Aperture oval, posteriorly slightly contracted; both lips fairly thick, smooth inside. Umbilicus open, fairly narrow, but very deep with radial wrinkles extended inside over its surface. Traces of coloration in the form of narrow, mostly somewhat oblique, light-brown bands, are preserved on most specimens.

**Remarks.** — The specimens described do not differ in size, shape, ornamentation and coloration from those described by BOETTGER (1901) from Kostež and Lapugy under the name *Collonia (Cirsochilus) globuliformis* BOETTGER. The separation of this species is not, however, sufficiently justified, since it does not differ from *Cirsochilus granulosus* (GRATELOUP) known from the Miocene of Aquitaine (COSSMANN & PEYROT, 1917). Minor differences in the details of ornamentation are only the symptom of individual variability. As a matter of fact, they are also observed in the specimens from Korytnica, in which, as compared with those from Aquitaine, the granules arranged in a spiral row on the apical side of shell disappear somewhat earlier.

This species has not so far been found in any locality of the Polish Miocene.

Family **CYCLOSTREMATIDAE** FISCHER, 1885Genus **SKENEA** FLEMING, 1825**Skenea kostejanum** (BOETTGER, 1901)

(Pl. II, Fig. 3)

1901. *Cyclostrema (Delphinoidea) kostejanum* n. sp.; O. BOETTGER, p. 167, No. 520.  
 1907. *Cyclostrema (Delphinoidea) kostejanum* BOETTGER; O. BOETTGER, p. 190, No. 643.  
 1928a. *Tinostoma Woodi* HOERN.; W. FRIEDBERG, pp. 521-522, Pl. 33, Fig. 10.  
 1934. *Skenea kostejanum* (BOETTGER); A. ZILCH, p. 203, Pl. 2, Fig. 37.

**Material.** — Forty-five specimens.

**Dimensions.** — The largest specimen (Pl. II, Fig. 3) is 1.0 mm high and 1.4 mm wide.

**Description.** — Shell very small, rather thin-walled, ellipsoidal. Protoconch formed by one whorl, distinctly separated from the rest of shell, but not projecting above the first teleoconchal whorl. Teleoconch reaching somewhat more than two whorls. In lateral outline, they are rounded, devoid of edges and bends, but a narrow and shallow troughlike depression runs just below the upper suture. The surface of shell quite smooth, strongly lustrous, in juvenile specimens sometimes slightly transparent. Aperture oval, posteriorly slightly contracted. Outer lip very thin and sharp, smooth inside; inner thicker, rounded on periphery and conspicuously turned outwards. Umbilicus very narrow and deep, quite open or more or less covered by the inner lip turned outwards.

**Remarks.** — The specimens described do not differ from the holotype of *Skenea kostejanum* (BOETTGER).

This species has not so far been mentioned from any Miocene locality in Poland. However, identical specimens, also from the Korytnica clays, were described by FRIEDBERG (1928a, Pl. 33, Fig. 10) as *Teinostoma woodi* HÖRNES. Outside Korytnica, *S. kostejanum* is known only from Kostej and Lapugy, Rumania.

**?Skenea subnitidum** (BOETTGER, 1907)

(Pl. II, Figs 4-6)

1907. *Cyclostrema (Delphinoidea) subnitidum* n. sp.; O. BOETTGER, p. 190, No. 644.  
 1934. *Skenea subnitidum* (BOETTGER); A. ZILCH, p. 203, Pl. 2, Fig. 38.  
 1966. *Skenea subnitida* BOETTGER; L. STRAUZ, p. 49, Text-fig. 29.

**Material.** — Eighty specimens.

**Dimensions.** — The largest specimen is 1.2 mm high and 1.3 mm wide.

**Description.** — Shell very small, thin-walled, subspherical. Protoconch consisting of about one convex and smooth whorl. Teleoconch reaching somewhat more than two strongly convex whorls, the last of them large and dumpy, without any edge or bend. Shell surface ornamented by very fine, closely-spaced, spiral grooves, best visible on the first whorl of teleoconch and on the base of the last whorl, while almost invisible on the apical side of its base. Aperture relatively large, oval, posteriorly somewhat contracted. Outer lip thin, with two shallow, sinuous notches,

one of them just above periphery, the other on base, occurring on its margin. These notches are also marked in the trace of growth lines. Inner lip also thin, except anteriorly where it is insignificantly thickened. Umbilicus open, bordered by a thin, threadlike rib, deep but fairly narrow, sometimes — with a strongly developed outer lip — visible only in the form of a narrow slit.

**Remarks.** — Shells of *Skenea subnitidum* (BOETTGER) have so far been described only from Kosteĵ, Rumania (BOETTGER, 1970) and Hidas, Hungary (CSEPREGHY-MEZNERCIS, 1950; STRAUZ, 1966). Relatively numerous specimens from Korytnica may be considered as conspecific with those from the two localities mentioned above, although they differ from each other in minor details. As compared to the lectotype from Kosteĵ (see ZILCH, 1934), the Korytnica specimens are somewhat smaller (but their teleoconch is smaller by about a half of whorl), have a slightly higher spire and more distinct spiral grooving. On the other hand, the specimens from Hidas very accurately conform in form with those from Korytnica but their surface is supposed to be smooth. The notches on outer lip have not been mentioned by any of the authors. The assignment of the species under study to the genus *Skenea* is not completely certain.

?*Skenea subnitidum* (BOETTGER) has not so far been known from the Miocene of Poland.

### ?*Skenea tenuis* sp. n.

(Pl. II, Figs 1-2)

*Holotype*: Pl. II, Fig. 1 (Z.PAL.U.W., No. BkK-G 69).

*Type horizon*: Lower Tortonian (= Lower Badenian).

*Type locality*: Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.

*Derivation of the name*: Lat. *tenuis* — after a characteristically very thin-walled shell.

**Diagnosis.** — Shell small, relatively low, very thin-walled, smooth, its umbilicus open, wide.

**Material.** — Ten specimens.

**Dimensions.** — The largest specimen is 1.0 mm high and 1.4 mm wide.

**Description.** — Shell very small and thin-walled, shaped like a disc with a more or less projecting spire. Protoconch formed by one and a quarter strongly convex and smooth whorls, rather distinctly separated from the rest of shell. Teleoconch reaching somewhat more than two whorls, which are strongly convex, separated by deep sutures, and on periphery and at base, rounded without even the smallest bend. The second half of the second whorl more strongly developed across and, consequently, larger specimens are relatively lower. The surface of shell quite smooth and lustrous; growth lines very delicate. Aperture roundish, both lips very thin. A wide but rather shallow sinuous notch is marked on the inner lip below the place of its adherence to the last but one whorl (seen abapically, this lip displays an S-shaped edge). Umbilicus spacious, deep and wide, without a distinct boundary with shell base.

**Remarks.** — *Adeorbis woodiformis* HILBER known from Pöls, Austria (HILBER, 1879) seems to be an only species similar in shape to the specimens described above. ?*Skenea tenuis* sp. n. differs from it in somewhat smaller dimensions, less disclike shape and thinner shell. Its generic assignment does not seem quite certain to the writer. Similar in shape and size are



also the shells of the genus *Skeneopsis* IREDALE, 1915 of the superfamily Rissoacea. The genus *Skeneopsis* has not been mentioned from fossil deposits. It lives in present-day North Atlantic (WENZ, 1939).

Genus **DARONIA** A. ADAMS, 1861

**Daronia hungarica** sp. n.

(Pl. II, Fig. 8)

1966. *Skenea carinella* REUSS; L. STRAUSZ, pp. 48-49, Pl. 50, Figs 16-18, *partim*.

*Holotype*: Pl. II, Fig. 8 (Z.PAL.U.W., No BkK-G 71).

*Type horizon*: Lower Tortonian (= Lower Badenian).

*Type locality*: Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.

*Derivation of the name*: Lat. *hungarica* — for its shells first found in the Miocene of Hungary.

**Diagnosis.** — Shell disclike, apically provided with one and, on the base, two edges, irregularly smooth or spirally grooved, its umbilicus spatious.

**Material.** — Two specimen.

**Dimensions.** — The larger specimen is 0.6 mm high and 1.2 mm wide.

**Description.** — Shell small, fairly thick-walled, disclike. Protoconch formed probably by one convex whorl, its boundary with the rest of shell indistinct. Teleoconch formed of one and three-fourths whorls arranged almost in the same plane with protoconch. A single, distinct carina runs on the apical surface of shell (almost through the middle of whorl in abapical view) and two similar carinae, one through the middle and the other on the periphery of umbilicus. On periphery whorls rounded. Shell surface nearly quite smooth, except for a very dense spiral grooving visible under a strong magnification on the apical surface near suture and on base between carinae. Aperture oval, slightly oblique to the axis of shell; both lips thick, blunt on edges. Umbilicus open, spatious, wide but not very deep.

**Remarks.** — The specimens described are somewhat similar to *Daronia deflexa* (BOETTGER), from which they differ, however, in smaller dimensions and a different coiling of shell. In the writer's opinion, they are conspecific with the specimen from Varpalota, Hungary, identified by STRAUSZ (1966, Pl. 50, Figs 16-18) as *Skenea carinella* REUSS. Since *S. carinella* is a species (comp. REUSS, 1860, Pl. 5, Fig. 10), differing from *D. hungarica* sp. n. in a smaller and lower shell, planispiral coiling and the presence of only one carina on base, STRAUSZ assignment is erroneous.

Genus **GANESA** JEFFREYS, 1883

**Ganesa devians** (BOETTGER, 1907)

(Pl. II, Fig. 7)

1907. *Cyclostrema (Ganesa) devians* n. sp.; O. BOETTGER, p. 191, No. 645.

1934. *Ganesa devians* (BOETTGER); A. ZILCH, p. 203, Pl. 2, Fig. 41.

**Material.** — One specimen.

**Dimensions.** — Height, 1.6 mm, width, 1.4 mm.

**Description.** — Shell small, thin-walled, oviform. Protoconch not separated from the whole of shell, which reaches three and a quarter convex whorls, the last of them particularly large and rather dumpy. Shell surface smooth, except for a delicate spiral grooving occurring at the base near umbilicus. Aperture oval, slightly contracted posteriorly. Umbilicus fairly deep and rather wide, but abapically seems to be covered by the terminal part of the last whorl.

**Remarks.** — The presence of spiral grooving near umbilicus is the only character in which the Korytnica specimen differs from the holotype of *Ganesa devians* (BOETTGER) from Kostej, Rumania (comp. ZILCH, 1934). The specimen from Korytnica is, in addition, somewhat smaller, but its shell is by a quarter of a whorl shorter. Despite these differences, the writer considers the Korytnica specimen as conspecific with *G. devians* (BOETTGER).

This species has not hitherto been known from the Miocene of Poland. Outside Korytnica, it occurs only at Kostej, Rumania, where one specimen was also found.

#### Genus LEUCORHYNCHIA CROSSE, 1867

#### *Leucorhynchia rotellaeformis* (GRATELOUP, 1840)

(Pl. V, Fig. 9)

1856. *Delphinula rotellaeformis* GRAT.; M. HÖRNES, p. 473, Pl. 46, Fig. 6.

?1907. *Leucorhynchia iricolor* n. sp.; O. BOETTGER, p. 194, No. 657.

1917. *Leucorhynchia rotellaeformis* (GRATELOUP); M. COSSMANN & A. PEYROT, pp. 205-206, Pl. 6, Figs 42-44.

?1934. *Leucorhynchia iricolor* BOETTGER; A. ZILCH, p. 205, Pl. 3, Fig. 50.

?1969. *Leucorhynchia iricolor* BOETTGER; I. CSEPREGHY-MEZNERICS, p. 67, Pl. 1, Figs 13 and 15.

**Material.** — Two specimens.

**Dimensions.** — The larger specimen is 2.5 mm high and 3.8 mm wide.

**Description.** — Shell small, rather thick-walled, ellipsoidal. Protoconch presumably consisting of one and one-third smooth and lustrous whorls, indistinctly separated from the rest of shell. Teleoconch reaching two and three-quarters whorls arranged approximately in the same plane. Its last whorl is particularly large and rounded on periphery without any trace of carina or bend. The entire surface is ornamented by delicate and very closely-spaced spiral grooves, except for the nearest surrounding of umbilicus where grooving disappears. Short, very shallow and slightly curving furrows radially diverge from suture on the apical surface. Similar, but somewhat narrower and considerably deeper furrows diverge from the periphery of umbilicus. Aperture round, both lips slightly thickened inside. The inner one anteriorly forms a small fold directed outwards and partly obscuring umbilicus. Umbilicus open, very deep and not very wide, with its diameter larger inside than at the outlet.

**Remarks.** — The specimens presented may be considered conspecific with the forms from both STEINABRUNN, Vienna Basin (HÖRNES, 1856) and SALLES, Aquitaine (COSSMANN & PEYROT, 1917), assigned to *Leucorhynchia rotellaeformis* (GRATELOUP). Their dissimilarity to *L. zboroviensis* FRIEDBERG, considerably more numerous in the Korytnica clays, is to the writer unquestionable. A markedly smaller protoconchal whorl in *L. rotellaeformis*, the lack of any carina on periphery, larger diameter of aperture, more projecting spire and a considerably narrower zone around umbilicus, devoid of spiral grooving, make up fundamental characters, which differ the two species.

Of two species described by BOETTGER (1901, 1907) from Kosteĵ, more related is *L. iricolor* BOETTGER. This species, erected on the basis of a single specimen, looks nearly identical, except for its supposedly smooth shell surface, which is emphasized by BOETTGER (1907, p. 194). This difference does not allow the present writer to be quite certain as to the conspecificity of this species with the Korytnica specimens. Other specimens from Kosteĵ, identified by BOETTGER (1901) as *L. rotelliformis* (GRATELOUP), undoubtedly do not belong here, since, although not illustrated, both their description (BOETTGER, 1901) and characters differing them from *L. iricolor* BOETTGER enable the conclusion that they rather correspond to the species *L. zboroviensis* FRIEDBERG, described below. A similar view is represented by the writer in regard to the specimens from Varpalota, Hungary (comp. STRAUZ, 1966, Pl. 50, Figs 10-15), in which carina is also clearly visible.

This species has not so far been known from the Miocene of Poland.

### **Leucorhynchia zboroviensis** FRIEDBERG, 1928

(Pl. V, Figs 10-11)

1901. *Leucorhynchia rotelliformis* (GRAT.); O. BOETTGER, p. 170, No. 526.

1928a. *Leucorhynchia zboroviensis* FRIEDB.; W. FRIEDBERG, pp. 473—474, Pl. 29, Figs 8-9.

1954. *Leucorhynchia rotellaeformis* GRAT.; L. STRAUZ, p. 8, Pl. 9, Fig. 161.

1966. *Leucorhynchia rotellaeformis* GRATELOUP; L. STRAUZ, p. 47, Pl. 50, Figs 10-15.

**Material.** — Thirty specimens.

**Dimensions.** — The largest specimen is 2.6 mm high and 4.3 mm wide.

**Description.** — Shell small, fairly thick-walled, shaped like a slightly flattened disc. Protoconch probably formed by about one smooth whorl with indistinct boundary. Teleoconch reaching nearly three whorls, situated approximately in one plane. A distinct ridge, sharper in younger specimens, runs on shell periphery. Shell base fairly strongly convex. Except for a wide zone around umbilicus, shell surface is delicately ornamented by spiral, closely spaced grooves. Radial furrows are developed only near umbilicus and only in juvenile specimens. In the adults, one or two furrows are usually observed on the entire last whorl. Aperture round, both lips slightly swollen inside. The inner lip anteriorly forms a robust fold, directed outwards and, in adults, completely covering umbilicus. Umbilicus open, deep and not very wide but visible only from the aperture.

**Remarks.** — As follows even from the remarks on the species described formerly, the separate character of here assigned specimens does not arouse doubts. The writer inclines to consider them conspecific with *Leucorhynchia zboroviensis* FRIEDBERG. Species described from Kosteĵ and Lapugy (BOETTGER, 1901) and from Varpalota (STRAUSZ, 1954, 1966) as *L. rotellaeformis* (GRATELOUP) should also be included with them.

This species has not so far been known from the Miocene of Poland. It was described by FRIEDBERG (1928a) from Zborów, Podolia.

Genus *CIRCULUS* JEFFREYS, 1865*Circulus planorbillus* (DUJARDIN, 1837)

(Pl. V, Fig. 1)

1917. *Tornus planorbillus* (DUJ.); M. COSSMANN & A. PEYROT, pp. 237-239, Pl. 7, Figs 57-62.  
 1928a. *Tornus planorbillus* DUJ.; W. FRIEDBERG, pp. 524-525, Pl. 33, Figs 13-14.  
 1930. *Tornus planorbillus* DUJ.; K. KOWALEWSKI, p. 149.  
 1949. *Circulus planorbillus* (DUJARDIN); I. CSEPREGHY-MEZNERICS, p. 23, Pl. 1, Figs 6-7.  
 1960. *Adeorbis planorbillus* (DUJARDIN); E. KOJUMDZIEVA, pp. 89-90, Pl. 29, Fig. 9.  
 1966. *Adeorbis planorbillus* DUJARDIN; L. STRAUZ, pp. 52-53, Pl. 50, Figs 24-25.

**Material.** — Forty specimens.

**Dimensions.** — The largest specimen (Pl. V, Fig. 1) is 1.5 mm high and 3.0 mm wide.

**Description.** — Shell small, fairly thin-walled, disclike, with a slightly projecting spire. Protoconch formed by about two and a quarter smooth and convex whorls, distinctly separated from the rest of shell. Teleoconch reaching nearly two whorls, provided with three spiral carinae, one of which running on periphery. Thin and sharp spiral ribs are sometimes developed along the carina. Carinae appear as early as on the boundary with protoconch, at first being relatively indistinct and gradually becoming sharper and sharper. Consequently, the last whorl is marked by a broken profile, that is, above the upper carina it is flat except close to suture where it is slightly convex, while between the carinae at the base, below the lower carina, it is slightly convex. Shell surface lustrous and nearly quite smooth, except for adult specimens, in which a few distinct spiral striae are developed in the region of umbilicus. In addition, traces of a not very dense spiral grooving may be discovered under a strong magnification on the entire last whorl. Aperture obliquely situated roundish, but slightly hexagonal in outline. Umbilicus relatively deep and wide, with protoconchal whorls visible inside.

**Remarks.** — The specimens presented, compared with the shells of *Circulus planorbillus* (DUJARDIN), described from other Miocene localities of Europe, do not display any major differences and, therefore, may be conspecific with them. Specimens of *C. praecedens* (KOENEN), mentioned (but, unfortunately, not illustrated) by BOETTGER (1907, p. 196) from Kostej, Rumania, are probably also conspecific. The species *C. praecedens* is similar (see GLIBERT, 1952, Pl. 2, Fig. 1; ANDERSON, 1959, Pl. 3, Fig. 6, JANSSEN, 1967, Pl. 3, Fig. 1) but, although separate, characteristic of the areas connected with the zone of the Miocene North Sea.

*C. planorbillus* was already mentioned from the Korytnica clays by FRIEDBERG (1928a, 1938) and KOWALEWSKI (1930). In the Miocene of Poland, it is also known from Skoczów (KRACH, 1974).

*Circulus frequens* sp. n.

(Pl. V, Fig. 3)

*Holotype:* Pl. V, Fig. 3 (Z.PAL.U.W., No BkK-G 77).

*Type horizon:* Lower Tortonian (= Lower Badenian).

*Type locality:* Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.

*Derivation of the name:* Lat. *frequens*, after its frequent occurrence.

**Diagnosis.** — Shell provided with four carinae, whorls broken in outline; sharp, listlike, spiral ribs running on three upper carinae.

**Material.** — Two hundred specimens.

**Dimensions.** — The largest specimen is 1.6 mm high and 3.3 mm wide.

**Description.** — Shell small, fairly thin-walled, disclike, with a projecting spire. Protoconch formed by about two convex and smooth whorls, its boundary being distinct only in some specimens. Teleoconch reaching two and a quarter whorls. The first of them convex and nearly quite smooth, except for a very delicate spiral grooving marked near both sutures. Beginning with the second teleoconchal whorl, the profile of shell is broken as the result of the development of four carinae, the first of them running on the apical side, the second on periphery and the remaining two on base. Above the first carina and between all whorls, the profile is flat and only below the last carina rounded. The first three carinae are sharp, which is additionally emphasized by thin, listlike, spiral ribs occurring on them. In this respect, particularly distinguished is the third carina. Shell surface between edges is ornamented by delicate and very thin spiral ribs. Growth lines very distinct, with frequently marked traces of an arrested growth. Aperture obliquely oriented, clearly hexagonal in outline. Both lips thin, umbilicus fairly narrow but deep.

**Remarks.** — The structure of here assigned shells, in particular of protoconch, is not quite clear. In some specimens, a distinct boundary, which may be interpreted as that of protoconch, is marked at the end of the second whorl, in some others it is invisible. However, a certain discontinuity, accompanied by the appearance of the upper carina and by a stronger development of ornamentation, may also be observed frequently at the end of the third whorl. There is, however, no rule in this respect, there are specimens with two such boundaries, with one, or, although least frequently, with no boundary at all. Induced by an analogous size of protoconch, in other species of the genus *Circulus* and by the appearance of ornamentation at the beginning of the third whorl, the writer considers the first of these discontinuities as the boundary of protoconch. Under similar circumstances GLIBERT (1952) mentions a three-whorl protoconch in the related species *C. hennei*. *C. frequens* sp. n. is most closely related to *C. hennei* GLIBERT, but differs from it in a slightly different and considerable poorer ornamentation on the apical surfaces of shell. In addition, the shape of shells in *C. hennei* is not uniform. If its specimens from the Miocene of Belgium (see GLIBERT, 1952, Pl. 1, Fig. 7) are similar to those of *C. frequens* sp. n., its specimens from the Miocene of Schleswig-Holstein and Rhineland (see ANDERSON, 1959, Text-fig. 3 and Pl. 3, Fig. 7) differ substantially from *C. frequens* sp. n., particularly in rounded upper parts of whorls. From *C. quadrifasciatus* (GRATELOUP), occurring in the Miocene of Aquitaine (see COSSMANN & PEYROT, 1917, Pl. 7, Figs 50-53), *C. frequens* sp. n. differs in a different distribution of carinae and in the presence of listlike spiral ribs on them. Finally, it deviates from *C. interpositus* (BOETTGER) from the Miocene of Kostej, Rumania (see ZILCH, 1934, Pl. 6, Fig. 3) in the height of shell and in a quite different development of base (comp. also the synonymy of *C. semilaevis* in the present work, p. 56). Describing an assemblage of gastropods from the region of Kostej, BOETTGER (1901) mentioned, under the name *Adeorbis trigonostoma* (BASTEROT), specimens which, as implied by their description (BOETTGER, 1901, p. 170), may be conspecific with *C. frequens* sp. n. These specimens were not illustrated. BOETTGER emphasized that, in identifying them, he only used illustrations of earlier authors, but, according to COSSMANN & PEYROT (1917) they are in this case inaccurate and misleading. The last-named authors' attitude towards this identification was very skeptical and they believed that it required revision.

**Circulus semilaevis** (BOETTGER, 1901)

(Pl. V, Figs 4-5)

1901. *Adeorbis semilaevis* n. sp.; O. BOETTGER, p. 171, No. 529.  
 1907. *Adeorbis interpositus* n. sp.; O. BOETTGER, pp. 195-196, No. 658.  
 1917. *Tornus subcirculus* n. sp.; M. COSSMANN & A. PEYROT, pp. 240-241, Pl. 7, Figs 54-56.  
 1934. *Adeorbis semilaevis* BOETTGER; A. ZILCH, p. 215, Pl. 6, Fig. 4.  
 1934. *Adeorbis interpositus* BOETTGER; A. ZILCH, p. 215, Pl. 6, Fig. 3.

**Material.** — Fifteen specimens.

**Dimensions.** — The largest specimen is 1.2 mm high and 2.8 mm wide.

**Description.** — Shell small, rather thin-walled, disclike, with an only slightly projecting spire. Protoconch consisting of about two and a quarter convex and smooth whorls, distinctly separated from the rest of shell. Teleoconch reaching somewhat more than two convex whorls rounded in outline. Apex and periphery ornamented by 12 to 14 thin spiral riblets, base smooth. In some specimens, two of these riblets, one on periphery and the other on the margin of base, are distinguished by a more robust, more or less listlike shape. Aperture distinctly oblique, oval in outline. Umbilicus wide, but relatively not very deep.

**Remarks.** — A considerable variability expressed in a variable development of riblets is observed among here assigned specimens, which display a gradual transition from those having all riblets uniform to those in which two riblets are listlike. Extreme specimens do not differ two varying species erected by BOETTGER (1901, 1907) on the basis of a material collected at Kosteĵ, Rumania. Shells with riblets looking uniform correspond to *C. semilaevis* (BOETTGER, 1901) while those having two listlike riblets to *C. interpositus* (BOETTGER, 1907). Since the Korytnica specimens, including several transitional forms, entitle the writer to maintain that the separation of the two species is groundless, *C. interpositus* (BOETTGER) should be considered as a younger synonym of *C. semilaevis* (BOETTGER). *C. interpositus* was erected on the basis of a single specimen only. *C. subcirculus* (COSSMANN & PEYROT), whose shells differ from the specimens from Korytnica and Kosteĵ only in a slightly more projecting spire, were described by COSSMANN & PEYROT (1917) from the Miocene of Aquitaine. Certain doubts may here arise if this was a sufficient basis for erecting a separate species and, therefore, the present writer considers them as conspecific with *C. semilaevis* (BOETTGER). It is quite certain that the species under study does not include a specimen from Bujtur, Rumania, presented by RADO (1960, Pl. 1, Figs 2-2a).

*C. semilaevis* (BOETTGER) has not so far been known from the Miocene of Poland.

**Circulus miobicarinatus** (SACCO, 1896)

(Pl. V, Fig. 2)

1896. *Tornus miobicarinatus* SACCO; F. SACCO, p. 54, Pl. 4, Fig. 74.  
 1917. *Tornus miobicarinatus* SAC.; M. COSSMANN & A. PEYROT, pp. 232-234, Pl. 7, Figs 42-46.  
 1966. *Adeorbis (Cochliolepis) miobicarinatus* SACCO; L. STRAUZ, pp. 53-54, Pl. 51, Fig. 1.

**Material.** — Three incomplete specimens.

**Dimensions.** — The larger specimens (with a broken off half of the last whorl) is 1.2 mm high and 2.8 mm wide.

**Description.** — Shell small, fairly thin-walled, discoid, with its spire not projecting above the last whorl. Protoconch consisting of somewhat more than two convex and smooth whorls and having a distinct boundary with the rest of shell. Teleoconch reaching two and one-third whorls. The profile of whorls, both on the apical surface and base, rounded. Prominent spiral ribs form ornamentation. A robust, listlike, riblet, resembling a keel, occurs on periphery. Eight prominent riblets, with very thin secondary ribs developed between them on the last whorl, occur on the apical surface. At the base, riblets start only at some distance from the periphery and cover the entire rest of whorl, along with the wall of umbilicus. Riblets are more numerous (twelve in all), but thinner on base than on the apical surface, except for one of them, that is, the outermost which is the strongest. Between the last-named and the peripheral riblet, whorl is slightly concave and its surface is in this place delicately spirally grooved. Umbilicus wide and relatively deep, with protoconch visible in its center.

**Remarks.** — The similarity between the two specimens from Korytnica and those presented by SACCO (1896), COSSMANN & PEYROT (1917) and STRAUZ (1966) is so complete that their assignment to *Circulus miobicarinatus* (SACCO) is beyond a doubt. The Korytnica specimens are incompletely preserved and hence their small dimensions (the larger of them, if preserved, would be about 6 mm wide). CSEPREGHY-MEZNERICS (1954) and STRAUZ (1966) assign this species to the subgenus *Cochliolepis (Laciniorbis)* MARTES, 1897. This view seems to be insufficiently founded, since the structure of protoconch, the manner of the coiling of teleoconch and the character of ornamentation are identical with those in other species assigned to the genus *Circulus*.

*C. miobicarinatus* (SACCO) has not so far been known from the Miocene of Poland.

## Family PHASIANELLIDAE SWAINSON, 1840

### Genus TRICOLIA RISSO, 1826

#### Subgenus TRICOLIA (TRICOLIA)

#### *Tricolia (Tricolia) eichwaldi* (HÖRNES, 1856)

(Pl. VII, Figs 1-4)

1856. *Phasianella Eichwaldi* HÖRN.; M. HÖRNES, pp. 430-431, Pl. 44, Fig. 1.

1928a. *Phasianella Eichwaldi* HOERN.; W. FRIEDBERG, p. 475, Pl. 30, Figs 1-2.

1949. *Tricolia eichwaldi* HÖRNES; M. GLIBERT, p. 79, Pl. 4, Fig. 15.

1966. *Phasianella (Tricolia) eichwaldi* HÖRNES; L. STRAUZ, p. 46, Pl. 47, Figs 4-8.

?1954. *Tricolia millepunctata* (BENOIST); I. CSEPREGHY-MEZNERICS, p. 14, Pl. 1, Figs 1-2 and 8-9.

1968. *Phasianella (T.) eichwaldi* HOERN.; L. STANCU & E. ANDREESCU, p. 461, Pl. 3, Fig. 23.

**Material.** — Two hundred and ten specimens.

**Dimensions.** — The largest specimen is 5.4 mm high and 3.3 mm wide.

**Description.** — Shell small or medium-sized, fairly thin-walled, conical-oviform. Protoconch formed by about one convex whorl; its boundary with the rest of shell very indistinct. Teleoconch reaching five whorls, more or less convex, but with a narrow and shallow, troughlike depression running in the upper part of each of them close to suture. The last whorl is sometimes dumpy, on periphery always rounded and devoid of any carinae and bends. Shell base convex. Surface quite smooth. Aperture oval, slightly contracted posteriorly. Outer lip thin, sharp on

edge, smooth inside. Inner also thin, frequently slightly turned outwards. Umbilicus either lacking or occurring in the form of a mere shallow and narrow groove running parallel to inner lip. Traces of considerably varying coloration preserved in nearly all specimens. Mostly they look like oblique, zig-zag, brown lines (Pl. VII, Figs 1-3), less frequently, oblique but parallel to each other. There are also shells with wide, oblique streaks or with sizable spots appearing in the upper part of a whorl at almost uniform intervals, e.g., six on each whorl. In specimens with zig-zag lines, particular lines frequently are not continuous but consist of separate dots (Pl. VII, Fig. 4) and sometimes the entire shell is punctate. The shells of this species were closed with calcareous opercula, which relatively frequently may be found inside aperture. A shell and an operculum shown in Pl. VII, Fig. 2 come from one and the same individual. The operculum is paucispiral, oval in outline, its external side convex and smooth, internal slightly concave with growth lines visible.

**Remarks.** — The specimens presented are undoubtedly conspecific with those described by many authors (see synonymy) under the name *Tricolia eichwaldi* (HÖRNES). In the writer's opinion, *T. millepunctata* (BENOIST), known from the Miocene of Aquitaine (COSSMANN & PEYROT, 1917, Pl. 6, Figs 20-23), from the Loire Basin (GLIBERT, 1949, Pl. 4, Fig. 16) and from Samsonhaza, Hungary (CSEPREGHY-MEZNERICS, 1954, Pl. 1, Figs 1-2 and 8-9) is also a related species. According to COSSMANN & PEYROT (1917), *T. millepunctata* differs from *T. eichwaldi* in the lack of a troughlike depression running in the upper part of whorls and in a different coloration of shell, as seen in the holotype of *T. eichwaldi* (oblique, parallel lines). Some doubts may arise if this is a sufficient basis for erecting separate species, especially in view of finding a considerable variability of coloration in the Korytnica specimens, including that typical of *T. millepunctata* (numerous fine dots). On account of the differences in the appearance of the upper parts of whorls, the writer does not associate the French specimens with *T. eichwaldi*, but he believes, on the other hand, that the specimens from Samsonhaza, Hungary may be conspecific with those from Korytnica.

*T. eichwaldi* has not so far been known from the Miocene of Poland. This species was described by FRIEDBERG from Zborów, Podolia. On the other hand, this investigator mentions *T. globosa* (FRIEDBERG) from the Korytnica clays (FRIEDBERG, 1938). The writer did not succeed in finding these specimens in FRIEDBERG's collection, but it may be supposed that they were young and more dumpy shells of *T. eichwaldi*.

## Superfamily NERITACEA RAFINESQUE, 1815

### Family NERITIDAE RAFINESQUE, 1815

#### Genus NERITA LINNAEUS, 1758

#### *Nerita plutonis* BASTEROT, 1825

(Pl. VII, Fig. 6)

- ?1856. *Nerita Plutonis* BAST.; M. HÖRNES, pp. 531-532, Pl. 47, Fig. 11.  
 1896. *Nerita Plutonis* BAST. var. *bicrassicincta* SACC.; F. SACCO, p. 59, Pl. 5, Fig. 49b.  
 1917. *Nerita Plutonis* BASTEROT; M. COSSMANN & A. PEYROT, pp. 246-247, Pl. 7, Figs 72-76.  
 1954. *Nerita plutonis* BAST.; L. STRAUZ, p. 9, Pl. 8, Fig. 158.  
 1966. *Nerita plutonis* BASTEROT; L. STRAUZ, pp. 56-57, Pl. 53, Figs 16?, 17-18.  
 1966. *Nerita plutonis* BAST.; J. KÓKAY, p. 31, Pl. 1, Fig. 13.



**Material.** — Three specimens.

**Dimensions.** — The largest specimen (Pl. II, Fig. 6) is 9.2 mm high and 10.0 mm wide.

**Description.** — Shell medium-sized, thick-walled, diagonally oviform. Protoconch (visible in one specimen only) formed by about one and a half convex whorls, with indistinctly marked suture, but very sharply outlined boundary with teleoconch. Teleoconch reaching two and a quarter whorls. The last of them particularly large (its height nearly equalling that of the entire shell), with a broken profile — flattened in the upper part and slightly rounded on periphery and base. Prominent spiral ribs form ornamentation. Ten of them appear just behind the protoconch. They are not uniform in thickness, three of them being distinctly stronger (two in the region of carina and one on base). The number of ribs increases due to the development of secondary and tertiary ones. On the last whorls of the specimen illustrated (Pl. VII, Fig. 6), the number of ribs amounts to 25, including seven above the carina. All ribs have an uneven and rough surface, resulting from intersections with very closely-spaced and sharp growth lines. Aperture of outlet spacious, roundish, but close behind the edge, due to the presence of the septum of inner lip, considerably contracted and semicircular in outline. Outer lip sharp on edge and considerably swollen inside just behind the edge. Labial area extensive, with three small teeth on the columellar edge and a roller-like thickening, limiting a shallow groove situated at the junction of both lips, occurring in the posterior part. Umbilicus absent.

**Remarks.** — The identification of the specimens described above is rather difficult. The writer assigns them to *Nerita plutonis* BASTEROT although it seems that they are not completely identical with any specimen described so far in literature. They most strongly resemble specimens from Northern Italy (SACCO, 1896, Pl. 5, Fig. 49b) and from Aquitaine (COSSMANN & PEYROT, 1917, Pl. 7, Figs 72-74) in which two ribs in the region of carina are also distinctly stronger. Specimens from the deposits of the Vienna-type Miocene (HÖRNES, 1856; STRAUZ, 1954, 1966) have shells with whorls more rounded. COSSMANN & PEYROT (1917) exclude from the species *N. plutonis* BASTEROT even the specimen described by HÖRNES (1856) and believe that it belongs to the different, although fairly similar, species *N. funata* DUJARDIN. This view may be correct, but attention should here be called to the fact that HÖRNES's specimen is exceptionally robust and it is difficult to compare it with considerably smaller specimens, such as both the shells from Korytnica and the specimens of *N. funata* DUJARDIN from Aquitaine.

*N. plutonis* BASTEROT has not so far been known from the Miocene of Poland.

## Genus *NERITINA* LAMARCK, 1816

### *Neritina picta* FÉRUSSAC, 1825

(Pl. VII, Figs 7-10)

1856. *Nerita picta* FÉR.; M. HÖRNES, pp. 535-536, Pl. 47, Fig. 14.  
 1896. *Puperita picta* FÉR. var. *taurinensis* SACC.; F. SACCO, p. 51, Pl. 5, Fig. 52.  
 1917. *Neritina picta* FÉRUSSAC; M. COSSMANN & A. PEYROT, pp. 255-258, Pl. 8, Figs 4-14.  
 1928a. *Neritina picta* FÉR.; W. FRIEDBERG, pp. 463-465, Pl. 28, Figs 14-20.  
 1930. *Neritina picta* FÉR.; K. KOWALEWSKI, p. 161.  
 1952. *Clithon (Vittoclithon) pictus pictus* (FÉRUSSAC); A. PAPP, p. 107, Pl. 1, Figs 1-2, 5-8 and 15-28.  
 1952. *Clithon (Vittoclithon) pictus pachii* (M. HÖRNES); A. PAPP, p. 107, Pl. 1, Figs 9-16.  
 1952. *Clithon (Vittoclithon) pictus nivovosus* (BRUSINA); A. PAPP, p. 107, Pl. 1, Figs 17-20.  
 1955. *Clithon (Vittoclithon) pictus pictus* (FÉRUSSAC); J. ŠVAGROVSKÝ, p. 204, Pl. 4, Figs 1-8.

1955. *Clithon (Vittoclithon) pictus pachii* (M. HÖRNES); J. ŠVAGROVSKÝ, p. 205, Pl. 5, Figs 1-6.  
 1955. *Clithon (Vittoclithon) pictus nivosus* (BRUSINA); J. ŠVAGROVSKÝ, p. 206, Pl. 5, Figs 7-12.  
 1958. *Clithon pictus pictus* FÉR.; D. JOVANOVIĆ, Pl. 5, Figs 1 and 3.  
 1966. *Neritina picta* FÉRUSSAC; L. STRAUZ, p. 58, Pl. 49, Figs 13-17.  
 1966. *Theodoxus pictus* (FÉR.); J. KÓKAY, p. 32, Pl. 1, Figs 14-16.  
 1966. *Theodoxus pictus nivosus* (BRUSS); J. KÓKAY, p. 32, Pl. 1, Fig. 17.  
 1968. *Theodoxus (Vittoclithon) pictus pictus* (FÉRUSSAC); L. HINCULOV, pp. 120-121, Pl. 27, Figs 8-11.  
 1968. *Theodoxus (Vittoclithon) pictus nivosus* (BRUSINA); L. HINCULOV, p. 121, Pl. 27, Figs 12-14.  
 1969. *Neritina (Theodoxus) picta* (FÉRUSSAC); M. A. ATANACKOVIĆ, p. 190, Pl. 7, Fig. 11.  
 1970. *Neritina picta* FÉRUSSAC; W. BAŁUK, pp. 141-143, Pl. 8, Figs 9-13.  
 1971. *Clithon (Vittoclithon) pictus pictus* (FÉRUSSAC); J. STANCU, M. D. GHEORGHIAN & A. POPESCU, p. 125, Pl. 6, Fig. 3.  
 1971. *Clithon pictus* (FÉRUSSAC); J. ŠVAGROVSKÝ, pp. 222-224, Pl. 28, Figs 3-5.

**Material.** — Two hundred and fifty specimens.

**Dimensions.** — The largest specimen is 8.2 mm high and 6.8 mm wide.

**Description.** — Shell small or medium-sized, not very thin-walled, but sometimes translucent, subspherical or oviform. Protoconch probably formed by about one and a half convex and smooth whorls, with an almost invisible suture, but very distinctly separated from teleoconch. Teleoconch reaching three whorls, the last of them particularly large (its height being only slightly smaller than that of the entire shell). Early whorls strongly convex, the last one either strongly convex, or provided with two rounded edges and between them either almost completely flat, or slightly concave. Shell surface smooth, usually lustrous. Aperture not very large, semilunar. Outer lip thin, quite smooth inside. Inner fairly thick, its labial area extensive, convex and smooth, except for the columellar edge on which a few (even to ten) teeth occur, two of them always more stronger. Excellently preserved coloration in the form of various brown or almost black zig-zag lines occurs on most specimens. Although there are no shells with identical patterns, but several types of them are frequently repeated (most frequent ones shown in Pl. VII, Figs 7-10).

**Remarks.** — The shells of *Neritina picta* FÉRUSSAC from the Korytnica clays are marked like those from other localities, by a considerable variability in shape. The variable shape of shells, known already to previous investigators, including HÖRNES (1856), was the reason why they were described under various names. Slightly differently shaped shells were earlier frequently treated as separate species and later (PAPP, 1952; ŠVAGROVSKÝ, 1955) considered as subspecies of *N. picta*. Such a standpoint is incorrect, since — as the writer had ample opportunity to convince himself (BAŁUK, 1970) — differences in shell shape are merely a symptom of individual variability, expressed in different profiles of whorls, height of spire and varying coloration. The generic assignment of this species is also a debatable problem. In the last two decades, most authors have assigned it to the subgenus *Vittoclithon* BAKER, 1923, placed either within the genus *Clithon* MONTFORT, 1810, or *Theodoxus* MONTFORT, 1810. The correctness of such an assignment seems to be doubtful. Apart from the fact that both *Clithon* and *Vittoclithon* are in the latest presentations of the taxonomy of the Gastropoda considered as subgenera of the genus *Theodoxus*, it seems substantial that the last-named genus is a fluvial form (see WENZ, 1938, p. 423; KNIGHT *et al.*, 1960, p. I 285), except for its subgenus *Theodoxus (Clithon)*, which occurs in both fluvial and brackish waters, while the species *Neritina picta* FÉRUSSAC, although frequent in brackish waters, is also commonly known from marine deposits formed in basins with a normal salinity and has never been recorded from fresh-water deposits. For this reason, it seems more correct to assign it either to the genus *Neritina* LAMARCK, whose representatives live in waters with a varying degree of salinity ranging between fresh and marine

waters (see KNIGHT *et al.*, 1960, p. I 254), or to the genus *Puperita* GRAY, 1857. Induced by the structure of opercula referred to this species (BALUK, 1970; ŠVAGROVSKÝ, 1971) the writer prefers the former of the two possibilities. These opercula are paucispiral and provided with a prominent process, while in the genus *Puperita* they are believed to be smooth (WENZ, 1938).

*N. picta* FÉRUSAC was mentioned from the Korytnica clays by FRIEDBERG (1928*a*, 1938) and KOWALEWSKI (1930). This is one of the most frequent species of gastropods in the Miocene deposits of Poland. It was recorded in Libiąż (KRACH, 1939), Małoszów (KRACH, 1947), Chmielnik (FRIEDBERG, 1933, 1938), Dwikozy (FRIEDBERG, 1928*a*, 1933, 1938; KOWALEWSKI, 1930), Rybnica (KOWALEWSKI, 1950), Nawodzice (BALUK & RADWAŃSKI, 1968), environs of Modliborzyce (AREŃ, 1962), Benczyn (KRACH, 1950*a*), Bogucice (LISZKA, 1933; FRIEDBERG, 1938), Zgłobice (FRIEDBERG, 1938) and Niskowa (FRIEDBERG, 1928*a*, 1938; SKOCZYLAŚOWNA, 1930; BALUK, 1970).

### Genus SMARAGDIA ISSEL, 1869

#### *Smaragdia expansa* (HÖRNES, 1856)

(Pl. VII, Fig. 5)

1856. *Nerita expansa* REUSS; M. HÖRNES, p. 536, Pl. 47, Fig. 15.

1917. *Neritina (Smaragdia) expansa* REUSS; M. COSSMANN & A. PEYROT, pp. 263-265, Pl. 8, Figs 29-34.

1949. *Smaragdia viridis expansa* (REUSS); M. GLIBERT, p. 83, Pl. 4, Fig. 13.

1966. *Neritina expansa* REUSS in HÖRNES; L. STRAUZ, pp. 60-61, Text-fig. 35*e-f*.

1966. *Smaragdia viridis expansa* (REUSS); J. KÓKAY, p. 33, Pl. 2, Fig. 1.

**Material.** — Three specimens.

**Dimensions.** — The largest specimen is 2.0 mm high and 1.8 mm wide.

**Description.** — Shell small, rather thin-walled, somewhat hemispherical (the flat surface corresponds to the plane of aperture). Protoconch relatively large, but with a number of whorls difficult to determine (one and a half?) on account of a completely invisible suture, strongly convex, smooth and more lustrous than teleoconch, from which it is very distinctly separated. Teleoconch has not yet reached full whorl in any of the specimens found. The profile of whorl fairly strongly convex, except for the upper part close to suture where it is slightly flattened, but without any carina marked. Surface smooth and lustrous, with only delicate growth lines visible on it. Aperture spacious, semilunar. Outer lip thin and sharp on periphery and slightly thickened inside beginning with the center. Labial area extensive, nearly flat, smooth, except for seven fine teeth, the external two of which are larger, occurring on an oblique and slightly bent columellar edge. Umbilicus lacking. Traces of coloration in the form of very thin and short, zig-zag, brown lines, running axially in the upper part of whorl, are preserved in one of the specimens.

**Remarks.** — All the three shells are juvenile specimens, but their identification does not arouse any doubt.

*Smaragdia expansa* (HÖRNES) has not so far been known from the Miocene of Poland.

## Order CAENOGASTROPODA COX, 1959

## Superfamily LITTORINACEA

## Family LITTORINIDAE GRAY, 1840

## Genus LITTORINA FÉRUSSAC, 1821

**Littorina obsoleta** BOETTGER, 1907

(Pl. VIII, Fig. 23)

1901. *Littorina zibinica* (DODERL.); O. BOETTGER, p. 135, No. 417.1907. *Littorina obsoleta* n. sp.; O. BOETTGER, p. 151, No. 520.1934. *Littorina obsoleta* BOETTGER; A. ZILCH, pp. 208-209, Pl. 5, Fig. 67.**Material.** — Thirty specimens.**Dimensions.** — The largest complete specimen (Pl. VIII, Fig. 23) is 3.8 mm high and 2.6 mm wide; judging by fragmentary shells, the complete ones might reach about 4 mm in width.**Description.** — Shell small, conical, relatively thick-walled. Protoconch destroyed in all specimens. Teleoconch reaching about four to five slightly convex whorls. Sutures very shallow. The last whorl, relatively large, makes up about four-fifths of the entire shell. It is provided with a distinct, although very sharp carina, below which the shell is slightly flattened. Surface quite smooth, with only growth lines marked on it. Aperture oval, anteriorly rounded, posteriorly somewhat sharpened. Umbilicus wide but shallow and as a rule completely covered by inner lip, only a few specimens visible in the form of a narrow rima. Traces of a uniform, orange coloration, sometimes only with a slightly lighter band occurring in the upper part of whorls (just below suture), are preserved on almost all shells. Variability is expressed, in the specimens found, in small differences in the slimness of shell (the specimen illustrated is among the slimmest) and prominence of carina on the last whorl.**Remarks.** — The specimens from Korytnica seem to be completely conspecific with the lectotype of this species (comp. ZILCH, 1934). Their surface is, however, smooth, while the presence of distinct spiral striae was emphasized by BOETTGER (1907) in his description. On the perfectly legible photograph of the lectotype, the surface of shell also seems to be quite smooth.

This species has not so far been known from the Miocene of Poland and it has hitherto been found only at Kosteń, Rumania and Korytnica.

Genus **MEDORIOPSIS** COSSMANN, 1888**Medoriopsis detrita** (BOETTGER, 1907)

(Pl. VIII, Fig. 22)

1907. *Lacuna (Entomope) detrita* n. sp.; O. BOETTGER, p. 152, No. 523.1934. *Medoriopsis detrita* (BOETTGER); A. ZILCH, p. 208, Pl. 4, Fig. 65.**Material.** — One specimen.**Dimensions.** — Height, 3.3 mm, width, about 2 mm.

**Description.** — Shell small and not very massive. Protoconch low, very indistinctly separated from the rest of shell, formed probably by one and a half whorls. Teleoconch consists of about four and a half slightly convex whorls, the last of which is large and makes up three-quarter of the entire shell. Surface ornamented by many spiral striae, uniform in width. Only a few of them are somewhat wider in the lower part of the last whorl. Very characteristically thin and closely-spaced “partitions” are marked in grooves (always narrower than striae) between striae. Aperture was probably ovally elongate (its outer lip is broken off), anteriorly rounded and posteriorly contracted. Umbilicus lacking.

**Remarks.** — The specimen described seems to be in a complete conformity with the holotype. Since, however, it is by about one whorl shorter, its ornamentation is not so prominent as seen on the illustration of the holotype (comp. ZILCH, 1934).

*Medoriopsis detrita* (BOETTGER) has not so far been known from the Miocene of Poland. Its shells are among the rarest, as only two specimens, one at Korytnica and the other at Kostej, Rumania have hitherto been found at all.

### Family LACUNIDAE GRAY, 1857

#### Genus LACUNA TURTON, 1827

#### Subgenus PSEUDOCIRSOPE BOETTGER, 1906

#### *Lacuna (Pseudocirsope) banatica* BOETTGER, 1901

(Pl. VIII, Fig. 25)

1901. *Lacuna banatica* n. sp.; O. BOETTGER, p. 136, No. 420.

1919. *Lacuna (Pseudocirsope) burdigalica* nov. sp.; M. COSSMANN & A. PEYROT, p. 651, Pl. 17, Figs 71-74.

1934. *Lacuna (Pseudocirsope) banatica* (BOETTGER); A. ZILCH, p. 208, Pl. 4, Fig. 64.

1966. *Lacuna (Pseudocirsope) banatica* BOETTGER; J. KÓKAY, p. 33, Pl. 2, Fig. 2.

**Material.** — Fifteen specimens.

**Dimensions.** — The largest specimen (Pl. VIII, Fig. 25) is 3.8 mm high and 2.6 mm wide.

**Description.** — Shell small, not very thin-walled, spherical, with a low, conical spire. Protoconch very small, not separated from the rest of shell (probably it is formed by about one whorl). Teleoconch reaching about four to four and a half strongly convex whorls. The last whorl large, nearly spherical, makes up about three-quarter of the entire shell. Surface ornamented by clearly visible, delicate and closely-spaced spiral grooves. Aperture spacious, anteriorly and posteriorly contracted, with a short, troughlike depression for inhalant siphon marked in its anterior part. Both lips having sharp edges, the outer one without varix. Umbilicus open, narrow and deep, rimmed by a prominent roller-like swelling, on which spiral grooves are also visible.

**Remarks.** — The specimens from Korytnica do not display any differences as compared with the holotype (comp. ZILCH, 1934). A new species, *L. burdigalica* COSSMANN & PEYROT, was described from the Miocene of Aquitaine by COSSMANN & PEYROT (1919), who found it very similar to *L. banatica* BOETTGER. The differences they cite, concerning the width of aperture and size of umbilicus, are so insignificant that, in the present writer's opinion, the separation of this new species is ill-grounded.

*L. banatica* BOETTGER has not so far been known from the Miocene of Poland.

**Lacuna (Pseudocirsope) hoernesii** BOETTGER, 1901

(Pl. VIII, Fig. 24)

1901. *Lacuna hoernesii* n. sp.; O. BOETTGER, pp. 135-136, No. 419.1907. *Lacuna hoernesii* BOETTGER.; O. BOETTGER, p. 151, No. 521.1934. *Lacuna (Pseudocirsope) hoernesii* (BOETTGER); A. ZILCH, p. 208, Pl. 4, Fig. 63.**Material.** — Two specimens.**Dimensions.** — The larger specimen (Pl. VIII, Fig. 24) is 3.9 mm high and 2.8 mm wide.**Description.** — Shell small, not very thin-walled, oviform. Protoconch very small and not separated from the rest of shell (it probably consists of about one whorl). Teleoconch reaching about four whorls. The last, large whorl, making up four-fifths of the entire shell, strongly convex. Surface seems to be smooth, but closely-spaced, spiral grooves, more distinct only in the region of umbilicus, are slightly marked on it. Aperture spacious, contracted both anteriorly and posteriorly. Siphonal trough only slightly marked. Both lips have a sharp edge, the outer one without varix. Umbilicus open, fairly deep, rimate.**Remarks.** — Both specimens found at Korytnica are in a complete conformity with the holotype of this species (comp. ZILCH, 1934). They distinctly differ from *Lacuna banatica* BOETTGER in a slightly higher spire, poorer ornamentation and lack of a rolled rimming umbilicus.

This species has not so far been known from the Miocene of Poland. It occurs only at Kostej, Rumania and at Korytnica.

## Superfamily RISSOACEA

## Family TRUNCATELLIDAE GRAY, 1840

## Genus TRUNCATELLA RISSO, 1826

## Subgenus TRUNCATELLA (TRUNCATELLA)

**Truncatella (Truncatella) subcylindrica** (LINNAEUS, 1766)

(Pl. VIII, Figs 27-30)

1882. *Truncatella subcylindrica* LIN. *et var.*; E. BUCQUOY, PH. DAUTZENBERG & G. DOLLFUS, pp. 319-322, Pl. 32, Figs 24-29.1907. *Truncatella kostejana* n. sp.; O. BOETTGER, p. 200, No. 676.1907. *Truncatella biornata* n. sp.; O. BOETTGER, p. 200, No. 677.1934. *Truncatella kostejana* BOETTGER; A. ZILCH, p. 209, Pl. 5, Fig. 70.1934. *Truncatella biornata* BOETTGER; A. ZILCH, p. 209, Pl. 5, Fig. 71.1966. *Truncatella (Truncatella) subcylindrica* (LINNÉ); L. B. ILINA, pp. 94-95, Pl. 4, Figs 5-7.**Material.** — Eight specimens.**Dimensions.** — The largest complete specimen (as understood typically of this species, that is, from the cicatrization of the shell to its aperture) is 5 mm high and 2.1 mm wide. Judging by fragmentary shells, there also occurred larger specimens.

**Description.** — Shell small, relatively thin-walled, cylindrical. Neither protoconch, nor the younger part of teleoconch preserved. They fall off from the rest of teleoconch still at the gastropod's life time and the place of breaking off becomes cicatrized. The preserved, adult part of shell consists of three to four slightly convex or nearly flat whorls. The surface of shell either smooth, or ornamented by many thin axial ribs. These ribs run continuously through the entire whorl, that is, from suture to suture (Pl. VIII, Fig. 30), or they may be marked to a varying degree only near sutures and completely disappear in the central part of whorl (Pl. VIII, Fig. 29). In smooth specimens, ribbing is, however, marked at the base of the last whorl (Pl. VIII, Fig. 28). The number of ribs is variable. In the specimen illustrated, it fluctuates between 35 on the first of the preserved whorls, to 26 on the last. On the largest fragment, mentioned above, it even amounts to 45 on the whorl. The surface on which shell is cicatrized is always smooth. Aperture oval, distinctly oblique. Both lips thin on edge and slightly turned outwards. The inner one completely covers umbilicus, the outer is smooth inside and reinforced with a narrow varix outside, close behind the edge of aperture.

**Remarks.** — As compared with the specimens of the Recent as well as the Late Quaternary *T. subcylindrica* (LINNAEUS) (comp. ILINA, 1966), those from Korytnica do not display any significant differences, and therefore, they may be referred to this species, whose occurrence has hitherto been known as late as from the Pliocene. Two fragmentary specimens have been found by BOETTGER (1907) in the Miocene deposits of Kostej. However, he identified them as two separate species, *T. kostejana* BOETTGER and *T. biornata* BOETTGER. In the present writer's opinion, the separation of the two species is insufficiently founded and they should be considered as synonyms of *T. subcylindrica*. The species *T. wattebledi* BENOIST with allegedly smaller shells (unfortunately, no dimensions are given) and slightly less cylindrical in outline, but with similarly variable ornamentation, were described by COSSMANN & PEYROT (1919) from the Miocene of Aquitaine.

This species has not so far been known from the Miocene of Poland.

## Family RISSOIDAE H. & A. ADAMS, 1854

### Genus PUTILLA A. ADAMS, 1867

#### Subgenus PSEUDOSETIA MONTEROSATO, 1884

#### *Putilla* (*Pseudosetia*) *taurominima* (SACCO, 1895)

(Pl. VIII, Figs 1-3)

1895. *Cingulina?* *taurominima* SACC.; F. SACCO, p. 32, Pl. 1, Fig. 85.

1907. *Cingula* (*Cingulina*) *communis* n. sp.; O. BOETTGER, p. 162, No. 557.

1934. *Cingula* (*Obtusella*) *communis* (BOETTGER); A. ZILCH, p. 210, Pl. 5, Fig. 78.

**Material.** — Forty specimens.

**Dimensions.** — The largest specimen is 1.3 mm high and 0.8 mm wide.

**Description.** — Shell very small, thin-walled, conical or slightly barrel-like. No boundary visible between proto- and teleoconch. As a whole, shell reaches four to four and a half more or less convex whorls. Shell surface smooth, although the presence of a very delicate spiral grooving may sometimes be observed on later whorl when viewed under very strong magnifi-

cation. Aperture roundish, posteriorly slightly contracted. Both lips very thin, the inner only partly covering umbilicus, which is not very spacious, usually rimated. Inner lip in some specimens is provided, just behind the apertural edge, with a delicate but typical varix (Pl. VIII, Fig. 2) which does not occur in some other specimens.

**Remarks.** — Although here described shells are marked by a rather considerable variability in shape, connected with the size of the last whorl, they may be considered conspecific with specimens described from the Miocene of Kostej (comp. ZILCH, 1934) as *Cingula communis* BOETTGER. The writer believes, however, that they also do not differ from *Cingulina taurominima* SACCO, a species described earlier from the Miocene of Sciolze, Northern Italy, although only juvenile specimens from Korytnica are as small as given by SACCO (1895). Very similar specimens have also been described sometimes (comp. FRIEDBERG, 1923, Pl. 24, Figs 15-16) under the name *Hydrobia punctum* (EICHWALD). The presence of the characteristic varix entitles the writer to maintain that the specimens from Korytnica do not belong to the genus *Hydrobia* HARTMANN, 1821.

This species has not so far been known from the Miocene of Poland.

### Genus CINGULA FLEMING, 1828

#### Subgenus HYALA, H. & A. ADAMS, 1852

#### *Cingula (Hyala) vitrea* (MONTAGU, 1803)

(Pl. VIII, Fig. 21)

1901. *Hyala vitrea* (MTG.); O. BOETTGER, p. 145, No. 447.

1914. *Rissoia (Hyala) vitrea* MTG.; S. CERULLI-IRELLI, p. (369), Pl. (47), Figs 51-52.

1966. *Cingula (Hyala) vitrea* (MONTAGU); J. KÓKAY, p. 36, Pl. 2, Fig. 17.

**Material.** — A hundred and thirty specimens.

**Dimensions.** — The largest specimen is 3.5 mm high and 1.4 mm wide.

**Description.** — Shell small, thin-walled, ovally-cylindrical. Protoconch, apically flattened, probably consists of somewhat less than two whorls, very indistinctly separated from the rest of shell. Teleoconch reaching four whorls (the entire shell reaching at most six whorls). Whorls are moderately convex, the last one being the largest and making up more than a half of shell. Surface smooth, with a very delicate grooving sometimes seen locally under a strong magnification. Aperture oval, posteriorly slightly contracted, anteriorly somewhat rounded. Both lips thin, the outer one slightly obliquely oriented in outline and deflected posteriorly. Umbilicus absent.

**Remarks.** — Here described specimens seem not to differ from Miocene (comp. KÓKAY, 1966) and Recent (comp. GLIBERT, 1952, Pl. 2, Fig. 4) forms.

This species had not so far been known from the Miocene of Poland.

#### Subgenus CERATIA H. & A. ADAMS, 1852

#### *Cingula (Ceratia) striata* (HÖRNES, 1856)

(Pl. VIII, Fig. 20)

1856. *Chemnitzia striata* HÖRN.; M. HÖRNES, pp. 541-542, Pl. 43, Fig. 21.

1901. *Pseudochemnitzia acicula* (DUBOIS); O. BOETTGER, p. 89, No. 278.

1966. *Cingula (Ceratia) striata* (HÖRNES); J. KÓKAY, pp. 35-36, Pl. 2, Fig. 15.



**Material.** — Twenty specimens.

**Dimensions.** — The largest specimen (Pl. VIII, Fig. 20) is 3.9 mm high and 1.4 mm wide.

**Description.** — Shell small, not very thin-walled, turretlike. Protoconch formed by one and two-thirds of convex and smooth whorls. The early complete whorl does not project above the rest of protoconch. A distinctly oblique boundary with protoconch is sharply outlined. Teleoconch reaching five, slightly convex whorls. Its surface is ornamented by closely-spaced, delicate, spiral grooves. The number of grooves on all whorls is constant (in particular individuals amounting usually to 13 to 15), with spaces between them increasing with the growth of shell. Similar, but less regularly, usually more closely-spaced grooves are also developed at the base of the last whorl. Aperture oval, posteriorly considerably contracted, anteriorly provided with a shallow but wide siphonal notch. Both lips thin, inner slightly turned onto columella, outer sigmoid in outline, without varix. Umbilicus absent.

**Remarks.** — The writer is quite convinced that here assigned specimens are conspecific with those described by HÖRNES (1856) as *Chemnitzia striata* HÖRNES, while considerably differing from those found by FRIEDBERG (1938, pp. 84-85, Text-fig. 22) at Korytnica and which the present writer considers as a new species and described below as *Cingula (Ceratia) friedbergi* sp. n. (see pp. 67—68). The differences between them are expressed in a more slender shape, more convex whorls and more numerous and more closely-spaced spiral grooves in *C. (C.) striata* HÖRNES. Although no number of grooves is given by HÖRNES, but his illustrations reveal that it is approximately the same as in our specimens and at any rate that the density of grooving is identical. HÖRNES's specimens are only slightly larger. Shells similar to those from Korytnica, but differing in a slimmer shape and yet larger were described by COSSMANN & PEYROT (1919, Pl. 16, Figs 92-93) from the Miocene of Aquitaine as *Ceratia suturalis* COSSMANN & PEYROT. In specimens equalling those from Korytnica in the number of whorls, their height reaches 6 mm and, therefore, there is no question of a more or less grown teleoconch. It is precisely for this reason that the writer believes them to be separate species. The generic assignment of the species under study is rather debatable. Erecting it, HÖRNES (1856) assigned it to the genus *Chemnitzia* d'ORBIGNY, 1839. Finding no similarity to several other generic taxons, including the genus *Ceratia*, BOETTGER (1901) identified it as *Pseudochemnitzia*. FRIEDBERG (1938) referred HÖRNES's species to the genus *Aclis* LOVEN, 1846. The structure of protoconch, shape of aperture and type of ornamentation convince the present writer that the species under study may be assigned to the genus *Cingula* and subgenus *Ceratia*. Its protoconch and aperture are developed similarly as in *Cingula (Hyalia) vitrea* (MONTAGU).

*C. (Ceratia) striata* HÖRNES has not so far been known from any Miocene locality in Poland (comp. p. 68).

### ***Cingula (Ceratia) friedbergi* sp. n.**

(Pl. VIII, Fig. 19)

1938. *Aclis striata* M. HOERN.; W. FRIEDBERG, pp. 84-85, Text-fig. 22.

*Holotype*: Pl. VIII, Fig. 19 (Z.PAL.U.W., No BkK-G 104).

*Type horizon*: Lower Tortonian (= Lower Badenian).

*Type locality*: Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.

*Derivation of the name*: *friedbergi* — in honour of the late Professor WILHELM FRIEDBERG.

**Diagnosis.** — Early whorls of teleoconch almost flat, later slightly convex; spiral grooving delicate, rather irregular and fairly sparse (six to nine grooves on the last but one whorl).

**Material.** — Two hundred specimens.

**Dimensions.** — The largest specimens is 4.5 mm high and 1.6 mm wide.

**Description.** — Shell small, not very thin-walled, shaped like a very slender, apically truncate cone. Protoconch, distinctly separated from teleoconch, consisting of one and two-thirds of smooth and convex whorls. The early, complete whorl almost does not project at all above the rest of protoconch. Teleoconch reaching six whorls, the first two of them almost flat or only slightly convex, the later whorls slightly convex. Surface ornamented by delicate, fairly widely-spaced and rather irregularly arranged spiral grooves, usually seven or eight, less frequently six or nine (counted on the last but one whorl). The base of the last whorl also grooved, but grooves are here somewhat more closely-spaced (particularly closely-spaced grooves observed on one of the specimens). Aperture oval, posteriorly contracted to a considerable degree. Outer lip sigmoid in outline, smooth inside, and without varix outside. Umbilicus absent.

**Remarks.** — Specimens identical with those here presented have already been described by FRIEDBERG (1938) from Korytnica under the name *Aclis striata* (HÖRNES). In the present writer's opinion, this assignment was, however, erroneous. For, although these specimens do not contradict HÖRNES's brief diagnosis, his illustration (see HÖRNES, 1856, Pl. 43, Fig. 21) indicates that he describes different shells (comp. remarks on the species described above). *C. (C.) friedbergi* sp. n. and *C. (C.) striata* HÖRNES are probably closely related to each other, as indicated by the identical type of protoconch and aperture, but they differ from each other to a sufficient degree to preclude their identification. The former differs from the latter in a less slender shell, flatter and relatively lower whorls and, finally, more delicate and more widely-spaced spiral grooving. No specimens have been found with characters transitional from the one to the other species.

Subgenus **SETIA** H. & A. ADAMS, 1854

**Cingula (Setia) laevigata** (EICHWALD, 1850)

(Pl. VIII, Fig. 7)

1853. *Rissoa laevigata* m.; E. EICHWALD, pp. 270-271, Pl. 10, Fig. 12.

1856. *Rissoa Lachesis* BAST. var. *laevis*; M. HÖRNES, p. 572, Pl. 48 Fig. 17.

1923. *Setia laevigata* EICHW.; W. FRIEDBERG, pp. 366-367, Pl. 21, Fig. 10.

1966. *Rissoa turricula laevis* HÖRNES; L. STRAUZ, p. 70, Pl. 47, Fig. 15.

**Material.** — Fourteen specimens.

**Dimensions.** — The largest specimen (Pl. VIII, Fig. 7) is 2.8 mm high and 1.8 mm wide.

**Description.** — Shell small, not very thick-walled, shaped like a rather slender cone. Protoconch probably consisting of two, strongly convex and smooth whorls, not very distinctly separated from the rest of shell. Teleoconch reaching four slightly convex whorls, only the last of which is more distinctly convex. Shell surface smooth, except for the base of last whorl, on which a few delicate spiral grooves are developed. Aperture oval, slightly contracted posteriorly. Inner lip fairly thin. Umbilicus covered or visible as a cliff. Outer lip sigmoid in outline, smooth inside, provided with a usually distinct but rather narrow varix outside. Traces of coloration in the form of many (about 15 on the last whorl), narrow, slightly undulating orange-yellow bands, on the whole running axially.

**Remarks.** — The specimens described are assigned by the present author to this species, but not without certain doubts. They seem to be conspecific with the shells presented by HÖRNES (1856) and FRIEDBERG (1923), but are smaller. They are of the same size as those from Szob, Hungary, described by STRAUZ (1966) as *Rissoa turricula laevis* HÖRNES. This assignment seems to be insufficiently grounded. *Rissoa turricula* EICHWALD is a quite different and considerably larger form (see CSEPHREGHY-MEZNERICS, 1956, Pl. I, Fig. 15). Specimens from the Miocene of Aquitaine (COSSMANN & PEYROT, 1919, pp. 597-598, Pl. 16, Figs 64-65) identified as *Setia laevis* (HÖRNES) differ from those from Korytnica in shape to such an extent that the writer does not connect them.

*C. (S.) laevigata* (EICHWALD) has not so far been known from Korytnica. On the other hand, it was recorded from other localities in Poland: Rybnica (KOWALEWSKI, 1950), Trzydnik (KRACH, 1950*b*), Łychów and Węglinek (KRACH, 1962*b*), Gliwice Stare (KRACH, 1954) and Brzeźnica (KRACH, 1960).

Genus **TURBOELLA** LEACH *in* GRAY, 1847

Subgenus **TURBOELLA** (TURBOELLA)

**Turboella (Turboella) acuticosta** SACCO, 1895

(Pl. VIII, Figs 9-11)

1856. *Rissoa Lachesis* BAST.; M. HÖRNES, p. 572, Pl. 48, Fig. 16.

1895. *Turbella acuticosta* SACCO; F. SACCO, p. 23.

1923. *Turbella acuticosta* SACCO; W. FRIEDBERG, pp. 369-370, Pl. 22, Fig. 1.

1923. *Turbella dubiosa* FRIEDB.; W. FRIEDBERG, pp. 371-372, Pl. 22, Fig. 4.

1932/33. *Turbella acuticosta* SACCO; I. MEZNERICS, p. 329, Pl. 13, Fig. 7.

1950. *Rissoa (Turboella) acuticosta* SACCO; I. CSEPHREGHY-MEZNERICS, p. 21, Pl. 1, Fig. 5.

1954. *Rissoa (Turbella) acuticosta* SACCO; L. STRAUZ, p. 11, Pl. 3, Fig. 62.

1966. *Rissoa turricula acuticosta* SACCO; L. STRAUZ, pp. 69-70, Pl. 46, Figs 6-7.

**Material.** — Two hundred and twenty specimens.

**Dimensions.** — The largest specimen is 3.2 mm high and 1.9 mm wide.

**Description.** — Shell small, thin-walled, shaped like a more or less slender cone. Protoconch consisting of about two and a half strongly convex, smooth and lustrous, whorls. Teleoconch reaching nearly four convex whorls. Ornamentation formed by many, almost quite straight axial ribs. Their number (and, consequently, density of distribution) varies from 15 to 19 on the early whorls and from 12 to 18 on the last whorl. The disappearance of ribs is sometimes observed on the whole or, more frequently, terminal part of the last whorl. Not very closely-spaced spiral grooves are developed in spaces between ribs and usually also on the base of the last whorl (sometimes, however, the base is nearly quite smooth). Aperture roundish, somewhat elongate, slightly contracted posteriorly. Inner lip thin, almost completely covering umbilicus which, however, is sometimes seen in the form of a narrow rima. Outer lip smooth inside, while outside provided with a rather irregular varix varying in width in particular specimens.

**Remarks.** — Here assigned specimens are marked by variability, expressed in particular in differences in the shape of shell, number and prominence of ribs and in the development of varix and spiral grooving. Despite them, all the specimens are considered conspecific. Considerable variability of this species was mentioned by both HÖRNES (1856) and STRAUZ (1966).

According to some authors (MEZNERICS, 1932/1933), it is closely related to the Recent species *Turboella (Turboella) parva* DA COSTA, which is also marked by considerable variability (comp. ILINA, 1966). STRAUZ'S (1966) view that the species under study is a more subspecies of *Rissoa turricula* EICHWALD is ill-founded, since these forms considerably differ from each other.

*T. (T.) acuticostata* SACCO was also mentioned from Korytnica by FRIEDBERG (1938). This species is also known from other Miocene localities in Poland, that is, Małuszów (KRACH, 1947), Rybnica (KOWALEWSKI, 1950) and Żegocina (FRIEDBERG, 1923). KOWALEWSKI (1930) mentions from Korytnica the species *Turbella dubiosa* FRIEDBERG var., which differs from *T. (T.) acuticosta* in the lack of spiral grooves and in a sharp outer lip devoid of varix.

### ***Turboella (Turboella) clotho* (HÖRNES, 1856)**

(Pl. VIII, Fig. 8),

1856. *Rissoa Clotho* HÖRN.; M. HÖRNES, pp. 574-575, Pl. 48, Fig. 20.

1901. *Rissoa clotho* M. HÖ.; O. BOETTGER, p. 139, No. 429.

**Material.** — Fifteen specimens.

**Dimensions.** — The largest specimen is 3.2 mm high and 1.4 mm wide.

**Description.** — Shell small, thin-walled, shaped like a very slender cone. Protoconch probably consisting of about two strongly convex and smooth whorls; its boundary with the rest of shell rather indistinct. Teleoconch reaching four and a half to five slightly convex whorls, which are the widest near the lower suture. Ornamentation formed by many, nearly straight axial ribs usually appearing as late as the first teleoconchal whorl. At first very delicate, they rapidly become fairly distinct. On the last whorl, their number amounts to 11 to 14, the same as on the remaining whorls, where only very rarely 15 of them may be seen. In addition, a not very dense spiral grooving occurs on shell, but it is developed only in intercostal spaces. The number of grooves on the last whorl amounts to six to ten. A considerable decrease in the prominence of ornamentation is observed in some specimens close to the end of the last whorl. The base of the last whorl is almost quite smooth, as both ribs and grooves disappear nearly completely. Aperture roundish, only slightly elongate, slightly contracted posteriorly. Both lips thin on edge. Inner lip only partly covers umbilicus. Outer smooth inside, externally reinforced, close behind edge, by a prominent but fairly narrow, roller-like varix.

**Remarks.** — Here described specimens from Korytnica differ from the holotype from Steinabrunn (HÖRNES, 1856) in slightly smaller dimensions. This species was also described from the Miocene of Hungary (CSEPREGHY-MEZNERICS, 1956, Pl. 1, Figs 22-23; STRAUZ, 1966, Pl. 13, Figs 1-2) and Bulgaria (KOJUMDIEVA, 1960, Pl. 30, Fig. 24). Specimens presented in the two cases considerably differ from the holotype and the writer is in doubt whether or not they can be assigned to this species, especially as the specimen from Dalgodelci, Bulgaria is far from being complete.

As already noticed by STRAUZ (1966, p. 128), the generic assignment of *Turboella (Turboella) clotho* is debatable (comp. also FRIEDBERG, 1938, p. 82). Erecting this species, HÖRNES (1856) assigned it to the genus *Rissoa* DESMAREST, 1814, but then this genus was very broadly understood. COSSMANN (*vide* FRIEDBERG, 1923) assigned HÖRNES'S species to the genus *Alaba* ADAMS, 1853 and subgenus *Gibborissoa* COSSMANN, 1895. Later investigators accepted this view, but this genus happens to be assigned to various superfamilies. CSEPREGHY-MEZNERICS (1956),

SIEBER (1958) and STRAUZ (1966) assign it to the superfamily Cerithiacea, while KOJUMDIEVA (1960), following SACCO's (1895) example, to the superfamily Rissoacea. COSSMANN's view seems to the present writer to be insufficiently justified and, therefore, because of the lack of characteristic varices, irregularly distributed on the last whorls of the specimens here described, he assigns the species under study to the genus *Turboella*. In addition, *T. (T.) clotho* (HÖRNES), although undoubtedly separate from *T. acuticostata* SACCO, does not differ from it to such an extent as to be assigned to another genus, not to mention higher taxons.

This species has not so far been known from the Miocene of Poland.

### ***Turboella (Turboella) johannae* (BOETTGER, 1901)**

(Pl. VIII, Fig. 4)

1901. *Rissoa (Turbellia) johannae* n. sp.; O. BOETTGER, pp. 138-139, No. 428.

1934. *Rissoa (Turboella) johannae* BOETTGER; A. ZILCH, p. 214, Pl. 6, Fig. 94.

**Material.** — Fifteen specimens.

**Dimensions.** — The largest specimen is 3.0 mm high and 1.4 mm wide.

**Description.** — Shell small, thin-walled, shaped like a slender, slightly cylindrical cone. Protoconch composed of almost two and a half strongly convex, smooth and lustrous whorls. Its boundary with the rest of shell frequently almost invisible. Teleoconch reaching four convex whorls (and the whole shell six and a half). Shell surface either almost completely smooth, or provided on some sectors of teleoconch with only slightly projecting axial ribs, which are relatively short, marked only in the central part of whorl and do not reach either the upper or lower suture. They are so closely-spaced that 15 to 20 of them occur on one whorl. Few very delicate spiral grooves, somewhat more distinct only on the base of the last whorl are sometimes marked on shell in addition to ribs. Aperture oval, posteriorly slightly contracted, anteriorly rounded. Inner lip thin, almost completely covering umbilicus, which is visible sometimes in the form of a narrow rima. Outer lip also thin and sharp on edge, inside smooth, outside with or without a very slightly marked varix.

**Remarks.** — The specimens described seem not to differ from the lectotype of this species (comp. ZILCH, 1934), although some of them are somewhat larger and have slightly more prominent ribs and less numerous grooves. This very rare species, found by BOETTGER (1901, 1907) at Kostej and Soos, is also mentioned (one specimen) in a mollusk assemblage from the Miocene of Szob, Hungary (CSEPREGHY-MEZNERICS, 1956; STRAUZ, 1966). Unfortunately, a very schematic illustration (STRAUZ, 1966, Text-fig. 39) does not allow us to compare it with the Korytnica specimens. STRAUZ's figure seems to present a much more conical shell.

This species has not so far been known from the Miocene of Poland.

### ***Turboella (Turboella) dilemma* (BOETTGER, 1907)**

(Pl. VIII, Fig. 5)

1907. *Rissoa (Turbellia) dilemma* n. sp.; O. BOETTGER, pp. 155-156, No. 534.

1934. *Rissoa (Turboella) dilemma* BOETTGER; A. ZILCH, p. 213, Pl. 6, Fig. 93.

**Material.** — Fifteen specimens.

**Dimensions.** — The largest specimen is 2.4 mm high and 1.6 mm wide.

**Description.** — Shell small, thin-walled, slender, conical. Protoconch formed by somewhat more than two strongly convex, smooth and lustrous whorls. Its boundary with the rest of shell is, however, indistinct. Teleoconch reaching nearly three whorls, the last of them relatively wide and dumpy. Shell surface almost quite smooth. Very poorly marked and irregular axial wrinkles and also poorly marked and rather widely-spaced spiral grooves visible only on the last whorls, occur locally on the surface. Aperture roundish, posteriorly slightly contracted. Both lips thin and sharp on the edge. The inner one usually completely covering umbilicus, which only exceptionally may be seen as a narrow rima. The outer lip inside smooth, outside provided with a narrow, poorly marked varix.

**Remarks.** — The specimens described above do not display any major differences as compared with the holotype (comp. ZILCH, 1934). On the other hand, the writer is not quite sure if this species and the previously described *T. (T.) johanna* (BOETTGER) are separate species as believed by BOETTGER (1907). The differences between them are not great consisting of a slightly shape of shell.

*T. (T.) dilemma* (BOETTGER) has not so far been mentioned from the Miocene of Poland. Outside of Korytnica, it occurs only at Kostej, Rumania, from which one specimen is known.

### **Turboella (Turboella) conoidea** sp. n.

(Pl. VIII, Fig. 6)

*Holotype:* Pl. VIII, Fig. 6 (Z.PAL.U.W., No BkK-G 112).

*Type horizon:* Lower Tortonian (= Lower Badenian).

*Type locality:* Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.

*Derivation of the name:* Lat. *conus* — after a conical shape of its shells.

**Diagnosis.** — Shell small, conical, with a relatively large apical angle.

**Material.** — Ten specimens.

**Dimensions.** — The largest specimen is 2.7 mm high and 1.8 mm wide.

**Description.** — Shell small, thin-walled, low, conical. Protoconch consisting of about two smooth and convex whorls, not very distinctly separated from the rest of shell. Teleoconch reaching three and a half slightly convex whorls, relatively rapidly growing in width, so that the last of them is fairly dumpy. Ornamentation formed by many, nearly straight and rather narrow ribs, usually pronouncedly less prominent near the upper suture. Most frequently, they appear only halfway the first teleoconchal whorl. Their number fluctuates between 14 to 21 on early whorls and 13 to 17 on the last one, except for one specimen having 20 of them. The base of the last whorl always smooth, as axial ribs do not reach as far. Intercostal spaces are also in principle smooth, except for the last whorl on which one or two very poorly marked grooves may be observed in the place where axial ribs terminate. Aperture roundish, posteriorly slightly contracted. Both lips thin, the inner one completely covering umbilicus, the outer inside smooth and outside provided with a poorly developed, narrow varix, which is only very slightly stronger than the ribs.

**Remarks.** — *Turboella* (*Turboella*) *conoidea* sp. n. differs from all above described species of the genus *Turboella* in a markedly stocky shape and an almost complete lack of spiral ornamentation. It is very likely that identical specimens were previously found at Korytnica by KOWALEWSKI (1930) who described them as *Turbella dubiosa* FRIEDBERG var.

Slightly similar shells were described by FRIEDBERG (1923) as *Mohrensternia sarmatica* FRIEDBERG, but they are more elongate, have only 12 to 14 axial ribs and are devoid of varix.

Genus ZEBINA H. & A. ADAMS, 1854

Subgenus STOSSICHTIA BRUSINA, 1870

**Zebina** (**Stossichia**) **multicingulata** (BOETTGER, 1887)

(Pl. VIII, Fig. 26)

1856. *Rissoa planaxoides* DESMOUL.; M. HÖRNES, pp. 578-579, Pl. 48, Fig. 24.

1901. *Stossichia multicingulata* BTGR.; O. BOETTGER, p. 146, No. 448.

1923. *Stossicia planaxoides* DES MOUL.; W. FRIEDBERG, pp. 361-362, Pl. 21, Fig. 4.

1932/33. *Stossicia planaxoides* DESM. var. *helvetica* COSSM. & PEYROT; I. MEZNERICS, p. 328, Pl. 13, Fig. 11.

1934. *Stossichia multicingulata* BOETTGER; A. ZILCH, pp. 209-210, Pl. 5, Figs 72-73.

1949. *Planaxis* (*Dalliella*) *dautzenbergi* GLIBERT; M. GLIBERT, pp. 133-134, Pl. 8, Fig. 6.

**Material.** — Ten specimens.

**Dimensions.** — The largest specimen preserved without early whorls (Pl. VIII, Fig. 26) is 5.3 mm high and 2.6 mm wide.

**Description.** — Shell small, relatively thick-walled, fusiform. Protoconch not preserved complete in any of the specimens. Teleconch reaching about five slightly convex whorls, the last of them flat or even slightly concave below suture. The surface of all whorls ornamented by many, shallow, spiral grooves. On early whorls, they are very poorly visible, the surface giving thus an impression of smoothness. Spaces between grooves are irregular, mostly the widest on the periphery of the last whorl. At shell base, grooves are more closely-spaced, deeper and wider. Their number on the last but one whorl amounts to 10 to 14 and on the last to 28 to 32. Aperture oval, relatively strongly elongate, with a very distinct siphonal depression marked in its anterior part. Both lips thick, the inner considerably turned out and, near the siphonal depression, provided with a tuberculate swelling. Outer lip provided inside with three prominent elongate teeth and outside with a reinforced, strong varix.

**Remarks.** — Here assigned specimens do not differ at all from specimens from Lapugy and Kostej (comp. ZILCH, 1934), while compared with specimens presented by HÖRNES (1856) and FRIEDBERG (1923), they have spiral grooves developed in a somewhat different manner. At the base of the last whorl, their grooves are more closely-spaced than on the rest of this whorl, that is, in the opposite manner than in the specimens described by the two investigators mentioned above. However, these differences are probably a symptom of specific variability only, since the number and density of grooves are also irregular in the Korytnica specimens. Two related forms were presented by COSSMANN & PEYROT (1919) from the Miocene in the Aquitaine. Both are, however, different than those occurring in the Vienna-type Miocene deposits. *Stossichia planaxoides* (DESMOULINS) from Aquitaine differs in ornamentation, its surface being covered with fewer and less distinct grooves (seven of them on the last but one whorl),

while *S. planaxoides* (DESMOULINS) mut. *helvetica* COSSMANN & PEYROT is considerably slenderer. These investigators believed that the Viennese specimens could not be assigned to *S. planaxoides* as HÖRNES (1856) and FRIEDBERG (1923) did. Under such circumstances, the name given by BOETTGER to the Viennese specimens has a priority.

A species, *Planaxis (Dalliella) dautzenbergi* GLIBERT, which, as far as it may be judged from the description and photographs, does not differ at all from *Z. (S.) multicingulata*, was described by GLIBERT (1949) from the Miocene of the Loire Basin. The genus *Planaxis* LAMARCK, 1822 is assigned to the superfamily Cerithiacea.

*Z. (S.) multicingulata* (BOETTGER) has not so far been known from the Miocene of Poland. This species was described by FRIEDBERG (1923) from Volhynia.

### Genus FOLINIA CROSSE, 1868

#### Subgenus MANZONIA BRUSINA, 1870

#### *Folinia (Manzonia) costata* (ADAMS, 1797)

(Pl. VIII, Fig. 12)

1915. *Rissoia (Manzonia) faunica* n. sp.; J. DE MORGAN, p. 234, Text-fig. 17.  
 1919. *Manzonia costata* (ADAMS) mut. *minuta* DOLLF. & DAUTZ.; M. COSSMANN & A. PEYROT, pp. 594-595, Pl. 16, Figs 125-126.  
 1923. *Manzonia costata* ADAMS var.; W. FRIEDBERG, pp. 385-386, Pl. 23, Fig. 5.  
 1930. *Manzonia costata* ADAMS var.; W. KOWALEWSKI, p. 152.  
 1949. *Alvania (Manzonia) costata falunica* DE MORGAN; M. GLIBERT, pp. 102-103, Pl. 5, Fig. 22.  
 1966. *Folinia (Manzonia) costata* (ADAMS); L. B. ILINA, pp. 91-92, Pl. 4, Fig. 2.  
 1970. *Folinia (Manzonia) costata* (ADAMS); G. BUCCHERI, pp. 248-249, Pl. 2, Fig. 3.

**Material.** — Thirty specimens.

**Dimensions.** — The largest specimen is 2.5 mm high and 1.4 mm wide.

**Description.** — Shell small, not very thin-walled, barrel-like, elongate. Protoconch smooth, without a distinct boundary with the rest of shell and composed probably of about two whorls. Teleoconch reaching about two and a half to three whorls. Ornamentation formed by slightly S-shaped axial ribs, obliquely oriented to shell axis. At first poorly developed, they rapidly become prominent. Their number per whorl amounts to eight to ten. In addition, thin, threadlike and closely-spaced spiral grooves (12 to 13 on the last whorl) are observed, which, running across ribs, make their ridges finely beady. Two robust, listlike spiral ribs run at the base of the last whorl, with a deep troughlike depression between them. Aperture oval, markedly oblique. Both lips thin, but the outer one surrounded by a wide and flat rim onto which spiral cords still reach. A roller-like varix, considerably stronger than ribs, occurs just behind the rim.

**Remarks.** — As compared with forms described from various Miocene localities, the Korytnica specimens do not display any essential differences. The same probably concerns Pliocene forms, although they seem (BUCCHERI, 1970) to have somewhat higher whorls and, consequently, slightly more spiral cords. The Recent species *Folinia costata costata* (ADAMS) is very similar to the Miocene specimens. According to GLIBERT (1949), it differs, however, from specimens of *Folinia costata falunica* (MORGAN) from the Loire Basin, the latter being allegedly identical (COSSMANN & PEYROT, 1919) with those found in the Miocene of Aquitaine. Two



slightly varying forms: *Rissoa (Manzonina) costata* ADAMS with nine to twelve ribs and *Rissoa (Manzonina) costata minuta* DOLLFUS & DAUTZENBERG with six to seven ribs per whorl were described by STRAUZ (1954, 1966) from the Miocene of Varpalota, Hungary. He identifies the latter form (comp. STRAUZ, 1966, p. 76, *synonymy*) with an identically called form from Aquitaine, which, however, is conspicuously different and, according to COSSMANN & PEYROT (1919) ornamented by ten ribs. The Korytnica specimens do not resemble either of the two forms. The illustration of the former is very indistinct, so that it is difficult to conclude what it actually represents (maybe, it is even a slender specimen of *Alvania (Taramellia) scalaris* (DUBOIS)), while the latter pronouncedly differs in less closely-spaced ribs.

This species was mentioned from Korytnica by KOWALEWSKI (1930) only. In the Miocene of Poland it is also known from Skoczów (KRACH, 1974) and Łychów (KRACH, 1962b).

### Genus *ALVANIA* RISSO, 1826

#### Subgenus *ALVANIA (TARAMELLIA)* SEGUENZA, 1903

#### *Alvania (Taramellia) scalaris* (DUBOIS, 1831)

(Pl. VIII, Figs 13-14)

1831. *Cyclostoma scalare* DUB.; F. DUBOIS DE MONTPEREUX, p. 47, Pl. 3, Figs 40-41.  
 1856. *Rissoa scalaris* DUB.; M. HÖRNES, pp. 567-568, Pl. 48, Fig. 12.  
 1923. *Manzonina scalaris* DUB.; W. FRIEDBERG, pp. 384-385, Pl. 23, Fig. 4.  
 1966. *Rissoa (Manzonina) scalaris* DUBOIS; L. STRAUZ, pp. 77, Text-fig. 42.  
 1970. *Manzonina (Taramellia) scalaris* DUB.; G. RADO & R. MUTIU, p. 147, Pl. 4, Figs 15-16.

**Material.** — Eighty-five specimens.

**Dimensions.** — The largest of the slenderest specimens (Pl. VIII, Fig. 13) is 2.5 mm high and 1.4 mm wide, while that of the most dumpy ones (Pl. VIII, Fig. 14) is 2.6 mm high and 1.7 mm wide.

**Description.** — Shell small, not very thick-walled, more or less slenderly barrel-like. Protoconch consisting of two convex and smooth whorls. Teleoconch reaching three to three and a half strongly convex whorls separated by deep sutures. Whorls provided with prominent, but rather thin and sharp axial ribs varying in number from nine to twelve, on the average eleven per whorl. In addition, thin spiral ribs, also marked on the ridges of axial ribs, run over whorls. The number of spiral ribs, at first amounting to three, increases to reach on the last whorl six to eight, which results from the appearance of ever new ones. Two much stronger spiral ribs, with a troughlike depression between them, also run at the base. Aperture roundish, slightly contracted posteriorly. Both lips thin, but the outer one surrounded by a wide and flat rim. A varix, somewhat stronger than the terminal axial ribs, stretches close behind aperture.

**Remarks.** — A considerable variability, expressed in a varying degree of slenderness of shell, prominence of axial and density of spiral ribs, is observed in the Korytnica specimens. Despite this fact, they are conspecific with those described by DUBOIS (1831), HÖRNES (1856), FRIEDBERG (1923) and RADO & MUTIU (1970). This species is also mentioned in a gastropod assemblage from Hidas, Hungary. Specimens from the last-named locality could not, however, be compared with those from Korytnica, since CSEPREGHY-MEZNERICS (1950) did not illustrate this species, while STRAUZ'S (1966) illustration (Text-fig. 42), a reproduction of FRIEDBERG'S

(1923, Pl. 23, Fig. 4) figure, representing a specimen from Zborów (sic!), was published without explanation.

This species was mentioned from Korytnica by FRIEDBERG (1938) only. In the Miocene of Poland it is also known from Małoszów (KRACH, 1947), Trzydnik (KRACH, 1950*b*), environs of Modliborzyce (AREŃ, 1962), Bogucice (LISZKA, 1933), Brzeźnica (KRACH, 1962*a*) and Niskowa (BAŁUK, 1970).

### *Alvania (Taramellia) alexandrae* BOETTGER, 1901

(Pl. VIII, Figs 17-18)

1901. *Alvania (Actonia) alexandrae* n. sp.; O. BOETTGER, pp. 142-143, No. 441.

1934. *Alvania (Actonia) alexandrae* BOETTGER; A. ZILCH, p. 213, Pl. 5, Fig. 90.

1928*a*. *Manzonia zetlandica* MONT. var. *korytnicensis* FRIEDB.; W. FRIEDBERG, pp. 608-609, Text-fig. 87.

1970. *Alvania* sp.; G. RADU & R. MUTIU, Pl. 4, Fig. 28.

**Material.** — A hundred and ten specimens.

**Dimensions.** — The largest specimen is 3.1 mm high and 1.5 mm wide.

**Description.** — Shell small, relatively thin-walled, slenderly conical. Protoconch consisting of two convex and smooth whorls. Shell ornamentation formed by intersecting axial and, only slightly less developed, spiral ribs. Spiny tubercles are marked at intersections. The number of axial ribs amounts on the early whorls to 13 to 15 and on the last whorl to 17 to 19. Two spiral ribs appear first, but it is still on the first teleoconchal whorls that the third rib develops between them. The fourth rib is found in some specimens at the beginning of the third whorl between the upper and the middle rib. One more rib is visible on the last whorl (on the preceding whorls it is hidden) and thus in some specimens (Pl. VIII, Fig. 17) there are four spiral ribs in this place, while in some others (Pl. VIII, Fig. 18) five. In addition, two quite smooth, listlike, spiral ribs, with a thin, troughlike depression running between them, occur at the base of the last whorl. Aperture oval, posteriorly slightly contracted, anteriorly rounded and characteristically bent. Both lips thin and sharp on edge, the outer one provided with a roller-like varix close behind the edge.

**Remarks.** — Specimens identical with here described ones and also coming from Korytnica were described by FRIEDBERG (1928*a*) as *Manzonia zetlandica* MONT. var. *korytnicensis* FRIEDBERG, whereas they are completely conspecific with the lectotype of *Alvania (Taramellia) alexandrae* BOETTGER and have to be assigned to this species. The only differences observed is the fifth spiral rib, occurring sometimes, which is a symptom of variability.

This species has not so far been known from the Miocene of Poland. Next to Korytnica, it was mentioned only from Kostej. The present writer also includes in this species a specimen from Islaz, Rumania, identified by RADO & MUTIU (1970) as *Alvania* sp.

### *Alvania (Taramellia) subzetlandica* BOETTGER, 1907

(Pl. VIII, Fig. 15)

1901. *Flemingia zetlandica* (MTG.); O. BOETTGER, p. 144, No. 444.

1907. *Flemingia subzetlandica* n. sp.; O. BOETTGER, p. 161, No. 552.

1930. *Manzonia Zetlandica* MONT. v. *miocrassicosta* SACCO; K. KOWALEWSKI, p. 152.

1934. *Alvania (Taramellia) subzetlandica* (BOETTGER); A. ZILCH, pp. 212-213, Pl. 5, Fig. 88.

**Material.** — Fifteen specimens.

**Dimensions.** — The largest specimen is 2.6 mm high and 1.7 mm wide.

**Description.** — Shell small, not very thick-walled, shaped like a slightly slender cone. Protoconch consisting of about two and a half smooth whorls, not very sharply separated from the rest of shell. Teleoconch reaching two and three-quarters to three whorls. Ornamentation formed by intersecting axial and, somewhat less developed, spiral ribs. The number of axial ribs per whorl amounts to 13 to 14 and of spiral ones to three from the very beginning and to four only on the last whorl. A considerably thinner cord also runs above the uppermost spiral rib and thin secondary ribs are formed between the main ones in the terminal part of the last whorl. In addition, two prominent, smooth spiral ribs run at the base with a troughlike depression occurring between them. Aperture roundish, slightly contracted posteriorly. Both lips thin, the outer one surrounded by a flat and not very wide rim. A prominent varix, considerably stronger than axial ribs, is situated close behind the apertural edge. Another, identical varix has been found as an exception in one of the specimens halfway its last whorl.

**Remarks.** — Here described specimens are identical with the holotype of this species (comp. ZILCH, 1934). Very similar specimens from Steinabrunn, Vienna Basin were described by HÖRNES (1856) as *Rissoa zetlandica* MONT. They are, however, larger, reaching, with the same number of whorls, 4 mm in height and this was the reason why that author (BOETTGER, 1907) did not consider them conspecific with specimens of *A. (T.) subzetlandica* from Kostej and Lapugy. HÖRNES' specimens were assigned by SACCO (1895) to the variety *miocrassicosta* SACCO, abundant in the Tortonian of Montegibbio, Northern Italy. Specimens, also slightly larger than those from Korytnica and having four spiral ribs on the last but one whorl and six on the last, were described by FRIEDBERG (1923) under this same name.

The species *A. (T.) subzetlandica* BOETTGER has not been mentioned from Korytnica, but specimens of this species from this same locality were identified by KOWALEWSKI (1930) as *Manzonina Zetlandica* MONT. v. *miocrassicosta* SACCO. This author mentions identical differences as compared with FRIEDBERG'S specimens.

### ***Alvania (Taramellia) kowalewskii* sp. n.**

(Pl. VIII, Fig. 16)

*Holotype:* Pl. VIII, Fig. 16 (Z.PAL.U.W., No BkK-G 120).

*Type horizon:* Lower Tortonian (= Lower Badenian).

*Type locality:* Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.

*Derivation of the name:* in honour of the late KAZIMIERZ KOWALEWSKI, a Polish geologist and investigator of the Korytnica fossils.

**Diagnosis.** — Shell ornamented by relatively few, equally prominent axial and spiral ribs, which intersecting each other form spiny tubercles.

**Material.** — Forty specimens.

**Dimensions.** — The largest specimen is 3.1 mm high and 1.7 mm wide.

**Description.** — Shell small, not very thin-walled, shaped like a slender, somewhat oviform cone. Protoconch consisting of about one and a half strongly convex and smooth whorls (a delicate spiral grooving is seen on the protoconchal surface of an excellently preserved spe-

cimen). Teleoconch reaching three to three and a half slightly convex whorls. Ornamentation formed by intersecting, relatively narrow axial and spiral ribs. Spiny tubercles are developed at intersections of ribs of the two types. The number of axial ribs varying from 11 to 13 in the early part of teleoconch to 13 to 15 on the last whorl. Three spiral ribs appearing at first, run without any accessory ones along all whorls, except for the base of the last whorl where another three such ribs occur. Since axial ribs never reach the base, the last two of the spiral ribs developed in this part of shell may be either tuberculate or smooth. Aperture oval, slightly obliquely oriented to shell axis, slightly contracted posteriorly. Both lips thin, the outer one inside smooth, without any traces of lists and outside provided with a thick and wide varix. Umbilicus absent.

**Remarks.** — No species, to which here described specimens could be assigned, have been found by the present writer in available literature. For this reason, he erects for them a new species, that is, *Alvania (Taramellia) kowalewskii* sp. n. This form is most closely related to *A. (T.) alexandrae* BOETTGER, from which it differs, however, in a less slender shape, more convex whorls, more prominent spiral and less numerous axial ribs.

#### Subgenus *ALVANIA* (*ALVANIA*)

#### *Alvania (Alvania) curta* (DUJARDIN, 1837)

(Pl. IX, Fig. 11)

1856. *Rissoa curta* DUJ.; M. HÖRNES, p. 571, Pl. 48, Fig. 15.  
 1895. *Alvania curta* (DUJ.) var. *crystalocosta* SACC.; F. SACCO, p. 23.  
 1919. *Alvania curta* (DUJARDIN); M. COSSMANN & A. PEYROT, pp. 582-584, Pl. 17, Figs 43-46.  
 1923. *Alvania curta* DUJ.; W. FRIEDBERG, pp. 374-375, Pl. 22, Figs 7-9.  
 1949. *Alvania curta* DUJARDIN; M. GLIBERT, p. 105, Pl. 6, Fig. 3.  
 1950. *Alvania curta crystalocosta* SACCO; I. CSEPREGHY-MEZNERICS, p. 20, Pl. 1, Fig. 4.  
 1954. *Alvania curta* DUJ.; L. STRAUZ, p. 11, Pl. 3, Fig. 60.  
 1966. *Rissoa (Alvania) curta* DUJARDIN; L. STRAUZ, pp. 71-72, Pl. 46, Figs 8-9.

**Material.** — Ninety specimens.

**Dimensions.** — The largest specimen is 3.8 mm high and 2.0 mm wide.

**Description.** — Shell small, rather thick-walled, shaped like a somewhat slender cone. Protoconch only slightly separated from the rest of shell and probably consisting of about two conspicuously convex whorls. Teleoconch reaching three to four and a half very slightly convex, sometimes even almost flat whorls. Shell ornamented by many prominent axial ribs which usually appear only as late as on the second teleoconchal whorl, while the first one remains smooth. The number of ribs per whorl varies from 11 to 15. In addition, spiral cords are seen on the two later whorls, but they occur only in intercostal spaces. They are closely-spaced, except for the periphery of the last whorl. Their number on the last whorl amounts to 10 to 15. Aperture oval, slightly oblique, markedly contracted posteriorly. Both lips thick, the outer one slightly upturned onto columella, the inner provided inside with five elongate lists and outside with a thick and wide varix. Umbilicus absent.

**Remarks.** — The Korytnica specimens are conspecific with forms coming from various Vienna-type Miocene localities, assigned to this species by HÖRNES (1856) and other authors. The only exceptions are the specimens from the Mecsek Mts, Hungary, being determined as *A. curta* (DUJARDIN) and *A. curta crystalocosta* SACCO (comp. BOHN-HAVAS, 1973, Pl. 2,

Figs 26 and 27), and which cannot be united with the Korytnica specimens into the same species. On the other hand, they slightly differ from specimens from Aquitaine (COSSMANN & PEYROT, 1919), in particular from those from the Loire Basin (GLIBERT, 1949). The fundamental difference is expressed in a slenderer shape of the Korytnica specimens, which even slightly resemble in this respect *Rissoa orthezensis* COSSMANN & PEYROT. These differences seem, however, to the present writer to be rather a symptom of a considerable variability of this common species.

This species has so far been mentioned from Korytnica by FRIEDBERG (1938) only. In the Miocene of Poland, it is also known from Małoszów (KRACH, 1947) and Rybnica (KOWALEWSKI, 1950).

***Alvania (Alvania) brachia* BOETTGER, 1901**

(Pl. IX, Fig. 12)

1901. *Alvania (Alvania) brachia* n. sp.; O. BOETTGER, p. 139, No. 430.

1934. *Alvania (Alvania) brachia* BOETTGER; A. ZILCH, p. 211, Pl. 5, Fig. 80.

**Material.** — Twenty-five specimens.

**Dimensions.** — The largest specimen is 2.9 mm high and 1.8 mm wide.

**Description.** — Shell small, fairly thick-walled, obtusely conical. Protoconch without any distinct boundary with the rest of shell; consisting of about two strongly convex whorls. Teleoconch reaching three and one-third to four slightly convex or nearly flat whorls. Axial ribs, at first thin and closely-spaced (16 to 18 per whorl) and then gradually becoming thicker and widely-spaced (11 to 12 on the last whorl) are the main element of ornamentation. In addition, many closely-spaced spiral cords appear from the very beginning of teleoconch. They are primarily seen in intercostal spaces, although they also occur on rib ridges of early whorls. The number of spiral cords on the last whorl fluctuates between 14 and 18, one or two of them being wider on periphery. Aperture oval, slightly contracted posteriorly. Both lips thin and sharp on periphery. The outer one provided inside with eight to ten thin, elongate lists and outside reinforced with a thick and wide varix, always situated near the apertural edge. Shell surface between edge and varix is smooth, devoid of spiral cords.

**Remarks.** — At a glance, *A. (A.) brachia* BOETTGER strongly resembles *A. (A.) curta* (DUJARDIN) from which it differs, however, in smaller dimensions of protoconch (with the same number of whorls), lower number of axial ribs on the last whorl, higher number of lists inside aperture (not less than eight), more closely-spaced spiral cords appearing from the very beginning of teleoconch and, finally, in a less slender shape of the specimens of *A. (A.) brachia* BOETTGER. Compared with the holotype described from Kostež (comp. ZILCH, 1934), the Korytnica specimens do not display any differences. Although, according to BOETTGER (1901), 14 to 18 axial ribs run on the last whorl of his specimens, a photograph of the holotype reveals that they are equally numerous as in those from Korytnica.

This species has not so far been known from the Miocene of Poland. Outside Korytnica, it was met with in the region of Kostež and Lapugy only.

***Alvania (Alvania) montagui ampulla* (EICHWALD, 1850)**

(P. IX, Fig. 9)

1853. *Rissoa ampulla* m.; E. EICHWALD, p. 274, Pl. 10, Fig. 16.

1856. *Rissoa Montagui* PAYR.; M. HÖRNES, pp. 569-570, Pl. 48, Fig. 13.

1895. *Alvania Montagui* var. *miocenica* SACC.; F. SACCO, p. 23.

1923. *Alvania Montagui* PAYR.; W. FRIEDBERG, pp. 375-376, Pl. 22, Fig. 11.  
 1923. *Alvania Montagui* PAYR. var. *ampulla* EICHW.; W. FRIEDBERG, p. 377, Pl. 22, Fig. 12.  
 1939. *Alvania Montagui* PAYR. var.; W. KRACH, p. 4, Pl. 1, Fig. 18.  
 1950b. *Alvania montagui* PAYR. var. *ampulla* EICHW.; W. KRACH, p. 303, Pl. 1, Fig. 7.  
 1956. *Alvania montagui miocaenica* SACCO; I. CSEPREGHY-MEZNERICS, p. 431, Pl. 2, Figs 1-4.  
 1960. *Alvania (Alvania) montagui* var. *miocaenica* SACCO; E. KOJUMDGIEVA, p. 101, Pl. 30, Fig. 17.  
 1960. *Alvania (Alvania) montagui* var. *ampulla* (EICHWALD); E. KOJUMDGIEVA, p. 101, Pl. 30, Fig. 18.  
 1966. *Rissoa (Alvania) montagui miocaenica* SACCO; L. STRAUZ, p. 74, Pl. 46, Figs 19-20.  
 1969. *Alvania (Alvania) montagui* (PAYRAUDEAU); M. A. ATANACKOVIĆ, p. 194, Pl. 8, Fig. 10.  
 1970. *Alvania montagui ampulla* EICHW.; G. RADO & R. MUTIU, p. 147, Pl. 4, Figs 6-7.  
 1970. *Alvania (Alvania) montagui ampulla* (EICHWALD); W. BAŁUK, p. 117, Pl. 9, Fig. 4.

**Material.** — Two hundred specimens.

**Dimensions.** — The largest specimen is 3.6 mm high and 2.0 mm wide.

**Description.** — Shell small, not very thick-walled, obtusely conical. Protoconch indistinctly separated from the rest of shell, consisting of about two and a half convex whorls. Teleoconch reaching four and a half whorls, but fully grown shell are also observed having one or even one and a half whorls less. Shell ornamented by axial ribs, at first very delicate, then gradually becoming more and more robust, their number on the first whorl amounting to 16 to 18, on the last one to 12 to 15 and on the average to 13. These ribs gradually disappear at the base of the last whorl. In addition, spiral ribs, considerably thinner than the axial ones, and also marked on their ridges, run on whorls. Two of them appear at first, soon, however, that is, still on the first teleoconchal whorl, two other ones are developed between the first two and above the upper one. Two secondary ribs, one each between the main ones, appear in addition on the last and, less frequently, on the last but one whorl in a considerable number of specimens. The base of the last whorl is also spirally ribbed by five to six ribs, the last three of them quite smooth. Aperture oval, markedly contracted posteriorly. Outer lip thin on edge, but reinforced close behind it by a wide, roller-like varix, which is provided inside with many (seven to ten) lists. Umbilicus absent.

**Remarks.** — As compared with Viennese specimens described by HÖRNES (1856), those from Korytnica differ only in slightly smaller dimensions. Since the Recent species *Alvania (Alvania) montagui montagui* (PAYRAUDEAU) supposedly differs from the closely related fossil form, SACCO (1895) suggested for HÖRNES's specimens the name *Alvania (Alvania) montagui miocenica*. It was, however, much earlier that EICHWALD (1853) had described similar specimens as *Rissoa ampulla* EICHWALD and their complete conspecificity with the Viennese specimens had been found by HÖRNES. For this reason, the subspecies *A. (A.) montagui miocenica* should be considered as a younger synonym of the subspecies *A. (A.) montagui ampulla*. The separation of two subspecies, as done by some authors, is ill-founded.

*A. (A.) montagui ampulla* (EICHWALD) is the most frequent representative of the genus *Alvania* in the Miocene deposits. It was mentioned from Korytnica by FRIEDBERG (1938). From the Miocene of Poland, it is known, in addition, from the following localities: Małoszów (KRACH, 1947), Rybnica (KOWALEWSKI, 1950), Trzydnik (KRACH, 1950b), Łychów (KRACH, 1962b), Węglin (BIELECKA, 1967), Brzeszcze (KRACH, 1939), Wieliczka (FRIEDBERG, 1933), Bogucice (LISZKA, 1933), Brzeźnica (KRACH, 1960) and Niskowa (BAŁUK, 1970).

**Alvania (Alvania) helenae** BOETTGER, 1901

(Pl. IX, Fig. 10)

1901. *Alvania (Alvania) helenae* n. sp.; O. BOETTGER, p. 140, No. 432.1934. *Alvania (Alvania) helenae* BOETTGER; A. ZILCH, p. 211, Pl. 5, Fig. 81.**Material.** — Five specimens.**Dimensions.** — The largest specimen is 2.6 mm high and 1.6 mm wide.

**Description.** — Shell small, not very thick-walled, slenderly conical. Protoconch consisting of about two smooth whorls, indistinctly separated from the rest of shell. Teleoconch formed by somewhat more than three slightly convex whorls, the last of them relatively high and somewhat flattened at the base. Fairly strong axial ribs, which on the last whorl do not pass onto the base, run over the shell surface. Their number on the first whorl of teleoconch amounts to 18 and on the last to 15. Spiral ribs, only slightly less developed than the axial ones, are another element of ornamentation. Two of them appear first and two more are then formed above the upper one of the first two and between them. Five more spiral ribs, all of them quite smooth except for the uppermost one, run over the base of the last whorl. Aperture oval, markedly contracted posteriorly near the junction of both lips; anteriorly rounded and somewhat elongate. Outer lip inside provided with eight fairly robust lists and outside reinforced with a strong varix. Umbilicus absent.

**Remarks.** — Few specimens from Korytnica here assigned do not differ from those of *A. (A.) helenae* BOETTGER from Kostej and Lapugy, Rumania, incomparably more abundant in those localities. *A. (A.) helenae* is marked by the presence of one more varix, occurring always on the fifth whorl. Although this character has not ever been found in the specimens from Korytnica, but compared with the lectotype of the species (comp. ZILCH, 1934) they are smaller by one whorl and their varix could be considered as the first (accessory) varix of BOETTGER's specimens. The second, terminal varix would probably be developed in them if the growth was continued.

This species has not so far been known from the Miocene of Poland. In addition to Korytnica, it occurs in the region of Kostej and Lapugy, mentioned above.

**Alvania (Alvania) productilis** BOETTGER, 1907

(Pl. IX, Fig. 6)

1907. *Alvania (Alvania) productilis* n. sp.; O. BOETTGER, pp. 156-157, No. 539.1934. *Alvania (Alvania) productilis* BOETTGER; A. ZILCH, p. 212, Pl. 5, Fig. 83.**Material.** — Three specimens.**Dimensions.** — The largest specimen (Pl. IX, Fig. 6) is 2.6 mm high and 1.6 mm wide.

**Description.** — Shell small, relatively thin-walled, shaped like a not very slender cone. Protoconch consisting of about two and a half smooth and convex whorls. Teleoconch reaching somewhat more than three whorls, the last of which is particularly strongly convex, without a flattening at the base. Ornamentation formed by rather thin, slightly sigmoid axial ribs, rounded in outline, whose number on the last whorl amounts to 19 or 20. In addition, very thin spiral

cords, seven or eight of them on the last but one whorl, run over the surface. The uppermost is the most distinct and on intersecting with axial ribs has a row of roundish tubercles. Seven to nine nearly quite smooth cords also run at the base. Aperture oval, contracted posteriorly. Inner lip completely covering the umbilicus. Outer reinforced by a wide varix, in two smaller specimens smooth inside, in the largest provided with many (13) thin lists.

**Remarks.** — Here assigned specimens do not display any major differences as compared to the lectotype of this species (comp. ZILCH, 1934). Minor differences from BOETTGER's (1907) description are expressed in somewhat more numerous axial ribs (*in* BOETTGER's specimens 16 to 19 on the last whorl) and in the presence of lists inside aperture, which do not occur in the specimens from Kostej.

This species has not so far been known from the Miocene of Poland. Next to Korytnica, it has been found at Kostej, Rumania only.

### ***Alvania (Alvania) oceani* (d'ORBIGNY, 1852)**

(Pl. IX, Fig. 17)

1856. *Rissoa Moulinsi* d'ORB.; M. HÖRNES, pp. 570-571, Pl. 48, Fig. 14.

1895. *Alvania curta?* var. *rotundulina* SACC; F. SACCO, p. 24.

1901. *Alvania (Alvania) rotundulina* SACCO; O. BOETTGER, pp. 139-140, No. 431.

1919. *Alvania Oceani* (d'ORB.); M. COSSMANN & A. PEYROT, pp. 587-588, Pl. 16, Figs 111-112.

**Material.** — Twenty specimens.

**Dimensions.** — The largest specimen (Pl. IX, Fig. 17) is 3.6 mm high and 2.2 mm wide.

**Description.** — Shell small, relatively thick-walled, shaped like a slightly slender cone. Protoconch consisting of about two weekly convex whorls without any distinct boundary with the rest of shell. Teleoconch reaching four nearly flat whorls, the last of them with a slightly flattened base. Prominent, straight axial ribs, slightly flattened laterally and not passing onto the base of shell make up the main element of ornamentation. Their number on the first teleoconchal whorl amounts to 16 to 18, on the middle ones to 18 to 22 and on the last one to 14 to 18. In addition, spiral cords distinctly marked in intercostal spaces and only very slightly on rib ridges, run over the surface of shell. Four of them appear first, supplemented later on by one more. Six to eight prominent cords, which except for the uppermost one are quite smooth, run on the base of the last whorl. Aperture oval, considerably contracted posteriorly. Inner lip completely covering umbilicus. Outer thin on edge and close behind it reinforced by a thick, but not very wide varix; inside provided with many (8 to 9), delicate lists.

**Remarks.** — The name *Alvania oceani* (d'ORBIGNY) was used by the investigators of the Miocene gastropods to determine specimens which even considerably differed from each other. In order to avoid ambiguity, the writer defined this species on the basis of the description and illustrations of specimens from the Miocene of Aquitaine (comp. COSSMANN & PEYROT, 1919), which are supposedly conspecific with *Rissoa moulinsi* d'ORBIGNY from the Miocene of the Vienna Basin (HÖRNES, 1856). In such a presentation, the specimens from Korytnica are not conspecific with forms described by FRIEDBERG (1923) as *Alvania oceani* (d'ORBIGNY). As found by the present writer, in FRIEDBERG's collections this name is used for identifying various forms, including the specimens from Korytnica, which in the present work are described as *Alvania tenuicostata* sp. n.

This species has not so far been known from Korytnica in the writer's interpretation.



**Alvania (Alvania) alta** sp. n.

(Pl. IX, Figs 20-21)

*Holotype*: Pl. IX, Fig. 20 (Z.PAL.U.W., No BkK-G 127).*Type horizon*: Lower Tortonian (= Lower Badenian).*Type locality*: Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.*Derivation of the name*: Lat. *alta* — after characteristically high shells.**Diagnosis.** — Shell relatively very high; its height almost twice as much as width.**Material.** — Thirty specimens.**Dimensions.** — The largest specimen is 4.4 mm high and 2.3 mm wide.

**Description.** — Shell small, not very thick-walled, shaped like a slender cone. Protoconch consisting of about two smooth and convex whorls. Teleoconch reaching four and a half slightly convex or nearly flat whorls. Fairly thin axial ribs, whose number varies within limits of 15 to 20 on the first teleoconchal whorl and 17 to 22 on the last form ornamentation. On the last whorl, the ribs are less regular, usually marked only in its upper part and not reaching the base. Sometimes, near the end of whorl they disappear at all. In addition, spiral cords, best visible in intercostal spaces, occur on shell. Their number on the last but one whorl amounts to seven or eight (sometimes, very rarely, six). Seven more spiral cords, which except for the uppermost one are quite smooth, run at the base of the last whorl. Aperture relatively spacious, oval, distinctly contracted posteriorly. Both lips thin on edge; the outer one always smooth inside and reinforced by a usually slightly developed varix outside. Umbilicus absent.

**Remarks.** *Alvania alta* sp. n. is closely related to the Pliocene species *A. reticulata* (MONTAGU), whose shells are smaller, less slender and having more convex whorls (comp. CERULLI-IRELLI, 1914, Pl. 48, Figs 4-9). Here assigned specimens markedly differ from those from Korytnica described as *A. (A.) oceani* (d'ORBIGNY) in conspicuously larger dimensions, slenderer shape and thinner and more numerous axial ribs.

**Alvania (Alvania) tenuicostata** sp. n.

(Pl. IX, Figs 7-8)

*Holotype*: Pl. IX, Fig. 7 (Z.PAL.U.W., No BkK-G 129).*Type horizon*: Lower Tortonian (= Lower Badenian).*Type locality*: Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.*Derivation of the name*: Lat. *tenuicostata* — after characteristically very thin ribs making up the main element of shell ornamentation.**Diagnosis.** — Shell thin-walled, with slightly convex whorls ornamented by many very thin axial ribs.**Material.** — Two hundred specimens.**Dimensions.** — The largest specimen (Pl. IX, Fig. 8) is 3.3 mm high and 1.8 mm wide.

**Description.** — Shell small, thin-walled, shaped like a slender cone. Protoconch consisting of about two smooth and convex whorls. Teleoconch reaching four and a half slightly convex whorls, the last of them rounded and without any flattening at the base. Ornamentation

delicate, very distinct, formed by very thin and sharp, slightly sigmoid axial ribs. They are closely-spaced and occur in considerable number which on the early teleoconchal whorls amounts to 26 to 34 and on the last whorl to 25 to 40. In addition, also closely-spaced spiral cords, only slightly less developed than ribs, run over shell surface. Four to five of them appear at first, further on increasing to seven to nine. Two uppermost ones are always somewhat more robust. Fine tubercles are formed at their intersections with axial ribs. Eight to nine more cords, slightly less closely-spaced, run at the base of the last whorl. Aperture oval, slightly contracted posteriorly. Both lips thin and sharp on the apertural edge. The inner one mostly only partly covers umbilicus which is seen as a small, narrow rima. The outer one usually completely smooth inside. Sometimes, however, very slightly marked lists may be observed in it. Outside, this lip is reinforced by a relatively narrow varix occurring close behind the apertural edge. In some specimens (fourteen of all found) there additionally occurs another varix, (usually about a quarter of the length of whorl before the apertural edge). Shell ornamentation between varices is always less distinct and regular.

**Remarks.** — As mentioned above, identical specimens were also found at Korytnica by FRIEDBERG (1938) who identified them as *Alvania oceani* (d'ORBIGNY), although they very distinctly differed from this species (comp. COSSMANN & PEYROT, 1919, Pl. 16, Figs 111—112).

### *Alvania (Alvania) sublaevigata* BOETTGER, 1907

(Pl. IX, Figs 1-2)

1907. *Alvania (Massotia) sublaevigata* n. sp.; O. BOETTGER, pp. 160-161, No. 550.

1934. *Alvania (Massotia) sublaevigata* BOETTGER; A. ZILCH, p. 212, Pl. 5, Fig. 87.

1966. *Rissoa (Alvania) sublaevigata* BOETTGER; L. STRAUZ, p. 74, Pl. 46, Figs 10-11.

**Material.** — Forty specimens.

**Dimensions.** — The largest specimen (Pl. IX, Fig. 1) is 3.0 mm high and 1.9 mm wide.

**Description.** — Shell small, fairly thin-walled, conical. Protoconch consisting of about two smooth and convex whorls. Teleoconch reaching three and two-thirds of slightly convex whorls the last of them rounded, at the base somewhat flattened. Ornamentation markedly not prominent, formed by narrow, very flat and closely-spaced axial ribs, whose number on the last whorl varies within limits of 40 to 55. Spiral cords, less strongly developed than ribs, are also visible on the shell. Five to six of them appear at first and later this number increases to eight or nine, two of them, the first and the last, being usually more distinct. In addition, nine to ten slightly more robust and less closely-spaced cords occur on the base of the last whorl. Aperture oval, markedly contracted posteriorly. Both lips thin; the inner one almost completely covering umbilicus, the outer provided inside with many (usually twelve) delicate lists and outside reinforced with a not very prominent varix. Another varix, situated always at the end of the second teleoconchal whorl, observed in five specimens.

**Remarks.** — Here described specimens are identical with the lectotype of this species (comp. ZILCH, 1934). Although BOETTGER (1907) emphasized that the outer lip of his specimens is not crenate, the photograph of the lectotype clearly reveals delicate lists quite identical with those seen in the Korytnica specimens. *A. (A.) sublaevigata* BOETTGER has also been men-

tioned from the Miocene of Hungary, but the specimen from Varpalota, presented by STRAUZ (1966) has a somewhat different shape. The conspecificity of this specimen with those here described is rather debatable.

This species has not so far been known from the Miocene of Poland.

Subgenus **TURBONA** LEACH *in* GRAY, 1847

**Alvania (Turbona) perregularis** (SACCO, 1895)

(Pl. IX, Figs 13-15)

1856. *Rissoa Mariae* d'ORB.; M. HÖRNES, pp. 563-564, Pl. 48, Fig. 9.

1895. *Acinus Mariae?* var. *perregularis* SACCO.; F. SACCO, p. 25.

1923. *Alvania perregularis* SACCO; W. FRIEDBERG, pp. 378-379, Pl. 22, Figs 14-15.

1923. *Alvania perregularis* SACCO var. *varicosa* FRIEDB.; W. FRIEDBERG, pp. 379-380, Pl. 22, Fig. 16.

1932/33. *Alvania (Acinus) perregularis* SACCO; I. MEZNERICS, pp. 331-332, Pl. 13, Fig. 9.

1973. *Alvania perregularis* SACCO; M. BOHN-HAVAS, p. 1037, Pl. 3, Figs 1-2.

**Material.** — A hundred and fifty specimens.

**Dimensions.** — The largest specimen is 3.8 mm high and 2.2 mm wide.

**Description.** — Shell small, fairly thick-walled, shaped like a slender cone. Protoconch very indistinctly separated from the rest of shell, probably consisting of two smooth and convex whorls. Teleoconch reaching four whorls; the early two of them nearly flat, the remaining ones slightly convex. Shell ornamentation formed by many fairly thin and not very projecting axial and spiral ribs. Roundish tubercles are developed at intersections of ribs. The number of axial ribs is variable in particular specimens. On the first teleoconchal whorl it varies from 19 to 25, on the middle whorls from 22 to 32 and on the last from 27 to 39. Two spiral ribs appear at first and soon after the third one develops above them, which is to the end distinctly separated from the rest of them. With the growth of shell, further ribs gradually appear between the two first ones so that a newly formed rib appears below the upper early rib. The number of spiral ribs on the last but one whorl amounts to six or seven and even, although very rarely, to eight. Six more spiral ribs run at the base of the last whorl. Aperture oval, very slightly contracted posteriorly. Both lips prominent and rather thick. The outer one provided inside with short but fairly robust lists (nine to eleven in all) and outside close behind the apertural edge, reinforced with a wide varix.

**Remarks.** — The specimens from Korytnica are conspecific with forms described by HÖRNES (1856) from the Vienna Basin from which they, however, differ in somewhat smaller dimensions. The specimen from Steinabrunn (comp. HÖRNES, 1856, Pl. 48, Fig. 9) is as high as 5 mm. *Alvania mariaae* (d'ORBIGNY), to which the Viennese specimens were assigned by HÖRNES, is, however, in the opinion of other investigators, a different form. It is even considered by COSSMANN & PEYROT (1919) as a variety of *Alvania oceani* (d'ORBIGNY). The Viennese specimens, discussed above, were thought by SACCO (1895) to be a variety of *Alvania mariaae* (d'ORBIGNY). SACCO suggested for it the name *perregularis*, generally accepted by later authors. The shells of *Alvania mariaae* (d'ORBIGNY) from the Pliocene of Sicily (comp. GRECO, 1970, Pl. 2, Figs. 2 and 4) are very similar to the Korytnica specimens, but distinctly differ from them in a smaller number of spiral ribs (five of them on the last but one whorl). Specimens, which in the present

writer's opinion do not belong to this species (comp. STRAUSZ, 1954, Pl. 3, Fig. 59; 1966, Pl. 46, Figs 12-13), were assigned by STRAUSZ (1954, 1966) to *Alvania perregularis* SACCO.

This species has not so far been known from Korytnica. On the other hand, it was mentioned from other Miocene localities of Poland, that is, Gliwice Stare (KRACH, 1954), Trzydnik (KRACH, 1950*b*), Łychów (KRACH, 1962*b*), Węglin (BIELECKA, 1967) and Bogucice (LISZKA, 1933).

***Alvania (Turbona) subcrenulata* (SCHWARTZ, 1869)**

(Pl. IX, Fig. 16)

1882. *Rissoa subcrenulata* SCHWARTZ; E. BUCQUOY, PH. DAUTZENBERG & G. DOLLFUS, pp. 293-294, Pl. 36, Figs 11-13.

1914. *Rissoia (Alvania) subcrenulata* SCHWARTZ; S. CERULLI-IRELLI, pp. (374)-(375), Pl. (47), Figs 75-77.

1965. *Alvania (Turbona) subcrenulata* (SCHWARTZ); G. RUGGIERI & A. GRECO, p. 56, Pl. 4, Fig. 11.

**Material.** — Two specimens.

**Dimensions.** — The larger specimen is 3.0 mm high and 1.9 mm wide.

**Description.** — Shell small, fairly thick-walled, shaped like a slender cone. Protoconch consisting of about two convex and smooth whorls. Teleoconch reaching four whorls. Ornamentation, relatively very prominent, formed by robust, although not very wide, axial ribs, also reaching onto the base of the last whorl, as well as not very less robust spiral ribs. The number of axial ribs on early whorls amounts to 13 or 14 and on the last whorl to 11. Spiral ribs are very distinct from the beginning. Two of them appear at first, but it is still on the first teleoconchal whorl that the third one is developed above them and the fourth between the first two on the next whorl. In addition, three robust spiral ribs run over the base of the last whorl. A troughlike depression stretches between the last two of them. Aperture relatively small, oval, posteriorly contracted. Outer lip sharp on edge and reinforced with a robust varix close behind it. Inside, it is provided with six strong lists terminating in tubercles. Secondary ribs also occur on varix between spiral ribs marked on it.

**Remarks.** — Compared to a specimen presented by RUGGIERI & GRECO (1965), the specimens described differ in a less prominent varix. In the Miocene deposits, this species has so far been found only at Kostej, Rumania (BOETTGER, 1907), but the specimens from this locality have never been illustrated.

It has not so far been known from the Miocene of Poland.

Subgenus **ACINULUS** SEGUENZA, 1903

***Alvania (Acinulus) venus transiens* SACCO, 1895**

(Pl. IX, Figs 18-19)

1856. *Rissoa Venus* d'ORB.; M. HÖRNES, pp. 565-566, Pl. 48, Fig. 10.

1895. *Acinopsis sculpta?* var. *transiens* SACC.; F. SACCO, pp. 27-28.

1901. *Alvania (Acinulus) sculpta* (PHIL.); O. BOETTGER, p. 141, No. 435.

1907. *Alvania (Acinulus) venus* d'ORB.; O. BOETTGER, p. 157, No. 542.

1923. *Alvania Venus* d'ORB. var. *danubiensis* COSSM. & PEYR.; W. FRIEDBERG, pp. 380-381, Pl. 22, Fig. 17.

1954. *Alvania venus danubiensis* COSSM. & PEYR.; L. STRAUSZ, p. 11, Pl. 3, Fig. 58.

1956. *Alvania venus danubiensis* COSSMANN & PEYROT; I. CSEPREGHY-MEZNERICS, p. 379, Pl. 2, Figs 15-16.

1960. *Alvania (Alvania) venus* var. *danubiensis* (COSSMANN & PEYROT); E. KOJUMDIEVA, p. 100, Pl. 30, Fig. 15.  
 1966. *Rissoa (Alvania) venus danubiensis* COSSMANN & PEYROT; L. STRAUZ, pp. 72-73, Pl. 46, Figs 17-18.  
 1970. *Alvania (Alvania) venus danubiensis* COSSM. & PEYR.; G. RADU & T. MUTIU, p. 147, Pl. 4, Figs 13-14.

**Material.** — A hundred and sixty specimens.

**Dimensions.** — The largest specimen is 4.0 mm high and 2.2 mm wide.

**Description.** — Shell small, fairly thick-walled, shaped like a slender cone. Protoconch composed of about two and a half smooth and strongly convex whorls, not very distinctly separated from the rest of shell. Teleoconch reaching four and one-third of whorls separated from each other by very distinctly marked sutures. Ornamentation formed by prominent axial and less so spiral ribs. Rounded tubercles are developed at rib intersections. The number of axial ribs varies within fairly wide limits, that is from 13 to 16. Two spiral ribs appear at first, followed later by the third developed above the upper one of these two and still later (usually at the end of the second teleoconchal whorl) by the fourth — between the first two. In addition, one or two secondary ribs appear at the end of the last whorl. Four spiral ribs, of which only the last is smooth, also run always at the base. Aperture oval, posteriorly only slightly contracted. Inner lip thin, umbilicus lacking. Outer lip inside provided with several (usually six to eight) thin lists, outside reinforced with a thick and wide varix.

**Remarks.** — The specimens described above seem to be completely conspecific with Viennese ones (see HÖRNES, 1856), although the number of their axial ribs varies within wider limits (according to HÖRNES, the Viennese specimens have 16 to 18 ribs on the last whorl). They also do not differ from specimens described by FRIEDBERG (1923, 1938), although this author's description lack information on the number of ribs. According to COSSMANN & PEYROT (1919), HÖRNES's specimens do not belong to the *Alvania venus* (d'ORBIGNY), but should be considered as a separate species, for which they suggested the name *Alvania danubiensis* COSSMANN & PEYROT. After this ascertainment, this name was used by other investigators who, treated it only as a new variety of *Alvania venus* (d'ORBIGNY). However, it was long before the publication of the monograph of COSSMANN & PEYROT that a similar conclusion was also drawn by SACCO (1895) who identified the Viennese specimens as *Alvania (Acinopsis) sculpta?* var. *transiens* SACCO, referring at the same time to an illustration of HÖRNES's specimen (1856, Pl. 48, Fig. 10). Thus, the name introduced by SACCO has a priority. A species, *Alvania anabaptizata* BOETTGER, which differs from that under study in only slightly more numerous axial ribs (18 to 22 being supposed to occur on its last whorl), was described by BOETTGER (1907) from Kostež. In the present writer's opinion, separating this species is insufficiently justified and the difference in the number of ribs should be treated rather as a symptom of variability.

FRIEDBERG (1938) mentioned this species from Korytnica. In the Miocene of Poland, it is also known from Małoszów (KRACH, 1947), Żegocina (FRIEDBERG, 1923), Bogucice (LISZKA, 1933), Skoczów (KRACH, 1974) and Brzeźnica (KRACH, 1960).

#### Subgenus **MASSOTIA** BUCQUOY, DAUTZENBERG & DOLLFUS, 1884

#### **Alvania (Massotia) ellae** BOETTGER, 1901

(Pl. IX, Fig. 22)

1901. *Alvania (Actonia) ellae* n. sp.; O. BOETTGER, p. 143, No. 442.  
 1934. *Alvania (Actonia) ellae* BOETTGER; A. ZILCH, p. 215, Pl. 5, Fig. 91.

**Material.** — Fifteen specimens.

**Dimensions.** — The largest specimen (Pl. IX, Fig. 22) is 4.0 mm high and 2.4 mm wide.

**Description.** — Shell small, thin-walled, oviform-conical. Protoconch probably consists of about two convex and smooth whorls, without a distinct boundary with the rest of shell. Teleoconch reaching about three and a half convex whorls, with a shallow and narrow, trough-like depression running in their upper part close to suture. Ornamentation delicate, formed by thin, fine, slightly sigmoid axial ribs, which only at the beginning run over an entire whorl (from suture to suture), later gradually shorten, reaching from the upper suture to halfway of the whorl and, finally, fade out completely, so that they do not occur at all in the terminal part of the last whorl (and very rarely, also on the entire last whorl). In addition, thin, closely-spaced spiral cords, whose number on the last whorl fluctuates between 20 and 26, run over the whorls. Aperture spacious, oval, posteriorly slightly contracted. Both lips thin. Inner lip incompletely covers a fairly deep umbilicus which is seen as a very narrow rim. Outer lip on edge sharp, inside smooth, outside close behind edge reinforced by a slightly developed varix. On the specimen illustrated, another, identical varix occurs, as an exception, halfway the last whorl.

**Remarks.** — The specimens described above are quite similar to the lectotype of the species (comp. ZILCH, 1934). BOETTGER (1901) assigns this species to the subgenus *Actonia* MONTEROSATO, 1884, but the structure of its shell disagrees with WENZ'S (1939) diagnosis in, among other things, the presence of umbilicus and character of ornamentation. More suitable seems to be the subgenus *Massotia* BUCQUOY, DAUTZENBERG & DOLLFUS, 1884.

This rare species has not so far been known from the Miocene of Poland and, outside Korytnica, it was found only at Kostej, Rumania.

Subgenus **ARSENIA** MONTEROSATO, 1891

**Alvania (Arsenia) punctura** (MONTAGU, 1803)

(Pl. IX, Figs 4-5)

1901. *Alvania (Actonia) punctura* (MTG.); O. BOETTGER, p. 142, No. 440.

1914. *Rissoa (Alvania) punctura* MTG.; S. CERULLI-IRELLI, pp. (377)-(378), Pl. (48), Figs 10-15.

**Material.** — Thirty specimens.

**Dimensions.** — The largest specimen (Pl. IX, Fig. 5) is 2.9 mm high and 1.6 mm wide.

**Description.** — Shell small or very small, thin-walled, slender, conical. Protoconch smooth, lustrous, composed of about two and a half whorls. Teleoconch reaching three and a half whorls, but mostly consisting of two to two and a quarter distinctly convex whorls. Ornamentation formed by thin and delicate axial and identical spiral ribs intersecting each other. Axial ribs closely-spaced, their number on the early whorl varying from 26 to 30, on the last whorl from 26 to 34 and, exceptionally, even amounting to 40. Five or, less frequently, four spiral ribs appear at first, with slightly less robust secondary ribs appearing between them at the end of the second whorl in some specimens. Six to seven spiral ribs still run at the base of the last whorl on which axial ribs gradually disappear. Aperture oval, posteriorly slightly contracted. Both lips thin. The inner lip incompletely covers umbilicus. The outer inside smooth or covered

with slight lists and outside provided with a not very thick varix, which in all specimens is developed at a moment when teleoconch reaches approximately two whorls. In most specimens, the growth of shell terminates in this stage, in some others it may be, however, continued even as far as three and a half whorls and afterwards varix is once again developed near aperture.

**Remarks.** — Here assigned Korytnica specimens seem not to differ either from the Pliocene forms described by CERULLI-IRELLI (1914) from Monte Mario near Rome or Recent ones living in the Mediterranean Sea (comp. GLIBERT, 1952, Pl. 2, Fig. 10).

This species has not so far been known from the Miocene of Poland. It was mentioned only by BOETTGER (1901, 1907) from the Miocene deposits of the region of Kostej and Lapugy, Rumania and Soos near Baden, the Vienna Basin.

Subgenus **GALEODINOPSIS** SACCO, 1895

**Alvania** (?*Galeodinopsis*) **schwartzi** (HÖRNES, 1856)

(Pl. IX, Fig. 3)

1856. *Rissoa Schwartzi* HÖRN.; M. HÖRNES, p. 573, Pl. 48, Fig. 18.  
 1901. *Alvania schwartzi* (M. Hö.); O. BOETTGER, p. 142, No. 438.  
 1956. *Alvania schwartzi* M. HÖRNES; I. CSEPREGHY-MEZNERICS, p. 380, Pl. 1, Fig. 18.  
 1966. *Rissoa (Alvania) schwartzi* HÖRNES; L. STRAUZ, p. 75, Pl. 46, Figs 14-16.

**Material.** — One specimen.

**Dimensions.** — Height, 2.1 mm, width, 1.4 mm.

**Description.** — Shell very small, thin-walled, barrel-like, with a slightly projecting apex. Protoconch consisting of about two convex and delicately grooved whorls. Teleoconch reaching two and a half slightly convex whorls, the last of them relatively very large. Whorls are provided with many not very prominent axial ribs, whose number on the first teleoconchal whorl amounts to 27 and on the last one 20. At its very end the ribs disappear at all. In addition, spiral grooves, at first two of them (which divide each rib into three distinctly separate sectors), run on whorls. Later on, there appear further grooves so that ten of them run on the last whorl. The upper parts of ribs, separated by the first groove running below suture, look like a spiral row of roundish tubercles. Aperture oval, posteriorly slightly contracted. Inner lip thin, almost completely covering a shallow umbilicus. Outer lip inside smooth and outside provided with a poorly developed varix.

**Remarks.** — The only specimen from Korytnica is similar to the holotype of this species (comp. HÖRNES, 1856), except for its slightly more-closely spaced axial ribs, as the Viennese specimens are supposed to have 14 to 16 on the last whorl. A proper subgeneric assignment of this species is rather difficult, as it is extinct and no Recent species has so far been found which would be closely related to it. The structure of its shell seems to correspond relatively best to the diagnosis of the subgenus *Galeodinopsis* SACCO, 1895 (comp. WENZ, 1939).

This species has not so far been known from the Miocene of Poland.

Genus **RISSOINA** d'ORBIGNY, 1840Subgenus **RISSOINA (RISSOINA)****Rissoina (Rissoina) podolica** COSSMANN, 1921

(Pl. X, Figs 11-14)

1856. *Rissoina pusilla* BROCC.; M. HÖRNES, pp. 557-558, Pl. 48, Fig. 4.  
 1895. *Rissoina pusilla* (BR.); F. SACCO, pp. 35-36, Pl. 1, Figs 98-98bis.  
 1914. *Rissoina pusilla* BROCC.; W. FRIEDBERG, pp. 358-359, Pl. 20, Fig. 22.  
 1928a. *Rissoina podolica* COSSM.; W. FRIEDBERG, p. 608.  
 1954. *Rissoina podolica* COSSMANN; I. CSEPREGHY-MEZNERICS, p. 16, Pl. 1, Fig. 21.  
 1954. *Rissoina podolica* COSSM.; L. STRAUZ, p. 11, Pl. 3, Fig. 65.  
 1956. *Rissoina podolica* COSSM.; I. CSEPREGHY-MEZNERICS, p. 431, Pl. 2, Figs 13-14.  
 1960. *Rissoina (Rissoina) podolica* COSSMANN; E. KOJUMDIEVA, p. 102, Pl. 30, Fig. 19.  
 1966. *Rissoina pusilla podolica* COSSMANN; L. STRAUZ, pp. 79-80, Pl. 12, Figs 23-28.

**Material.** — A hundred and fifty specimens.

**Dimensions.** — The largest specimen, preserved without early whorls, (Pl. X, Fig. 12), is 6.8 mm high and 2.8 mm wide.

**Description.** — Shell medium-sized, fairly thick-walled, cylindrical-turretlike. Protoconch (preserved in few specimens only) consisting of incomplete three, convex, smooth and lustrous whorls. Teleoconch reaching about seven slightly convex whorls, the last of them only somewhat smaller than a half of the height of the entire shell. Ornamentation formed by many, straight or slightly oblique and sigmoid axial ribs, which on the last whorl also reach onto its base. Their number on the first teleoconchal whorl amounts to 12 to 14, on further whorls to 16 to 24, on the last but one to 19 to 31 on the last to 19 to 38. On the early whorls, ribs are usually somewhat thicker and on the two later whorls — considerably thinner. There are also specimens, in which ribs are uniform and relatively thick on all whorls. This variability causes the number of ribs on later whorls to fluctuate within fairly wide limits. In addition, thin, threadlike spiral cords, best visible in intervals between axial ribs, occur on the base of the last whorl and in the lower part (close above the lower suture) of the remaining whorls. In the remaining part of shell, intercostal spaces are smooth, although even here very closely-spaced and fine spiral grooving may be observed in well-preserved specimens under a strong magnification. Aperture spacious, nearly semicircular, markedly obliquely oriented, both anteriorly and posteriorly contracted and terminating in troughlike depressions. Both lips rather thick, the inner one completely covering umbilicus, the outer inside smooth and outside reinforced by a thick varix, along which several (even to ten) thin axial ribs run usually.

**Remarks.** — The specimens here described are completely similar with the Viennese ones, which earlier were assigned, after HÖRNES (1856) to a Pliocene species, *Rissoina pusilla* (BROCCHI). As, however, found by COSSMANN (*vide* FRIEDBERG, 1928a), the specimens from the Viennese Miocene considerably differ from *R. pusilla* from the Pliocene of Italy. He described them as a separate species, *Rissonia podolica* COSSMANN. The specimens from Korytnica are marked by a relatively high degree of variability, expressed in considerable differences in the number and thickness of ribs, irregular convexity of whorls and more or less slender shape.

This species has not so far been known from Korytnica, but it was mentioned from other Miocene localities of Poland, that is, Łychów and Węglinek (KRACH, 1962b), Benczyn (KRACH, 1950a), Żegocina (FRIEDBERG, 1923), Niskowa (SKOCZYŁASÓWNA, 1930), Bogucice (LISZKA, 1933) and Brzeźnica (KRACH, 1960).



**Rissoina (Rissoina) vindobonensis** SACCO, 1895

(Pl. X, Figs 6-7)

1856. *Rissoina Bruguieri* PAYR.; M. HÖRNES, pp. 558-559, Pl. 48, Fig. 5.  
 1895. *Rissoina Bruguieri* var. *vindobonensis* SACCO.; F. SACCO, p. 35.  
 1954. *Rissoina vindobonensis* SACCO.; L. STRAUZ, p. 12, Pl. 3, Fig. 66.  
 1960. *Rissoina (Rissoina) vindobonensis* (SACCO); E. KOJUMDGIEVA, p. 102, Pl. 30, Fig. 20.  
 1966. *Rissoina bruguieri vindobonensis* SACCO; L. STRAUZ, p. 80, Pl. 12, Figs 19-22.

**Material.** — Four specimens.

**Dimensions.** — The largest specimen, preserved without apical whorls, is 6.0 mm high and 2.9 mm wide.

**Description.** — Shell medium-sized, not very thick-walled, turretlike. Protoconch not preserved in any of the specimens. Teleoconch reaching at least five and a half whorls (counting from aperture, since early whorls might fall off, along with protoconch, yet at the animal's lifetime and the trace of damage might cicatrize). Whorls convex in outline, except for the base of the last of them where a fairly wide, troughlike depression occurs. Ornamentation consisting of fairly prominent, slightly obliquely oriented, straight or somewhat sigmoidal bent (in particular on the last whorl) axial ribs. Their number amounts to 16 to 19 on the last whorl and to 15 to 20 on the rest of them. In addition, spiral cords, irregular in thickness and rather widely-spaced on the surface of the entire whorl, occur on shell. Their number on the last whorl varies from 15 to 18. Aperture oval, obliquely oriented, bilaterally considerable contracted and with a distinct siphonal notch. Both lips fairly thick. The inner one completely covering umbilicus and, in addition to the siphonal notch, having a small but distinctly visible fold. The outer one inside smooth, outside reinforced by a thick, but fairly narrow varix.

**Remarks.** — The specimens here assigned are quite conspecific with those described from the Miocene of Bulgaria (KOJUMDGIEVA, 1960) and Hungary (STRAUSZ, 1954, 1966), while they seem to have slightly more prominent ribs as compared of those displayed by a specimen from Steinabrunn, presented by HÖRNES (1856).

This species has not so far been known from the Miocene of Poland.

Subgenus **ZEBINELLA** MÖRCH, 1876**Rissoina (Zebinella) decussata** (MONTAGU, 1803)

(Pl. X, Figs 8-9)

1856. *Rissoina decussata* MONT.; M. HÖRNES, pp. 553-554, Pl. 48, Fig. 1.  
 1895. *Zebinella decussata* (MONT.); F. SACCO, p. 38, Pl. 1, Fig. 106.  
 1914. *Rissoina (Zebinella) decussata* MTG.; S. CERULLI-IRELLI, p. (379), Pl. (48), Figs 22-23.  
 1914. *Rissoina decussata* MONT.; W. FRIEDBERG, pp. 355-356, Pl. 20, Figs 19-20.  
 1950. *Rissoina decussata* MONT.; W. KRACH, p. 304, Pl. 1, Fig. 10.  
 1960. *Rissoina (Zebinella) decussata* (MONTAGU); E. KOJUMDGIEVA, pp. 102-103, Pl. 30, Fig. 21.  
 1968. *Rissoina (Zebinella) decussata* (MONTAGUE); L. HINCULOV, pp. 123-124, Pl. 28, Fig. 18.  
 1970. *Rissoina (Zebinella) decussata* (MONTAGU); E. GRECO, pp. 284-285, Pl. 2, Figs 11, 13, 15 and 17.

**Material.** — Thirty-five specimens.

**Dimensions.** — The largest specimen is 6.2 mm high and 3.1 mm wide.

**Description.** — Shell medium-sized, relatively thick-walled, turretlike. Protoconch (preserved only in juvenile specimens) consisting of about three smooth, convex and relatively low whorls. Teleoconch reaching six to seven slightly convex or, less frequently, nearly flat whorls. A delicate carina, running at equal distances from both sutures, is marked on the first of them. Shell ornamentation formed by many, somewhat arcuate axial ribs. On early whorls, they are sometimes so closely-spaced that intercostal spaces appear as narrow grooves. On the last whorl, ribs are usually considerably thinner, only slightly marked on its base and resembling rather growth lines. The number of ribs amounts to 15 to 18 on the first teleoconchal whorl, to 28 to 35 on the middle ones and to 40-52 on the last but one. In addition, many, thin spiral cords, best visible in intercostal spaces and on the base of the last whorl where they are somewhat more prominent, run over the surface of shell. Their number on the last whorl amounts to 30 to 35. Aperture oval, obliquely oriented to shell axis, bilaterally strongly contracted, anteriorly terminating in a short and shallow siphonal notch. Inner lip relatively thin, completely covering umbilicus. Outer inside smooth, outside reinforced by a roller-like varix.

**Remarks.** — As compared with most specimens described from Miocene deposits as *Rissoina decussata* (MONTAGU), the shells from Korytnica are slightly less slender. In shape and ornamentation, they resemble to largest extent specimens from the Miocene of the Mehadia Basin, Rumania (HINCULOV, 1968) and those from the Pliocene of Italy (CERULLI-IRELLI, 1914). Specimens from the Miocene of France, both from Aquitaine (COSSMANN & PEYROT, 1919, Pl. 17, Figs 28-29) and the Loire Basin (GLIBERT, 1949, Pl. 5, Fig. 23) so strongly differ in their slenderer shape and considerably more delicate ornamentation that the present writer doubts if it is advisable to connect them with those here considered.

This species has not so far been known from Korytnica, but was mentioned from other Miocene localities of Poland, that is, Rybnica (KOWALEWSKI, 1950), Trzydnik (KRACH, 1950*b*), Łychów and Węglin (KRACH, 1962*b*) and Brzeźnica (KRACH, 1960).

### *Rissoina (Zebinella) varicosa* BOETTGER, 1907

(Pl. X, Figs 2-3)

1907. *Rissoina (Zebinella) varicosa* n. sp.; O. BOETTGER, p. 164, No. 567.

1934. *Rissoina (Zebinella) varicosa* BOETTGER; A. ZILCH, p. 215, Pl. 6, Fig. 99.

**Material.** — Six specimens.

**Dimensions.** — The largest specimen (Pl. X, Fig. 3) is 5.8 mm high and 2.4 mm wide.

**Description.** — Shell medium-sized, relatively thin-walled, slenderly turretlike. Protoconch consisting of about two and three quarters smooth, lustrous, distinctly convex and relatively low whorls. Teleoconch reaching nearly six whorls which are convex except for the first or the first two whorls having a poorly developed carina running at equal distances from both sutures. Ornamentation very delicate, formed by many thin, slightly obliquely running axial ribs, which only on two or three early whorls are more prominent, on further ones being very thin rather resembling sharp growth lines. The number of ribs amounts to 15 to 17 on the first teleoconchal whorl, to 19 to 25 on the second and varying from 40 to 65 on the last but one. In addition, many thin spiral cords (about 40 on the last whorl) run over shell surface. They are irregular in thickness and spacing, usually stronger at the base of the last whorl. Aperture oval, relatively considerably elongate, and strongly contracted posteriorly, where it develops

a sinuate channel. Siphonal furrow shallow and slightly separated in the anterior part of aperture. Inner lip very thin, completely covering umbilicus. Outer lip inside smooth, outside reinforced with a not very thick varix.

**Remarks.** — The specimens described above seem to be quite similar to the lectotype of this species (comp. ZILCH, 1934). The presence of another varix at the beginning of the last whorl (BOETTGER, 1907) is frequently observed in the materials from Kostej and Lapugy, where *Rissoina varicosa* BOETTGER is very numerous represented (more than 500 specimens found in these localities). This character is not recorded in the specimens from Korytnica. *R. (Z.) varicosa* is similar to *R. decussata* (MONTAGU), but there are differences between the two species which enable their separation. The shell of *R. (Z.) varicosa* BOETTGER is slenderer, considerably thinner, has convex whorls and its ornamentation is much more delicate.

This species has not so far been known from the Miocene of Poland. The region of Kostej and Lapugy, Rumania has so far been the only locality of its occurrence.

### *Rissoina (Zebinella) sororcula* BOETTGER, 1901

(Pl. X, Fig. 1)

1901. *Rissoina (Zebinella) sororcula* n. sp.; O. BOETTGER, p. 150, No. 462.

1934. *Rissoina (Zebinella) sororcula* BOETTGER; A. ZILCH, p. 214, Pl. 6, Fig. 98.

1966. *Rissoina (Zebinella?) sororcula* BOETTGER; L. STRAUZ, p. 82, Pl. 12, Figs 29-30.

**Material.** — Twelve specimens, including incomplete or juvenile ones.

**Dimensions.** — The specimen illustrated, complete but juvenile, is 3.9 mm high and 1.9 mm wide. Judging by fragmentary specimens, the shells of adults reached about 6.5 to 7 mm in height.

**Description.** — Shell medium-sized, thin-walled, turretlike. Protoconch consisting of about three smooth and convex whorls. Teleoconch, as far as it can be judged by the largest, but incomplete (without aperture) specimen, reaches more than six and a half whorls. The early whorls (usually three of them) are angularly bent in profile as the result of the presence of a very distinct carina running through the middle of whorls. This carina becomes gradually less and less prominent and, consequently, further whorls become convex. Ornamentation formed by many axial ribs, as early whorls relatively more prominent and widely-spaced, on further ones gradually less and less prominent, thinner and thinner and more and more closely-spaced. The number of ribs usually amounts to 15 to 16 on each of the two early teleoconchal whorls, to 30 to 45 on the fifth whorl and yet more on further, only fragmentarily preserved, whorls. In addition, many (more than 30) closely-spaced spiral cords, developed both in the spaces between axial ribs and on their ridges, run over shell surface. On later whorls, they are only slightly thinner than the axial ribs. The thickness of cords is not uniform; the cord running along the carina is usually the most prominent. Aperture in juvenile specimens relatively strongly elongate, in adults not preserved.

**Remarks.** — In the writer's opinion, the specimens described above can be assigned to the species *R. sororcula* BOETTGER, although they slightly differ from the lectotype from Kostej (comp. ZILCH, 1934) in more numerous and thinner axial ribs and a more prominent carina on early teleoconchal whorls. *R. (Z.) sororcula* is strongly related to *R. loueli* HÖRNES (comp.

GLIBERT, 1949, Pl. 6, Fig. 7), but its shells are considerably smaller and with more prominent axial ribs. According to BOETTGER (1901, 1907), the separate character of these species is beyond any doubt.

*R. sororcula* BOETTGER has not so far been recorded in the Miocene deposits of Poland.

**Rissoina (Zebinella) extranea** (EICHWALD, 1830)

(Pl. X, Fig. 10)

1928a. *Rissoina striata* ANDRZ.; W. FRIEDBERG, pp. 607-608, Pl. 38, Fig. 13.

1932/33. *Rissoina (Zebinella) extranea* EICHW.; I. MEZNERICS, pp. 326-327, Pl. 13, Fig. 14.

1938. *Rissoina decussata* MONT.; W. FRIEDBERG, pp. 78-79 *partim*.

**Material.** — One specimen.

**Dimensions.** — Height, 6.2 mm, width, 2.6 mm.

**Description.** — Shell medium-sized, not very thick-walled, slenderly conical. Protoconch (preserved incomplete) probably consisting of about three smooth and slightly convex whorls. Teleoconch formed by seven almost quite flat whorls, with a delicate carina, running somewhat nearer the upper suture, occurring on the first of them. Shell ornamented by many, prominent, slightly obliquely oriented and arcuate axial ribs, also distinctly marked on the base of the last whorl. The number of ribs amounts to 13 on the first teleoconchal whorl, to 15 to 19 on further ones and to 21 on the last. In addition, very distinct cords, developed only in intercostal spaces, run on the base of the last whorl and in the lower part of the last but one. In the remaining part of shell, intercostal spaces are delicately and densely grooved. The boundary between the part covered with cords and that with grooves is very distinctly and sharply outlined. The number of spiral cords on the last whorl amounts to 14. Aperture oval, obliquely oriented, bilaterally contracted and anteriorly having a distinct siphonal furrow. Both lips fairly thick, the inner one completely covering umbilicus, the outer inside smooth and outside reinforced with a robust varix, with five irregular and slightly separated wrinkles somewhat resembling axial ribs, which run along it.

**Remarks.** — A correct identification of this specimen is difficult. The most strongly related are specimens described by FRIEDBERG (1928a) as *Rissoina striata* (ANDRZEJOWSKI), which differ only in slightly more numerous axial ribs (about 26 of them on the last but one whorl). However, in his later paper, FRIEDBERG (1938) included these specimens in *R. decussata* (MONTAGU), thus returning to his earliest view (FRIEDBERG, 1913). In the present writer's opinion, both these specimens and that here described from Korytnica differ from a typical *R. decussata* (MONTAGU) to such an extent that connecting them with this species is not justified. Thicker and less numerous axial ribs and primarily quite differently developed spiral cords (more similar to those observed in *R. podolica* COSSMANN) seem to be the most important differences. However, since the description and illustration of ANDRZEJOWSKI (1833, Pl. 11, Fig. 3) are inaccurate, to which attention was already called by FRIEDBERG (1913, p. 356), *R. striata* (ANDRZEJOWSKI) seems to be insufficiently defined. Specimens, described under the same name by HILBER (1882), were at first assigned by FRIEDBERG (1913), who had seen them directly, to *R. podolica* COSSMANN. Since it is impossible to compare directly all of the earlier investigators' specimens here discussed with those from Korytnica here described, it seems most correct to assign the last-named specimen to *R. extranea* (EICHWALD). According to SCHWARTZ v. MOHRENSTEIN (*vide* FRIEDBERG,

1914), this species differs from *R. decussata* (MONTAGU) in thicker axial ribs and a more swollen outer lip. Very similar specimens from Steinabrunn were also assigned by MEZNERICS (1932/33) to *R. extranea* (EICHWALD), although her standpoint was not accepted by FRIEDBERG (1938) who included these specimens in *R. podolica* COSSMANN. *R. semidecussata* BOETTGER from the Miocene of Kosteĵ, Rumania differs from the Korytnica specimen in conspicuously convex whorls. To sum up, the statement should here be made that the specimen under study is decidedly different from *R. decussata* (MONTAGU), *R. podolica* COSSMANN and *R. semidecussata* BOETTGER and that it cannot, therefore, be related with either of them.

This species has not so far been known from the Miocene of Poland. Specimens of *R. striata* (ANDRZEJOWSKI) were described by FRIEDBERG (1928a) from Podolia and Volhynia.

#### Subgenus PHOSINELLA MÖRCH, 1876

#### *Rissoina* (*Phosinella*) *steinabrunnensis* SACCO, 1895

(Pl. X, Figs 4-5)

1856. *Rissoina Burdigalensis* d'ORB.; M. HÖRNES, pp. 559-560, Pl. 48, Fig. 6.

1895. *Rissoina lamellosa* var. *steinabrunnensis* SACCO.; F. SACCO, p. 37.

1914. *Rissoina burdigalensis* d'ORB.; W. FRIEDBERG, pp. 359-360, Pl. 21, Figs 2-3.

1932/33. *Rissoina* (*Phosinella*) *steinabrunnensis* SACCO; I. MEZNERICS, pp. 327-328, Pl. 13, Fig. 3.

1938. *Rissoina steinabrunnensis* SACCO; W. FRIEDBERG, p. 78.

1954. *Phosinella steinabrunnensis* SACCO; L. STRAUZ, p. 12, Pl. 3, Fig. 67.

1966. *Rissoina* (*Phosinella*) *steinabrunnensis* SACCO; L. STRAUZ, pp. 80-81, Pl. 12, Figs 15-18.

**Material.** — Twenty-five specimens.

**Dimensions.** — The largest complete specimen (Pl. X, Fig. 4) is 5.4 mm high and 2.3 mm wide, another, preserved as the last whorl only, 3.5 mm high and 2.6 mm wide.

**Description.** — Shell medium-sized, fairly thin-walled, shaped like a slender, tierlike turret. Protoconch consisting of two and a half convex, smooth and lustrous whorls. Teleoconch reaching six slightly convex whorls, with a not very prominent carina marked in their upper part and giving the shell its tierlike outline. Ornamentation formed by prominent axial ribs, slightly obliquely oriented and somewhat flattened laterally. Their number amounts to 10 on the first teleoconchal whorl, to 12 to 14 on further whorls and to 14 and, less frequently, to 15 or 16 on the last whorl. In addition, spiral cords (12 to 16 of them on the last whorl), most distinct in intercostal spaces and on shell base, run over shell surface. The thickness of cords and spaces between them are irregular, but usually two or three cords running on the periphery of the last whorl are somewhat thicker. No cords occur over the carina mentioned above. Aperture oval, obliquely oriented, posteriorly slightly contracted, anteriorly provided with a distinct siphonal furrow. Both lips fairly thick, the inner one completely covering umbilicus, the outer inside smooth and outside reinforced with a thick varix.

**Remarks.** — A considerable variability, expressed in differences in shell slenderness, degree of the prominence of carina and irregularity in the development of spiral cords, may be observed among the specimens here assigned. Despite this fact they are quite conspecific with specimens described from numerous localities of the Vienna-type Miocene deposits.

This species has not so far been known from Korytnica. From the Miocene of Poland it is mentioned only from Łychów (KRACH, 1962b).

## Family OMALOGYRIDAE

Genus OMALOGYRA JEFFREYS, 1860

**Omalogyra atomus** (PHILIPPI, 1860)

(Pl. XI, Figs 4-5)

1867. *Skenea simplex* REUSS; A. E. REUSS, pp. 151-152, Pl. 8, Fig. 2.1882. *Homalogyra atomus* PHILIPPI; E. BUCQUOY, PH. DAUTZENBERG & G. DOLLFUS, pp. 324-325, Pl. 37, Figs 30-32.1923. *Skenea simplex* REUSS; W. FRIEDBERG, p. 421.1939. *Omalogyra atomus* (PHILIPPI); W. WENZ, p. 648, Text-fig. 1839.1970. *Omalogyra atomus* (PHILIPPI); A. GRECO, p. 285, Pl. 6, Figs 9-10.**Material.** — Fifty specimens.**Dimensions.** — The largest specimen is 0.3 mm high and 0.8 mm wide.

**Description.** — Shell very small, relatively not very thin-walled, disclike, approximately planispiral. Protoconch consisting of one incomplete, convex, smooth and lustrous whorl, distinctly separated from teleoconch (the boundary is best visible in the specimens whose teleoconch is formed by less than one complete whorl). Teleoconch reaching about two and a half whorls. Its surface smooth, with only delicate growth lines and, more distinct, lines marking arrested growth stages. Aperture roundish, with inner lip slightly bent inwards (in conformity with the outline of the last but one whorl). Umbilicus shallow but very wide, with protoconch visible in its center (the same as on the apical side).

**Remarks.** — *Omalogyra atomus* (PHILIPPI) is a Recent species, which has thus far been known in fossil state since the Pliocene (GRECO, 1970). In the present writer's opinion, it should also include specimens, for which the species *Skenea simplex* REUSS was erected by REUSS (1867) and which do not display any major differences as compared with *O. atomus*.

This species has not so far been known from Korytnica. In the Miocene of Poland, it was recorded (under the name *Skenea simplex* REUSS) from salt clays of Wieliczka (REUSS, 1867; FRIEDBERG, 1923, 1933).

**Omalogyra rota** (FORBES & HANLEY, 1853)

(Pl. XI, Figs 1-2)

1882. *Homalogyra rota* FORBES & HANLEY; E. BUCQUOY, PH. DAUTZENBERG & G. DOLLFUS, pp. 325-326, Pl. 37, Figs 33-34.1950. *Adeorbis ammonoides* sp. n.; I. CSEPREGHY-MEZNERICS, pp. 23-24, Pl. 1, Fig. 8.1966. *Omalogyra (Ammonicera) rota* FORBES & HANLEY; L. STRAUSS, p. 51, Pl. 50, Fig. 39.1970. *Omalogyra (Ammonicera) rota* (FORBES & HANLEY); A. GRECO, pp. 285, Pl. 6, Fig. 11.**Material.** — Forty specimens.**Dimensions.** — The largest specimen is 0.3 mm high and 0.7 mm wide.

**Description.** — Shell very small, thin-walled, shaped like an almost planispiral disc. Protoconch formed by about two-thirds of a convex whorl, distinctly separated from the rest of shell. Teleoconch reaching almost two whorls, its surface delicately ornamented. Two spiral ribs, one on the apical side and the other on base, run on a whorl, which is convex between them with a slight bend on periphery. Many axial ribs, varying in number in particular specimens

from 16 to 25 on the first teleoconchal whorl, are, however, a fundamental elements of sculpture. Their prominence is also variable, the more numerous the narrower and the thinner they are. Fine tubercles are formed at the intersections of axial and spiral ribs. Usually ribs disappear on periphery to appear once again on base. In the terminal part of the second whorl, ribs become thinner and sometimes, less frequently, even fade out. Aperture pentagonal in outline. Umbilicus very wide and shallow, with protoconch visible in its center.

**Remarks.** — Very characteristic shells, described above, resembling evolutely coiled shells of ammonities, belong to the Recent species *Omalogyra rota* (FORBES & HANLEY). It is also known in fossil state, but is very rarely found due to, among other factors, its very small dimensions. From the Miocene deposits only one specimen is known from Hidas, Hungary (CSEPREGHY-MEZNERICS, 1950). It was described as *Adeorbis ammonoides* CSEPREGHY-MEZNERICS, but which, as noticed by STRAUZ (1966), should be rather assigned to *O. rota*. This specimen is completely conspecific with the Korytnica specimens and is most similar to those of them which have less numerous, but more prominent axial ribs.

*O. rota* (FORBES & HANLEY) has not so far been recorded from the Miocene of Poland.

### ***Omalogyra carinella* (REUSS, 1860)**

(Pl. XI, Fig. 3)

1860. *Skenea carinella* m. n. sp.; A. E. REUSS, p. 206, Pl. 5, Fig. 10.

1882. *Homalogyra Fischeriana* MONTEROSATO; E. BUCQUOY, PH. DAUTZENBERG & G. DOLLFUS, pp. 326-327, Pl. 37, Figs 35-37.

**Material.** — Six specimens.

**Dimensions.** — The largest specimen is 0.3 mm high and 0.75 mm wide.

**Description.** — Shell very small, thin-walled, shaped like an almost planispiral disc. Protoconch formed by about two-thirds of a convex whorl. Teleoconch reaching somewhat more than one and a half whorls. One fairly prominent spiral rib each runs on the apical side of shell and on the base. Barring these two ribs, the shell is smooth, although thin and dense wrinkles corresponding to growth lines may be seen under strong magnification. A small, rounded bend is marked on shell periphery. Aperture pentagonal in outline, both lips thin. Umbilicus very wide, shallow, with protoconch visible in its center.

**Remarks.** — *Omalogyra carinella* (REUSS) displays a similarity to *O. rota*, from which it differs in the larger dimensions of protoconch and the presence of quite smooth spiral ribs which is connected with the lack of axial ribs. Distinguishing these species may be very difficult, especially so in view of the tendency of axial ribs to disappear in *O. rota* (FORBES & HANLEY). The conspecificity of the Korytnica specimens with the holotype of *O. carinella* (REUSS, 1860) seems to be unquestionable. They do not differ from it in size, shape and ornamentation. It is also *O. fischeriana* (MONTEROSATO, 1869), living at present in the Mediterranean Sea (comp. BUCQUOY, DAUTZENBERG & DOLLFUS, 1882), which in the present writer's opinion, is conspecific with *O. carinella*. A specimen from Varpalota Hungary, quite dissimilar to the holotype, twice as large and having a slightly projecting spire, was presented by STRAUZ (1966, Pl. 50, Figs 16-18) under the name *Skenea carinella* REUSS. The present writer considers this specimen as erroneously identified and belonging to the species *Daronia hungarica* sp. n., described in the present monograph.

*Omalogyra carinella* (REUSS) has not so far been known from the Miocene of Poland. CSEPREGHY-MEZNERICS'S (1950) information on its occurrence in Poland is probably erroneous. For, from the territory of Poland REUSS (1867) described a different species, that is, *Skenea simplex* REUSS = *Omalogyra atomus* (PHILIPPI), while *O. carinella* was described from Rudoltice, Czechoslovakia (REUSS, 1860; BUDAY, 1937).

## Family TORNIDAE SACCO, 1896

### Genus TORNUS JEFFREYS, 1867

#### *Tornus globosus* BOETTGER, 1907

(Pl. XI, Fig. 11)

1907. *Tornus globosus* n. sp.; O. BOETTGER, p. 197, No. 663.

1928. *Tornus Dollfusi* COSSM.; W. FRIEDBERG, p. 523, Pl. 34, Fig. 1.

1934. *Adeorbis globosus* (BOETTGER); A. ZILCH, p. 216, Pl. 6, Fig. 7.

1970. *Adeorbis dollfusi* (COSSMANN); W. BAŁUK, p. 117, Pl. 9, Figs 5-6.

**Material.** — Two specimens.

**Dimensions.** — The larger specimen is 1.0 mm high and 1.7 mm wide.

**Description.** — Shell small, thick-walled, disclike. Protoconch consisting of about one and a half smooth and convex whorls, fairly distinctly separated from the rest of shell. Teleoconch reaching about one and three-quarters whorls which rapidly grow in width. At first, two carinae run on its surface, one apically near the surface and the other on shell periphery. Between the suture and the first of the carinae, whorl is flat or slightly concave and below the second carina (that is, on shell base) flat. On the other hand, between the carinae, whorl is equally convex, with another, slightly marked carina appearing here at the end of the first teleoconchal whorl. Ornamentation formed by closely-spaced, not very prominent and rather irregular axial riblets running conformingly with growth lines. In addition, a relatively strong spiral rib, situated somewhat nearer the periphery of shell than a sharply outlined edge of umbilicus, runs on shell base. Aperture spacious, obliquely oriented. Outer lip strongly prosocline. Umbilicus deep, but not very wide, with growth lines continuing on its surface.

**Remarks.** — The species *Tornus globosus* BOETTGER was erected on the basis of a single specimen found at Kosteĵ, Rumania. The two specimens from Korytnica, not exactly in the best state of preservation, are conspecific with the holotype (comp. ZILCH, 1934), although the existence of only two carinae are mentioned in BOETTGER'S (1907) description. The third carina in the Korytnica specimens is considerably less strongly developed and more rounded than the remaining two; the traces of its existence may also be seen in the illustration of the holotype. Quite similar specimens were described by FRIEDBERG (1928a) as *T. dollfusi* COSSMANN. They were somewhat larger and had a more distinct sculpture. In the present writer's opinion, they do not differ from *T. globosus* BOETTGER to such an extent as to enable their assignment to two separate species and, therefore, *T. dollfusi* should be considered as a younger synonym of *T. globosus*.

*T. globosus* has not so far been known from Korytnica. *T. dollfusi* COSSMANN has been mentioned in gastropod assemblages from Bogucice (LISZKA, 1933), Brzeźnica (KRACH, 1960) and Niskowa (BAŁUK, 1970).



**Tornus pseudotinostoma** (BOETTGER, 1907)

(Pl. XI, Fig. 10)

1907. *Adeorbis pseudotinostoma* n. sp.; O. BOETTGER, pp. 196-197, No. 662.  
 1934. *Adeorbis pseudotinostoma* BOETTGER; A. ZILCH, p. 216, Pl. 6, Fig. 6.  
 1954. *Tornus trigonostoma* BAST.; L. STRAUZ, p. 13, Pl. 9, Fig. 164.  
 1966. *Adeorbis trigonostoma* BASTEROT; L. STRAUZ, p. 53, Pl. 50, Figs 22-23.

**Material.** — Fifty-five specimens.

**Dimensions.** — The largest specimen is 0.75 mm high and 1.9 mm wide.

**Description.** — Shell small, thin-walled, sometimes translucent, disclike. Protoconch relatively large, consisting of somewhat more than two whorls, which are quite smooth, lustrous, convex, without any traces of flattening at the base. They are very distinctly separated from the rest of shell, which is particularly well-visible in specimens whose teleoconch do not yet reach a complete whorl. Teleoconch reaching merely somewhat more than one whorl rapidly growing in width. This whorl is gently convex apically (except for a shallow and narrow troughlike depression stretching close to suture) and strongly flattened at the base. A more or less sharp carina, suddenly appearing on the boundary between proto- and teleoconch, runs on periphery. Teleoconchal surface in principle smooth, except for a single, thin spiral riblet running on base near periphery. Very delicate and dense spiral grooving may also be observed apically under a strong magnification. Aperture relatively spacious. Outer lip thin, strongly prosocline, inner considerably thicker. Umbilicus not very wide, shallow.

**Remarks.** — In the present writer's opinion, the specimens described belong to *T. pseudotinostoma* (BOETTGER). As compared with the holotype (comp. ZILCH, 1934), they are smaller, but only as a consequence of their teleoconch being by about half a whorl shorter. In the holotype from Kostej (an only specimen found in that locality), the spiral riblet at the base is also slightly more prominent. Very similar specimens were described from Varpalota by STRAUZ (1954, 1966) who assigned them to *Tornus trigonostoma* (BASTEROT). The differences between the two species is not very large but distinct and it is expressed in a different outline of shell. In the specimens of *T. trigonostoma* (BASTEROT), shell is bent apically as the result of the existence of another, not so sharp carina (comp. COSSMANN & PEYROT, 1919, Pl. 7, Figs 47-49 and Pl. 10, Figs 87-88; GLIBERT, 1949, Pl. 6, Fig. 13). This difference is best-visible in illustrations representing the shell's outline. Despite the fact that no specimens thus situated were illustrated by STRAUZ (1954, 1966), the present writer believes that the specimens from Varpalota belong to *T. pseudotinostoma* (BOETTGER).

*T. pseudotinostoma* has not so far been known from the Miocene of Poland.

**Tornus belgicus varius** ssp. n.

(Pl. XI, Figs 12-14)

*Holotype:* Pl. XI, Fig. 14 (Z.PAL.U.W., No BkK-G 166).

*Type horizon:* Lower Tortonian (= Lower Badenian).

*Type locality:* Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.

*Derivation of the name:* Lat. *varius* — after a very variable degree of the prominence of ornamentation.

**Diagnosis.** — Shell relatively high, hemispherical, with two poorly developed spiral riblets at its base.

**Material.** — Twenty-four specimens.

**Dimensions.** — The largest specimen is 1.5 mm high and 2.0 mm wide.

**Description.** — Shell small, thin-walled, nearly hemispherical. Protoconch consisting of about two convex and quite smooth whorls, distinctly separated from the rest of shell. Teleoconch reaching two convex whorls, the last of them large, rather dumpy and flattened at the base. On periphery, carina is very slightly developed or lacking at all. Ornamentation variable from very distinct to nearly invisible. Four spiral riblets, distributed at almost equal intervals, are developed apically, the first of them running close to suture, the fourth along shell periphery. Two other spiral riblets, considerably more robust than the former four and, in addition, a strong roller-like rim of a sharply separated umbilicus, run also at the base. The roller-like rim is an only element identically developed in both distinctly ornamented and nearly quite smooth specimens. In addition, oblique, closely spaced and very thin riblets, more distinct apically, run on shell conformably to growth lines. Aperture spacious, oval. Both lips thin, converging posteriorly at a very acute angle. Outer lip strongly prosocline. Umbilicus not very wide, but very deep, semilunar in outline.

**Remarks.** — *T. belgicus varius* ssp. n. differs from the nominal subspecies *T. belgicus belgicus* GLIBERT (1949, Pl. 6, Fig. 14) in smaller dimensions, more spherical shape, more projecting spire and slightly different ornamentation of base, that is, having two less strongly developed spiral ribs instead of one, but robust. The specimens from Herend, Hungary, should likely be included here; these were described by KOKAY (1966, Pl. 3, Figs 9-10) as *Adeorbis dollfussi* (COSM.). These specimens are evidently not conspecific, in contrary to KÓKAY (1966, p. 39), with those described by FRIEDBERG (1928a, Pl. 34, Figs 1a and 1b).

## Genus TEINOSTOMA H. & A. ADAMS, 1853<sup>1)</sup>

### Subgenus SOLARIORBIS CONRAD, 1865

#### *Teinostoma* (*Solariorbis*) *woodi* (HÖRNES, 1856)

(Pl. XI, Figs 7-8)

1856. *Adeorbis Woodi* HÖRN.; M. HÖRNES, pp. 440-441, Pl. 44, Fig. 4.  
 1896. *Tinostoma Woodi* (HOERNES) et var. *astensis* SACC.; F. SACCO, p. 52, Pl. 4, Figs 64-65.  
 1901. *Tinostoma frequens* n. sp.; O. BOETTGER, pp. 167-168, No. 521.  
 1901. *Tinostoma fuchsi* n. sp.; O. BOETTGER, p. 168, No. 522.  
 1901. *Tinostoma affine* n. sp.; O. BOETTGER, p. 169, No. 524.  
 1917. *Tinostoma (Solariorbis) Degrangei* nov. sp.; M. COSSMANN & A. PEYROT, pp. 219-221, Pl. 7, Figs 14-19.  
 1934. *Teinostoma (Solariorbis) frequens* (BOETTGER); A. ZILCH, p. 204, Pl. 3, Fig. 45.  
 1934. *Teinostoma (Solariorbis) fuchsi* (BOETTGER); A. ZILCH, p. 204, Pl. 3, Fig. 46.  
 1934. *Teinostoma (Solariorbis) affine* (BOETTGER); A. ZILCH, p. 204, Pl. 3, Fig. 47.  
 1954. *Cyclostrema woodi* HÖRN.; L. STRAUZ, p. 12, Pl. 9, Fig. 163.

<sup>1</sup> The genus *Teinostoma* H. & A. ADAMS was most frequently assigned to the family Skeneidae of the order Archaeogastropoda (comp. WENZ, 1938). However, its relationship to the genus *Vitrinella* C. B. ADAMS, 1850 has recently been accepted by KNIGHT *et al.* (1960), who included it in the order Caenogastropoda.

1954. *Cyclostrema frequens* BOETTGER; L. STRAUZ, p. 12, Pl. 9, Fig. 164.

1959. *Tinostoma woodi* HOERN.; P. M. STEVANOVIC & V. M. MILOŠEVIC, p. 96, Pl. 4, Fig. 5 (*exclud. synon.*).

1966. *Teinostoma woodi* HÖRNES; L. STRAUZ, p. 48, Pl. 50, Figs 4-6.

1966. *Teinostoma woodi frequens* BOETTGER; L. STRAUZ, p. 48, Pl. 50, Figs 7-9.

**Material.** — A hundred and fifty specimens.

**Dimensions.** — The largest specimen is 1.9 mm high and 3.8 mm wide.

**Description.** — Shell small, not very thin-walled, discoid. Protoconch consisting of two and a quarter convex and quite smooth whorls. The early part of protoconch slightly projecting above the apical surface of shell. Teleoconch reaching two and a half slightly convex whorls, rapidly growing in width. At the base, shell is slightly flattened, its periphery either rounded or with a slightly marked carina. Ornamentation in the form of a very delicate, spiral grooving. A row of fine pits, best seen in the early part of protoconch, may be observed within each groove. Only the part of shell base near umbilicus is devoid of grooving. Aperture roundish, slightly triangular in outline. Outer lip thin, on edge sharp, prosocline. Inner posteriorly thin, anteriorly considerably swollen and forming a fold turned outwards and sometimes to a considerable extent covering umbilicus. Umbilicus variously developed, usually deep, but of different width, sometimes, very rarely, completely covered.

**Remarks.** — The specimens here assigned are marked by a relatively considerable degree of variability. This particularly concerns the development of umbilicus and, in addition, the prominence of spiral grooving and shape of the last whorl. This variability explains a certain divergence of opinions of individual investigators who described very strongly related specimens under different specific names. Several species, at least three of them (see synonymy) not differing, in the present writer's opinion, from *Teinostoma woodi* (HÖRNES) were described by BOETTGER (1901, 1907) from the Miocene of Kostež and Lapugy, Transylvania, Rumania. One of them, *T. frequens* BOETTGER, described as having a quite smooth shell, has also a spiral grooving, which may easily be checked in the illustration of lectotype (comp. ZILCH, 1934). Quite different specimens, belonging to *Skenea kostejanum* (BOETTGER) were described by FRIEDBERG (1928*a*, Pl. 33, Fig. 10) from Korytnica and Chomentów under the name *T. woodi* HÖRNES. Specimens from Trzydnik (comp. KRACH, 1950*b*, Pl. 2, Fig. 8) also do not belong to *T. (S.) woodi*. Specimens from the Miocene of Bulgaria (comp. KOJUMDIEVA, 1960, Pl. 29, Fig. 8), whose different shape arouses doubts if they belong to this species, also have not been included by the present writer in the synonymy.

*T. (S.) woodi* has not so far been known from Korytnica. In other Miocene localities of Poland, outside of Trzydnik, *T. woodi* (HÖRNES) was also mentioned in a gastropod assemblage from Brzeźnica (KRACH, 1960).

#### Subgenus **IDIORAPHE** PILSBRY, 1922

#### **Teinostoma (Idioraphe) minimum** BOETTGER, 1907

(Pl. XI, Fig. 6)

1907. *Tinostoma minimum* n. sp.; O. BOETTGER, pp. 193-194, No. 654.

1934. *Teinostoma minimum* BOETTGER; A. ZILCH, p. 204, Pl. 2, Fig. 43.

**Material.** — Eight specimens.

**Dimensions.** — The largest specimen (Pl. XI, Fig. 6) is 0.8 mm high and 1.5 mm wide.

**Description.** — Shell very small, not very thin-walled, discoid. Shell structure very characteristic and rather non-typical. A very small protoconch (or its incipient part) is visible on a slightly excentrically situated and almost not projecting apex. Nearly all of teleoconchal whorls (probably about two and a half in the largest specimen) are very closely coiled so that the last, convolute one, completely embraces all earlier whorls, exposing protoconch only. Consequently, suture consists of a line encircling protoconch and a short sector running radially towards the convergence of both apertural lips. The last whorl is apically more convex than on base and its periphery is rounded and devoid of carina. Shell surface ornamented by delicate and closely-spaced grooves, which, however, are visible under a strong magnification only. Grooves are lacking near umbilicus only. Aperture roundish, somewhat obliquely oriented. Umbilicus completely filled by callus.

**Remarks.** — The conspecificity of the specimens here described with the holotype of this species (comp. ZILCH, 1934) is indisputable. The present writer does not agree with BOETTGER'S (1907) view on a close relationship of *T. minimum* BOETTGER to *T. callosum* BOETTGER. These species differ from each other not only in size, but also and primarily in a quite different manner of shell coiling, while the presence of a strongly developed callus completely filling umbilicus in the two species is a character of a rather minor importance. A characteristic type of shell coiling enables the assignment of the species *T. minimum* BOETTGER to the subgenus *Idioraphe* PILSBRY. *T. minimum* was mentioned by CSEPREGHY-MEZNERICS (1956) in a gastropod assemblage from Szob, unfortunately without illustrations. STRAUZ'S (1966, Text-fig. 28c) schematic drawing, concerning this same find, presents a specimen differing in structure.

*T. (I.) minimum* has not so far been known from the Miocene of Poland. Outside of Korytnica, it occurs only at Kosteĵ and Lapugy, Rumania, where a single specimen was found in each of the two localities (BOETTGER, 1907).

#### Genus **ROTELLORBIS** COSSMANN, 1888

##### **Rotellorbis ?plicatus** (BENOIST, 1873)

(Pl. XI, Fig. 9)

1917. *Rotellorbis plicatus* (BEN.); M. COSSMANN & A. PEYROT, pp. 225-226, Pl. 7, Figs 33-35.

**Material.** — One specimen.

**Dimensions.** — Height, 1.1 mm, width, 1.9 mm

**Description.** — Shell small, fairly thick-walled, shaped like a slightly flattened disc. Protoconch consisting of two and a quarter slightly convex and quite smooth whorls, distinctly separated from the rest of shell. Teleoconch reaching one and a quarter whorls rounded on periphery and devoid of carina. Teleoconchal ornamentation formed by very prominent spiral ribs, which appear abruptly on the boundary with protoconch. Apically, they are less numerous (five), thicker and less closely-spaced than on shell base. Near umbilicus, two ribs (in particular the external one) are, however, more prominent, with a shallow, troughlike depression stretching between them. Aperture roundish. Outer lip prosocline, somewhat thinner and more rounded than inner one. Umbilicus fairly narrow and completely covered by a thin and slightly concave callus, distinctly separated from lip. In the terminal part of teleoconch (over a quarter of the last whorl), ornamentation gradually diminishes and finally fades out.

**Remarks.** — The specimen described is tentatively assigned by the present author to *Rotellorbis plicatus* (BENOIST), a species known from the Miocene of Aquitaine. In many respects the specimen from Korytnica is in conformity with that presented by COSSMANN & PEYROT (1917), from which it, however, differs in having, with the same number of whorls, slightly smaller dimensions, lower number of ribs on the apical side, more strongly developed ribs around umbilicus and a gradually disappearing ornamentation. Having at one's disposal a single specimen only, it is impossible to decide if these characters are permanent which could justify the erection of a separate subspecies.

*R. plicatus* has not so far been known from the Miocene of Poland. It makes up a great rarity not only in the Korytnica assemblages. As far as the present writer knows, it was not found in any locality of the Vienna-type Miocene deposits.

Superfamily CERITHIACEA FLEMING, 1822

Family TURRITELLIDAE CLARK, 1851

Genus TURRITELLA LAMARCK, 1799

Subgenus TURRITELLA (TURRITELLA)

*Turritella (Turritella) communis subuliformis* BOETTGER, 1907

(Pl. XII, Figs 14-16)

1907. *Turritella communis* RISSO var. *subuliformis* n.; O. BOETTGER, p. 165, No. 572.

1934. *Turritella communis subuliformis* BOETTGER; A. ZILCH, p. 216, Pl. 6, Fig. 8.

?1956. *Turritella communis subuliformis* BTG.; I. CSEPREGHY-MEZNERICS, p. 384, Pl. 2, Figs 31-33.

**Material.** — Ten specimens.

**Dimensions.** — The largest specimen (preserved in the form of about nine later whorls, Pl. XII, Fig. 15) is 28 mm high and 7.5 mm wide.

**Description.** — Shell medium-sized, fairly thin-walled, slenderly turretlke, with an apical angle of 15 to 18°. Protoconch consisting of about two smooth and convex whorls, not very distinctly separated from the rest of shell. Teleoconch reaching about 15 convex whorls. A not very sharp carina is marked at the bottom of the last whorl. Shell base slightly flattened. Ornamentation not prominent. A robust, spiral cord is first developed on the first whorl, soon followed by two somewhat thinner ones which appear above and below it. On the nine to eleven early whorls, these three cords distinctly predominate over the remaining ones. On later whorls, these differences disappear so that only the central cord remains somewhat thicker than the rest of them. Beginning with the second or third whorl, there appear very delicate secondary cords whose number increases with the growth of shell. Some of them (one each between the cardinal cords, three to four above them and one to two below them) gradually reach the thickness of the main cords and thus the ornamentation on later whorls consists of about ten more prominent cords, with fairly numerous thinner ones occurring between them. Aperture destroyed in all specimens.

**Remarks.** — Here assigned specimens do not display any substantial differences as compared with that from Kostej, Rumania, considered by ZILCH (1934) as a lectotype of the subspecies *T. (T.) communis subuliformis* BOETTGER. In the present writer's opinion, the conspecificity

of the specimens from Korytnica and Kosteĵ is beyond any doubt. The variability observed among the Korytnica specimens is expressed only in a more or less prominent ornamentation. Somewhat similar specimens also occur at Steinabrunn, Vienna Basin, but they are less slender having somewhat lower whorls. According to SIEBER (1960, Pl. 1, Fig. 27), they do not belong to the subspecies under study. In the Miocene of Aquitaine, there occur *T. acuta* MAYER, whose shells are similar in size and shape, but have a somewhat different ornamentation, that is, on their later whorls the central one of the main cords completely does not differ from the others and, consequently, the outline of whorl is somewhat different (COSSMANN & PEYROT, 1922, Pl. 2, Figs 46-47).

*T. (T.) communis subuliformis* BOETTGER has not so far been known from the Miocene of Poland.

### Subgenus **TURRITELLA (ZARIA)** GRAY, 1847

#### **Turritella (Zaria) spirata** (BROCCHI, 1814)

(Pl. XIII, Fig. 14)

1853. *Turritella spirata* BROCC.; E. EICHWALD, pp. 281-282, Pl. 10, Fig. 24.  
 1856. *Turritella subangulata* BROCC.; M. HÖRNES, pp. 428-429, Pl. 43, Figs 5-7.  
 1895. *Zaria subangulata* (BR.); F. SACCO, p. 10.  
 1895. *Zaria subangulata* var. *spirata* (BR.); F. SACCO, p. 10-11, Pl. 1, Fig. 34.  
 1909. *Turritella subangulata* BROCC. var. *polonica* FRIEDB.; W. FRIEDBERG, pp. 21-22, Pl. 14, Figs 25-26.  
 1914. *Turritella subangulata* BROCC. var. *polonica* FRIEDB.; W. FRIEDBERG, pp. 331-332, Pl. 19, Figs 17-18.  
 1922. *Turritella (Zaria) subangulata* BROCC. var. *spirata* BROCC. var. *spirata* BROCC. var. *spirata* BROCC.; M. COSSMANN & A. PEYROT, pp. 17-18, Pl. 2, Figs 12-13.  
 1930. *Turritella subangulata* BROCC. var. *polonica* FRIEDB.; K. KOWALEWSKI, p. 143.  
 1938. *Turritella subangulata* BROCC. var. *spirata* BROCC.; W. FRIEDBERG, pp. 92-93.  
 1949. *Turritella (Zaria) subangulata* BROCC.; M. GLIBERT, p. 117, Pl. 7, Figs 1.  
 1952. *Turritella (Zaria) subangulata* BROCC.; M. GLIBERT, pp. 25-26, Pl. 2, Fig. 12.  
 1955b. *Turritella (Torculoidella) subangulata* BROCC. var. *polonica* FRIEDBERG; G. MOISESCU, pp. 128-130, Pl. 11, Figs 1-10.  
 1956. *Turritella (Zaria) spirata* (BROCCHI); I. CSEPREGHY-MEZNERICS, p. 385, Pl. 2, Fig. 29.  
 1960. *Turritella (Torculoidella?) spirata* BROCC.; R. SIEBER, pp. 261-262, Pl. 2, Fig. 17; Pl. 3, Fig. 1.  
 1960. *Turritella (Torculoidella) subangulata polonica* FRIEDB.; R. SIEBER, p. 262, Pl. 2, Fig. 16.  
 1960. *Turritella (Torculoidella) subangulata* var. *subacutangula* (ORBIGNY); E. KOJUMDIEVA, p. 114, Pl. 32, Figs 5-6.  
 1960. *Turritella (Torculoidella) subangulata* var. *spirata* (BROCCHI); E. KOJUMDIEVA, p. 114, Pl. 32, Fig. 7.  
 1961. *Turritella (Zaria) subangulata spirata* BROCC.; J. MARINESCU, pp. 525-526, Pl. 3, Fig. 12.  
 1966. *Turritella subangulata spirata* BROCC.; L. STRAUZ, pp. 84-85, Pl. 2, Fig. 4.  
 1968. *Archimediella (Torculoidella) spirata* (BROCCHI); E. ROBBA, pp. 511-513, Pl. 39, Fig. 12.  
 1968. *Turritella subangulata spirata* BROCC.; W. KRACH, p. 487, Pl. 2, Fig. 6.  
 1968. *Turritella (Zaria) subangulata spirata* BROCC.; L. HINCULOV, p. 134, Pl. 32, Fig. 7.  
 1970. *Turritella (Torculoidella) spirata* (BR.); E. CAPROTTI, pp. 140-141, Pl. 1, Fig. 2.  
 1971b. *Turritella subangulata* BROCC.; M. EREMIJA, pp. 35-36, Pl. 9, Fig. 6.  
 1973. *Turritella (Zaria) spirata* (BROCCHI); M. BOHN-HAVAS, p. 1042, Pl. 3, Fig. 9

**Material.** — Two specimens.

**Dimensions.** — The larger specimen (composed of about six middle whorls) is 18 mm high and 7.2 mm wide.

**Description.** — Shell medium-sized, fairly thin-walled, slender, turretlike. Neither protoconch, nor early teleoconchal whorl preserved in any specimen. Teleoconchal whorls are

marked by a bent outline, with one, fairly sharp, spiral rib running on the bend situated in the middle of whorls (but somewhat nearer the lower suture). The surface of whorl, both above and below this rib, is covered with very delicate spiral striae (on early whorls, even seems to be quite smooth). A distinct carina, along which runs one more, also sharp rib (partly visible also on earlier whorls), occurs at the bottom of the last whorl. Shell base strongly flattened. Aperture destroyed in the two specimens.

**Remarks.** — The specimens here assigned are conspecific with those described from various localities (see synonymy). They are particularly similar to those from Baden, Vienna Basin (HÖRNES, 1856) and Szob, Hungary (STRAUSZ, 1966). Among the shells presented by individual authors a great variability is observed, expressed in particular in the situation and sharpness of bend in the outline of whorls, in the prominence of the spiral rib and the striae. Thus, although particular specimens even strongly differ in shape from each other, it seems that distinguishing them as separate taxons is groundless. The generally used names *T. spirata* (BROCCHI), *T. subangulata* (BROCCHI), *T. subacutangula* d'ORBIGNY and *T. subangulata polonica* FRIEDBERG should be considered as synonyms (see HÖRNES, 1856; GLIBERT, 1949, 1952; ROBBA, 1968; CAPROTTI, 1970). The first of them, *T. spirata* (BROCCHI), as earlier used (in this same paper) has a priority.

*T. (Z.) spirata* (BROCCHI) was mentioned as *Z. subangulata polonica* from Korytnica by KOWALEWSKI (1930) and FRIEDBERG (1938). Specimens from the environs of Korytnica, identified by PUSCH (1837) as *T. subangulata* probably did not belong to the species under study, but to *T. badensis*. In the Miocene of Poland this species was also recorded from Gliwice Stare (FRIEDBERG, 1914; KRACH, 1954), Małoszów (KOWALEWSKI, 1930; KRACH, 1947), environs of Józefów (AREŃ, 1962; KRACH, 1968), Benczyn (KRACH, 1950a), Żegocina (FRIEDBERG, 1914), Skoczów (KRACH, 1974), Bogucice (LISZKA, 1933; FRIEDBERG, 1938), Brzeźnica (KRACH, 1960) and Zgłobice (FRIEDBERG, 1914).

### Subgenus **TURRITELLA (HAUSTATOR) SACCO, 1895**

#### **Turritella (Haustator) badensis SACCO, 1895**

(Pl. XII, Figs 22-27)

1837. *Turritella subangulata* BROCCHI; G. PUSCH, p. 104.  
 1837. *Turritella fasciata* LAM.; G. PUSCH, p. 104.  
 1856. *Turritella turris* BAST.; M. HÖRNES, pp. 423-424, Pl. 43, Figs 15-16.  
 1895. *Turritella turris* cf. *badensis* SACCO; F. SACCO, p. 3.  
 1909. *Turritella turris* BAST. var. *badensis* SACCO; W. FRIEDBERG, pp. 4-7, Pl. 13, Figs 3-4.  
 1914. *Turritella turris* BAST.; W. FRIEDBERG, pp. 327-329, Pl. 19, Figs 14-15, Text-fig. 70.  
 1914. *Turritella turris* BAST. var. *sexcincta* FRIEDB.; W. FRIEDBERG, p. 329.  
 1914. *Turritella turris* BAST. var. *oligocincta* FRIEDB.; W. FRIEDBERG, pp. 329-330, Text-fig. 71.  
 1914. *Turritella turris* BAST. var. *duplicata* FRIEDB.; W. FRIEDBERG, p. 330.  
 1930. *Turritella turris* BAST.; K. KOWALEWSKI, pp. 142-143.  
 1938. *Turritella badensis* SACCO, et *formae*; W. FRIEDBERG, pp. 88-89.  
 1956. *Turritella (Haustator) badensis* SACCO, et var. *sexcincta* FRIEDBERG; I. CSEPREGHY-MEZNERICS, pp. 381-382, Pl. 2, Figs 17 and 30.  
 ?1956. *Turritella (Archimediella) partschi* ROLLE an sp. dist.; I. CSEPREGHY-MEZNERICS, p. 384, Pl. 2, Figs 22-25.  
 1960. *Turritella (Haustator) badensis badensis* SACCO; R. SIEBER, pp. 239-240, Pl. 3, Figs 2 and 8/2.  
 1960. *Turritella (Haustator) badensis plana* ssp. n.; R. SIEBER, p. 240, Pl. 1, Fig. 32.  
 1960. *Turritella (Haustator) badensis carinata* ssp. n.; R. SIEBER, p. 241, Pl. 1, Fig. 24; Pl. 3, Fig. 8/7.

1960. *Turritella (Haustator) badensis* SACCO; T. BÁLDI, pp. 58-59, Pl. 1, Fig. 13.  
1960. *Turritella (Archimediella) turris* var. *badensis* SACCO; E. KOJUMDIEVA, p. 113, Pl. 32, Fig. 8.  
1966. *Turritella turris badensis* SACCO; L. STRAUZ, pp. 99-102, Pl. 3, Figs 13-17; Pl. 78, Fig. 4.  
1969. *Archimediella turris badensis* SACCO; M. A. ATANACKOVIĆ, pp. 197-198, Pl. 9, Figs 1-2.  
1970. *Turritella (Torculoidella) bieniaszi* FRIEDB.; G. RADO & R. MUTIU, p. 148, Pl. 5, Figs 9-11.  
1971. *Turritella turris badensis* SACCO; J. STANCU, M. D. GHEORGIAN & A. POPESCU, p. 125, Pl. 8, Fig. 1.  
1973. *Turritella (Haustator) badensis* SACCO; M. BOHN-HAVAS, p. 1040, Pl. 3, Fig. 2.

**Material.** — More than 1000 specimens.

**Dimensions.** — The largest specimen, composed of 15 whorls without the early whorls (Pl. XII, Fig. 23) is 65 mm high and 13.5 mm wide. In other specimens, the width reaches 16 mm.

**Description.** — Shell large, not very thick-walled, slender, turretlike. Protoconch (together with the earliest teleoconchal whorls preserved only in juvenile specimens) consisting of about two convex and smooth whorls, without a distinct boundary with the rest of shell. Teleoconch reaching 22 to 24 more or less convex whorls. Shell base slightly flattened. Ornamentation formed by fairly prominent spiral cords. Three of them appear almost simultaneously on the first whorl, the third of them most prominent and appearing somewhat earlier. It is already on the second whorl that the fourth cord develops above the uppermost one close to suture and one more cord on the fifth or sixth whorl always below the fourth cord. The last-named two cords are at first markedly less robust than the remaining ones and these differences disappear only on later whorls. Such a pattern of ornamentation is typical of about ten early whorls and it only exceptionally remains unchanged to the end of shell. For, on further whorls, there usually appear thin, secondary cords. Sometimes, one of them may even reach the thickness of cardinal cords and then six prominent cords run on whorls. Not infrequent are also certain complications in sculpture, which consist in either the disappearance or bifurcation of some of the cardinal cords. Such changes occur as a rule suddenly after the phase of growth arrest or after the damage of shell (in the gastropod's lifetime). One more cardinal cord, sometimes partly visible also on preceding whorls, runs on the last whorl below other cardinal cords. Fairly numerous, thin, spiral cords, five to seven of which are usually more strongly developed, occur on the base. Aperture oval in outline, destroyed in all specimens. Traces of orange-red coloration are preserved on some shells.

**Remarks.** — The shells described are among the most common in the Korytnica clays. A very strong variability in both shape and ornamentation is observed in them. The variability in shape is expressed in a varying convexity of whorls. In an extreme case, whorls are nearly quite flat (this concerns the middle and later whorls) and such shells (Pl. XII, Fig. 26) are completely conspecific with specimens of *T. (H.) badensis plana* SIEBER, described by SIEBER (1960) from Grund, Vienna Basin. Such specimens cannot, however, be separated from others with a "normal" convexity, as there are many transitional forms and, in addition, the differences in convexity mentioned above are not observed almost at all on early whorls. The variability in ornamentation is expressed in a varying number and prominence of secondary cords. Specimens in which one of the secondary cords reached the thickness of cardinal ones were separated (FRIEDBERG, 1909, 1914; CSEPREGHY-MEZNERICS, 1956) as *T. (H.) badensis sexcincta* FRIEDBERG, which is unjustified, much the same as the separation of specimens in which one of the ribs disappears (*T. badensis oligocincta* FRIEDBERG) or bifurcates (*T. badensis duplicata* FRIEDBERG). The variability in ornamentation is also manifested in a variable prominence of the middle cord of the three early cardinal cords. When it is particularly strongly developed, whorls take



an angularly bent aspect. Such shells strongly resemble specimens from Soos, Vienna Basin, described by SIEBER (1960) as *T. (H.) badensis carinata* SIEBER. Analogous specimens were formerly described from Korytnica by FRIEDBERG (1914, Text-fig. 70, on the left). It is also in this case, that, in the present writer's opinion, there is no sufficient basis for erecting a separate subspecies. *T. (H.) badensis* SACCO is a species frequently met with in the Vienna-type Miocene deposits and it is everywhere marked by a considerable variability (STRAUSZ, 1966). Juvenile specimens from Islaz, Rumania, identified by RADO & MUTIU (1970) as *T. (Torculoidella) bieniaszi* FRIEDBERG, undoubtedly also belong to this species.

*T. (H.) badensis* SACCO was mentioned from the Korytnica clays by all investigators of local fossils (PUSCH, 1837; MURCHISON, 1845; KONTKIEWICZ, 1882; FRIEDBERG, 1914, 1928*b*, 1938; KOWALEWSKI, 1930). In the Miocene of Poland, this species is known from, among other localities, Biskupice (ROEMER *fide* FRIEDBERG, 1914), Małoszów (KRACH, 1947), Gartatowice (KRACH, 1967), Pińczów and Szczaworyż (KOWALEWSKI, 1930), Staszów and Szydłów (PUSCH, 1837), Rybnica (KOWALEWSKI, 1930), Skoczów (KRACH, 1974), Andrychów (KRACH, 1956), Benczyn (KRACH, 1950*a*), Żegocina (FRIEDBERG, 1914), Bogucice (LISZKA, 1933), Błonie (FRIEDBERG, 1914) and Niechobrz (GOŁĄB, 1932; FRIEDBERG, 1938).

### **Turritella (Haustator) partschi** ROLLE, 1856

(Pl. XII, Figs 19-21)

1879. *Turritella partschi* ROLLE; V. HILBER, p. 445, Pl. 5, Fig. 1.

1958. *Turritella (Haustator) partschi partschi* ROLLE; R. SIEBER, pp. 237-238, Pl. 1, Fig. 2.

1966. *Turritella eryna partschi* ROLLE; L. STRAUZ, pp. 97-98, Pl. 3, Figs 6-11.

**Material.** — Eight specimens.

**Dimensions.** — The largest specimen (Pl. XII, Fig. 20) is 28.5 mm high and 6 mm wide.

**Description.** — Shell medium-sized(?), not very thin-walled, shaped like a very slender turret, with an apical angle of 12° to 13°. Protoconch consisting of two smooth and convex whorls, indistinctly separated from the rest of shell. Teleoconch reaching 18 to 19 whorls, the early ones being bent in outline, the later slightly convex. Ornamentation consisting of spiral cords varying in thickness. A cord situated somewhat nearer the lower suture, appears at the beginning on the first whorl, followed closely by another cord just below the first. The first cord is much more prominent on early whorls, while on later whorls this difference decreases. Three very delicate secondary cords are developed on the third whorl, two of them above the upper and one below the lower cardinal cord. A few more secondary cords are formed on subsequent whorls. Three early secondary cords, in particular that situated above the upper cardinal cord, are more prominent on later whorls than others, but always less strongly developed than the cardinal ones. Several (five to six) thin spiral cords are also visible in all at the base of shell. Aperture destroyed in all specimens.

**Remarks.** — The specimens described may be assigned without any major reservations to the species *T. (H.) partschi* ROLLE. Their conspecificity with those occurring in the Vienna Basin (SIEBER, 1960) and Varpalota, Hungary (STRAUSZ, 1966) does not arouse any doubt. The Korytnica specimens are only somewhat slenderer and relatively small (not fully grown up). The last-named fact makes difficult developing a sound view on their relationship to the subspecies *T. (H.) partschi quadricincta* SIEBER. It seems, however, that separating this subspecies (SIEBER, 1960, Pl. 1, Figs 3-4) is insufficiently justified, since SIEBER's (1960, Pl. 3, Figs 8/3 and

8/5) schematic figures give ample evidence how small are the differences between it and the nominal subspecies. The variability observed in the Korytnica specimens is not very large and it is expressed mostly in a varying prominence of the two cardinal spiral cords.

*T. (H.) partschi* ROLLE has not so far been known from the Miocene of Poland.

***Turritella (Haustator) cf. striatellata* SACCO, 1895**

(Pl. XII, Fig. 13)

1896. *Haustator striatellatus* SACCO; F. SACCO, p. 16, Pl. 1, Fig. 59.

1907. *Turritella (Haustator) striatellata* SACCO; O. BOETTGER, p. 167, No. 578.

1960. *Turritella (Haustator) striatellata* SACCO; R. SIEBER, pp. 242-243, Pl. 1, Fig. 19.

1968. *Turritella striatellata* SACCO; J. STANCU & E. ANDREESCU, Pl. 3, Fig. 27.

**Material.** — One specimen.

**Dimensions.** — Height, 21 mm, width, 6.5 mm.

**Description.** — Shell medium-sized(?), not very thin-walled, shaped like a slender turret. Neither protoconch, nor the earliest teleoconchal whorls are preserved. The first of the preserved whorls are bent in outline, further ones nearly quite flat. Ornamentation relatively very delicate. A prominent and fairly sharp spiral cord runs on early whorls along the bend, with another one, considerably smaller, occurring below it. In addition, the surface of these whorls is densely covered with delicate secondary cords. On further whorls, the upper cardinal cord gradually becomes less and less prominent, while the lower one, vice-versa, becomes more and more so and one of the secondary cords, situated above the upper cardinal cord, reaches a thickness equalling that of cardinal cords. Thus, three robust and 14 thinner, almost uniform secondary cords (3-3-5-3, counting from the upper suture) run over the later whorls preserved.

**Remarks.** — The identification of this incomplete, although fairly well-preserved specimen is difficult. Its assignment to the species *T. (H.) striatellata* SACCO may arouse certain doubts. It seems most closely related to a specimen from the environs of Dolinesti, Rumania (STANCU & ANDREESCU, 1968). A specimen, described by SIEBER (1960) from Immersdorf near Grund, Vienna Basin, differs, however, in the outline of whorls. Also very closely related seems to be the species *T. (H.) sulcomarginalis* SACCO (see HÖRNES, 1856, Pl. 43, Fig. 4; CSEPREGHY-MEZNERICS, 1956, Pl. 2, Figs 34-35; EREMIJA, 1971a, Pl. 6, Fig. 5), although the younger part of the specimen from Steinabrunn, presented by HÖRNES (1856) is different in shape. On the other hand, the specimen from Korytnica undoubtedly does not belong to *T. holubicensis* FRIEDBERG, a species mentioned (although only tentatively) from Korytnica by KOWALEWSKI (1930). The shells of the last-named species have a somewhat different ornamentation (a different arrangement of its robust cords) and absolutely different shape of growth lines.

*T. (H.) striatellata* SACCO has not so far been known from the Miocene of Poland.

***Turritella (?Haustator) tricincta* BORSON, 1821**

(Pl. XII, Figs 7-9)

1856. *Turritella Riepleri* PARTSCH; M. HÖRNES, pp. 421-422, Pl. 42, Fig. 2.

1895. *Haustator tricinctus* (BORS.); F. SACCO, pp. 25-26, Pl. 2, Fig. 28.

1909. *Turritella tricincta* BORS.; W. FRIEDBERG, pp. 22-23, Pl. 14, Fig. 15.

1914. *Turritella tricincta* BORS.; W. FRIEDBERG, p. 350, Pl. 20, Fig. 15.  
 1930. *Turritella tricincta* BORS.; K. KOWALEWSKI, p. 146.  
 1960. *Turritella (Haustator) tricincta tricincta* BORSON; R. SIEBER, pp. 245-246, Pl. 3, Fig. 8/12.  
 1960. *Turritella (Turculoidella) tricincta* BORSON; E. KOJUMDIEVA, p. 116, Pl. 32, Fig. 18.  
 1961. *Turritella (Haustator) tricincta* BORSON; J. MARINESCU, p. 521, Pl. 2, Fig. 7.  
 ?1966. *Turritella vermicularis* BROCCHI; L. STRAUZ, pp. 94-95, Pl. 3, Fig. 3.  
 ?1968. *Turritella triplicata* BROCC.; J. STANCU & E. ANDREESCU, p. 462, Pl. 3, Fig. 26.  
 1970. *Turritella tricincta* BORSON; W. BALUK, p. 117, Pl. 10, Fig. 20.  
 1971a. *Turritella tricincta* BORS.; M. EREMIJA, pp. 69-70, Pl. 6, Fig. 2.

**Material.** — Ten specimens.

**Dimensions.** — The largest specimen (consisting of about 12 whorls, without the earliest ones) is 60 mm high and 16.5 mm wide; in other specimens, the width reaches 18 mm.

**Description.** — Shell large, thick-walled, shaped like a not very slender turret. Protoconch and the earliest teleoconchal whorls not preserved. Teleoconch reaching about 18 to 19 slightly convex whorls. A rounded carina occurs in the lower part of the last whorl. Shell base slightly flattened. Two prominent spiral cords, the upper one stronger and situated at identical distances from both sutures, run on earlier whorls. In addition, many thin cords occur on these whorls. On further whorls, two early cords gradually transform into fairly wide, although not very prominent ribs with rounded ridges. Thin cords also run on these ribs, the same as on the remaining parts of whorls. A third, similar, although only somewhat thinner, rib is developed on middle whorls above the upper rib. A fourth rib, sometimes also partly visible on earlier whorls, occurs along the carina on the last whorl. In two specimens, one more rib, much thinner than the remaining ones, runs in the upper part of the later whorls. Shell base ornamented by four to six spiral cords. Aperture destroyed in all specimens.

**Remarks.** — The specimens from Korytnica are undoubtedly conspecific with those of *T. riepeli* PARTSCH from Steinabrunn, Vienna Basin (HÖRNES, 1856, Pl. 43, Fig. 2). The last-named specimens were included by SACCO (1895) in *T. (H.) tricincta* BORSON. On the other hand, STRAUZ (1966) related them with another species, *T. vermicularis* (BROCCHI) which incidentally also occurs at Steinabrunn (HÖRNES, 1856, Pl. 43, Figs 17-18). Due to the unknown range of variability and the unknown development of the earliest whorls (including the protoconchal ones) in the two species mentioned above, it is difficult to evaluate the correctness of STRAUZ'S (1966) view. The specimen from Budapest (STRAUSZ, 1966, Pl. 3, Fig. 3) is at any rate very similar to those from Korytnica.

*T. (H.) tricincta* BORSON was mentioned from Korytnica by KONTKIEWICZ (1882), FRIEDBERG (1909, 1914, 1938) and KOWALEWSKI (1930). In the Miocene of Poland, this species is also known from Skoczów (KRACH, 1974), Bogucice (LISZKA 1933; FRIEDBERG, 1938) and Niskowa (BALUK, 1970).

#### Subgenus **TURRITELLA (EICHWALDIELLA)** FRIEDBERG, 1933

##### **Turritella (Eichwaldiella) bicarinata** EICHWALD, 1850

(Pl. XII, Figs 1-6)

1837. *Turritella scalaria* DE BUCH; G. PUSCH, p. 104.  
 1853. *Turritella bicarinata* m.; E. EICHWALD, pp. 280-281, Pl. 10, Fig. 23.  
 1856. *Turritella bicarinata* EICHW.; M. HÖRNES, pp. 426-427, Pl. 43, Figs 8-12.

1895. *Archimediella bicarinata* (EICHW.) var. *taurevanescens* SACC.; F. SACCO, p. 15, Pl. 1, Fig. 51.  
 1895. *Archimediella bicarinata* (EICHW.) var. *subunocincta* SACC.; F. SACCO, p. 15.  
 1907. *Turritella* (*Archimediella*) *conospira* n. sp.; O. BOETTGER, pp. 166-167, No. 567.  
 1909. *Turritella bicarinata* EICHW.; W. FRIEDBERG, pp. 19-21, Pl. 14, Figs 9-12.  
 1914. *Turritella bicarinata* EICHW.; W. FRIEDBERG, pp. 332-334, Pl. 19, Figs 19-21.  
 1930. *Turritella bicarinata* EICHW.; K. KOWALEWSKI, p. 144.  
 1934. *Turritella* (*Archimediella*) *conospira* BOETTGER; A. ZILCH, p. 216, Pl. 6, Fig. 9.  
 1935. *Turritella bicarinata* EICHW.; W. FRIEDBERG, pp. 137-144, Pl. 4, Figs 8-12.  
 1949. *Turritella* (*Archimediella*) *bicarinata* EICHWALD; M. GLIBERT, pp. 117-119, Pl. 6, Fig. 17.  
 1956. *Turritella* (*Archimediella*) *subarchimedis* d'ORB.; I. CSEPREGHY-MEZNERICS, p. 431, Pl. 2, Fig. 19.  
 1959. *Turritella bicarinata* EICHW.; M. EREMIJA, Pl. 1, Fig. 1.  
 1960. *Turritella* (*Torculoidella*) *bicarinata bicarinata* EICHW.; R. SIEBER, p. 257, Pl. 2, Figs 7, 19, 21, 23.  
 1960. *Turritella* (*Torculoidella*) *bicarinata taurevanescens* SACCO; R. SIEBER, p. 258, Pl. 2, Fig. 25.  
 1960. *Turritella* (*Torculoidella*) *bicarinata subunocincta* SACCO; R. SIEBER, pp. 258-259, Pl. 2, Fig. 20.  
 1960. *Turritella* (*Torculoidella*) *scalaria praescalaria* ssp. n.; R. SIEBER, p. 259, Pl. 2, Figs 24 and 26.  
 1960. *Turritella* (*Torculoidella*) *bicarinata* var. *subarchimedis*; E. KOJUMDGIEVA, p. 115, Pl. 32, Fig. 15.  
 1966. *Turritella bicarinata* EICHWALD; L. STRAUZ, p. 86, Pl. 2, Fig. 13.  
 1966. *Turritella bicarinata subarchimedis* d'ORBIGNY; L. STRAUZ, pp. 87-88, Pl. 2, Figs 7-8.

**Material.** — A hundred and ten specimens.

**Dimensions.** — The largest specimen, preserved without protoconch and earliest whorls, is 50 mm high and 14.5 mm wide; in other specimens, the width reaches 16 mm.

**Description.** — Shell large, thick-walled, shaped like a more or less slender turret. Protoconch (only exceptionally preserved even in juvenile specimens) consisting of two smooth and convex whorls. Teleoconch reaching about 15 to 17 whorls. Shell ornamentation relatively prominent. Two spiral cords appear on the first whorl, followed, beginning with the third or fourth whorl, by many thin secondary cords. The upper cord of two initial ones rapidly becomes stronger and stronger, transforming into a fairly thick rib with a rounded ridge. This rib is a predominant element of ornamentation. The lower cord, on the other hand, rapidly becomes thinner and thinner, and, beginning with the sixth (and less frequently, somewhat later) whorl, is indistinguishable from secondary cords. Another, slightly wider but less prominent rib occurs at the bottom of the last whorl. Depending on the way in which whorls are coiled (convoluteness of whorls and depth of suture), the last-named rib may be either visible on the last whorl (a relatively rare occurrence, see Pl. XII, Fig. 3), or more or less visible on the middle and later whorls (Pl. XII, Figs 2 and 4). Not infrequently, the second rib is nearly as strongly developed as the first one (Pl. XII, Fig. 5) and, if such is the case, the shell is ornamented by two robust spiral ribs. In addition, the entire surface of whorls (including both ribs) is covered with many, thin, almost uniform spiral cords, whose number on later whorls fluctuates between 35 and 50. Sometimes, fine swellings running along growth lines and intersecting ribs give them an irregular, as if granulated appearance. Shell base slightly flattened and provided with four to six not very strongly developed spiral ribs, with thin cords running between and on them. Aperture destroyed in all specimens.

**Remarks.** — The variability observed among the specimens of *T. (E.) bicarinata* EICHWALD, fairly abundant in the Korytnica clays, is relatively very extensive. On the one hand, it concerns the shape of shell, which may be more or less slender and more or less conical in younger parts and, on the other, in a varying prominence for the lower rib and the degree of its visibility on whorls. Although particular specimens sometimes considerably differ from each other, the existence of those with transitional characters irrefutably shows that the differences observed are the expression of the specific variability. The considerable variability caused that many

investigators described only slightly differing specimens as separate species or subspecies (former varieties). The present writer believes the Korytnica specimens to be conspecific with all specimens listed in the synonymy. Shell with "granulated" ribs seem, in addition, to correspond to specimens from Lapugy, described as *T. bicarinata* EICHW. var. *tuberculata* MOISESCU, although a complete certainty in this respect is out of the question, since the illustration of the holotype (MOISESCU, 1955a, Pl. 1, Fig. 7) is exceptionally illegible, its photographic plate being, on top of all that, inverted. On the other hand, it seems that specimens from the Miocene of Yugoslavia, described under this name by EREMIJA (1971a, Pl. 6, Fig. 8; 1971b, Pl. 14, Fig. 12), do not belong to *T. bicarinata*.

*T. (E.) bicarinata* EICHWALD was mentioned from the Korytnica clays by nearly all investigators (PUSCH, 1837; EICHWALD, 1853; KONTKIEWICZ, 1882; FRIEDBERG, 1914, 1938; KOWALEWSKI, 1930). This species, frequent in the Miocene of Poland, was recorded from, among other localities, Przeroszów (KRACH, 1963), Małoszów (KOWALEWSKI, 1930; FRIEDBERG, 1938; KRACH, 1947), Gartatowice (KRACH, 1967), Pińczów and Szczaworyż (KOWALEWSKI, 1930), Benczyn (KRACH, 1950a), Bogucice (LISZKA, 1933; FRIEDBERG, 1938), Zgłobice and Grudna Dolna (FRIEDBERG, 1914).

#### Subgenus **TURRITELLA (ARCHIMEDIELLA) SACCO, 1895**

#### **Turritella (Archimediella) erronea erronea** COSSMANN *in* FRIEDBERG, 1914

(Pl. XII, Figs 17-18)

1837. *Turritella Archimedis* AL. BRONGN.; G. PUSCH, p. 104.  
 1856. *Turritella Archimedis* BRONG.; M. HÖRNES, pp. 424-426, Pl. 43, Figs 13-14.  
 1909. *Turritella Archimedis* BRONG.; W. FRIEDBERG, pp. 8-9, Pl. 13, Figs 11-12.  
 1914. *Turritella erronea* COSSM.; W. FRIEDBERG, pp. 335-337, Pl. 19, Fig. 23.  
 1930. *Turritella erronea* COSSM.; K. KOWALEWSKI, p. 145.  
 1938. *Turritella erronea* COSSM. f. *infratricincta* FRIEDB.; W. FRIEDBERG, p. 90, Text-fig. 25.  
 1956. *Turritella (Archimediella) erronea* COSSMANN; I. CSEPREGHY-MEZNERICS, p. 431, Pl. 2, Figs 11-12.  
 1959. *Turritella archimedis* BRONG.; M. EREMIJA, Pl. 2, Fig. 13.  
 1960. *Turritella (Archimediella) erronea erronea* COSSM.; R. SIEBER, pp. 252-253, Pl. 2, Fig. 8; Pl. 3, Fig. 8/16.  
 1960. *Turritella (Torculoidella) erronea* COSSMANN *in* FRIEDBERG; E. KOJUMDGIEVA, p. 115, Pl. 32, Figs 16-17.  
 1961. *Turritella (Archimediella) erronea* COSSMANN; J. MARINESCU, pp. 527-528, Pl. 4, Fig. 14.  
 1966. *Turritella thetis erronea* COSSMANN; L. STRAUZ, pp. 88-90, Pl. 2, Figs 15-17, Pl. 78, Fig. 1.

**Material.** — A hundred and twenty specimens.

**Dimensions.** — The largest specimen (without the earliest whorls, Pl. XII, Fig. 18) is 54 mm high and 12 mm wide; in other specimens, the width reaches 15 mm.

**Description.** — Shell large, not very thin-walled, shaped like a slender turret. Protoconch (preserved in juvenile specimens only) consists of two smooth and strongly convex whorls, the first of them more dumpy and even slightly wider. Teleoconch reaching about 20 whorls, with a not very sharp carina running at the bottom of the last of them. Shell base flattened. Two spiral ribs, which appear as on the first whorl, make up the fundamental element of ornamentation. At first thin and sharp, later their ridges become slightly rounded. The upper rib is more prominent on early whorls. Whorls are very characteristic in outline. The entire part of a whorl above the upper rib, between the ribs and below the lower rib is slightly concave. In addition to the two ribs, beginning with the third whorl there also appear many, delicate and closely-

spaced spiral cords, which, on the middle and later whorls, also cover both ribs. Usually, one (less frequently two) of such cords which is situated above the upper rib is conspicuously robust. Less frequently, one of the cords situated between ribs is distinguished in a similar way. A bifurcation of a rib, which always takes place after a clearly visible damage of shell (at the animal's lifetime), may be also observed now and again. One more, considerably less robust, rib runs at the bottom of the last whorl. Shell base also provided with spiral cords, four to seven of them being more strongly developed. Aperture destroyed in all specimens.

**Remarks.** — The conspecificity of the Korytnica specimens with those described by HÖRNES (1856) from the Vienna Basin as *T. archimedis* is beyond any doubt. Such specimens, for which the name *T. erronea* was suggested by COSSMANN (*in* FRIEDBERG, 1914) to distinguish them from the Eocene species *T. archimedis*, are fairly common in the Vienna-type Miocene deposits. The variability, observed among the specimens from Korytnica is relatively not very extensive and expressed only in a stronger or poorer development of some spiral cords. The separation of specimen having a prominent cord between both ribs and calling them *T. erronea infratricincta* FRIEDBERG, 1938 is of course unjustified.

*T. (A.) erronea erronea* COSSMANN was mentioned from the Korytnica clays by PUSCH (1837), MURCHISON (1845), KONTKIEWICZ (1882), FRIEDBERG (1909, 1914, 1930, 1938) and KOWALEWSKI (1930). It is not unlikely that the specimens from Korytnica identified by EICHWALD (1853) as *T. indigena*, should also be referred to the species under study. In the Miocene of Poland, *T. erronea* was also mentioned from Małoszów (KOWALEWSKI, 1930; KRACH, 1947), Gartatowice (KRACH, 1967), Szczaworyż (KOWALEWSKI, 1930), Żegociny (FRIEDBERG, 1914), Benczyn (KRACH, 1950*a*), Bogucice (FRIEDBERG, 1914; LISZKA, 1933) and Grudna Dolna (FRIEDBERG, 1914). Some of these mentions may, however, concern the subspecies *T. (A.) erronea subpythagoraica* FRIEDBERG (1914, Pl. 19, Fig. 24).

### ***Turritella (Archimediella) dertonensis* MAYER, 1868**

(Pl. XII, Figs 10-12)

1895. *Archimediella dertonensis* (MAY.); F. SACCO, pp. 12-13, Pl. 1, Fig. 39.  
 1895. *Archimediella Archimedis* (BRONG.) var. *dertonatior* SACC.; F. SACCO, p. 12, Pl. 1, Fig. 38.  
 1909. *Turritella dertonensis* MAY.; W. FRIEDBERG, pp. 9-10, Pl. 13, Fig. 13.  
 1914. *Turritella dertonensis* MAY.; W. FRIEDBERG, pp. 338-339, Pl. 19, Fig. 25.  
 1930. *Turritella dertonensis* MAY.; K. KOWALEWSKI, p. 146.  
 1956. *Turritella (Archimediella) dertonensis* MAY.; I. CSEPREGHY-MEZNERICS, p. 383, Pl. 2, Fig. 18.  
 1960. *Turritella (Archimediella) dertonensis dertonensis* MAYER; R. SIEBER, pp. 255-256, Pl. 2, Figs 11-12, Pl. 3, Fig. 8/25.  
 1961. *Turritella (Archimediella) dertonensis* MAYER; J. MARINESCU, pp. 529-530, Pl. 4, Fig. 18.  
 1966. *Turritella (Archimediella) dertonensis* MAYER; J. KÓKAY, p. 39, Pl. 3, Fig. 13.

**Material.** — Thirty specimens.

**Dimensions.** — The largest specimen, composed of about eight later whorls, is 41 mm high and 12.8 mm wide.

**Description.** — Shell fairly large, not very thin-walled, shaped like a slender turret. Protoconch (preserved in juvenile specimens only) consisting of two smooth and convex whorls, the first of them somewhat smaller. Teleoconch reaching about 18 whorls. Two spiral ribs, the upper somewhat robust on early whorls, represent the main element of ornamentation. In addition, the surface of whorls is provided with many thin and rather closely-spaced spiral

cords, which on later whorls run also on ribs. One (or, less frequently, two) of such cords, situated above the upper rib, is more strongly developed than the rest of them. Above the upper rib, the surface of whorl is flat and sloping in a tierlike manner towards the rib. One more rib, considerably less robust than the remaining two, also occurs at the bottom of the last whorl. Shell base flattened and ornamented by a few spiral cords. Aperture destroyed in all specimens.

**Remarks.** — The specimens here assigned, although fairly similar to *T. (A.) erronea* COSSMANN, are rather easily distinguishable. *T. (A.) dertonensis* MAYER have a different (flat) outline of whorl above the upper rib, blunter and less prominent spiral ribs (this in particular concerns the early whorls), less regular spiral cords and a pronouncedly different shape of the first protoconchal whorl. Since no specimens with transitional characters have ever been met with, the separateness of these species is unquestionable. According to STRAUZ (1966), specimens from Szob, Hungary (CSEPREGHY-MEZNERICS, 1956, Pl. 2, Fig. 18) do not belong to *T. dertonensis* but to *T. erronea* (*T. thetis erronea* as called by STRAUZ, 1966). The correctness of STRAUZ'S view may only be checked by comparing the younger parts of the specimens called in question. STRAUZ (1966) also believes that the early whorls in *T. dertonensis* and *T. erronea* considerably differ from each other and, therefore, the two species can hardly be considered as closely related to each other. The observations of the Korytnica specimens of these species do not corroborate STRAUZ'S opinion. Their early whorls, although surely different from each other, display such strong similarities, that their close relationship seems irrefutable.

*T. (A.) dertonensis* MAYER has already been mentioned from Korytnica by FRIEDBERG (1914, 1938) and KOWALEWSKI (1930). In the Miocene of Poland, this species also occurs at Małoszów (KRACH, 1947) and Gartatowice (KRACH, 1967).

#### Subgenus **TURRITELLA (TORCULOIDELLA) SACCO, 1895**

#### **Turritella (Torculoidella) praevaricosa** SIEBER, 1960

(Pl. XII, Fig. 13)

1960. *Turritella (Torculoidella) praevaricosa* sp. n.; R. SIEBER, pp. 260-261, Pl. 2, Fig. 28; Pl. 3, Fig. 8/20.

**Material.** — One specimen.

**Dimensions.** — Height, 29 mm, width, 9.5 mm.

**Description.** — Shell fairly large, rather thick-walled, shaped like a not very slender turret. Protoconch and the earliest and later teleoconchal whorls not preserved. Two spiral cords, the upper one of them situated halfway the height of whorl and considerably robuster, form the ornamentation of early whorls. In addition, many delicate secondary cords run over the surface of whorls. On further whorls, the upper rib becomes slightly thinner, but continues to be a predominant element of sculpture. Two of the secondary cords, situated above the upper cardinal rib, reach the same thickness as the lower cardinal rib. At the bottom of whorls, one more cord is slightly more prominent close to suture.

**Remarks.** — The present writer believes that the unique specimen from Korytnica described above may be assigned to the species *T. (Torculoidella) praevaricosa* SIEBER. Compared with a holotype specimen from Windpassing near Grund, Vienna Basin (SIEBER, 1960, Pl. 2, Fig. 28), it does not display any differences. On the other hand, certain doubts may be aroused by the

question if this species was not separated overhastily, since a specimen presented by GUILLAUME (1925, Pl. 11, Fig. 12) from the Pliocene of Normandy as *T. incrassata* SOWERBY var. seems to be fairly similar.

*T. (T.) praevericosa* SIEBER has not so far been known from the Miocene of Poland.

**Turritella** sp.

(Pl. XII, Fig. 11)

**Material.** — One incomplete specimen consisting of about four middle whorls.

**Dimensions.** — Height, 12 mm, width, 6 mm.

**Description.** — Shell medium-sized(?), not very thin-walled, turretlike. The teleoconchal whorls preserved are characteristically rooflike in outline. A sharp carina is developed in their lower part. The base of whorls flattened, its periphery visible on each whorl. Seven almost uniform spiral cords (the cord running along carina is bifurcate) make up the ornamentation of the rooflike part of whorls. The space between the 4th and the 5th cord is somewhat wider and deeper than between the remaining cords. A very thin secondary cord runs in the middle of this space. The projecting part of the base of whorls is ornamented by very delicate cords.

**Remarks.** — The identification of the specimen described is very difficult. The present writer does not know any species to which this shell could be assigned without reservations. Its similarity to a specimen from Steinabrunn, Vienna Basin, described by SIEBER (1958*b*, Pl. 1, Fig. 31) as *T. (Haustator) laevissima subrotundula* SACCO is rather apparent only. In addition, another specimen of this subspecies presented by SIEBER (1958*b*, Pl. 1, Fig. 17) does not display similarity. A similar outline of whorls is also recorded in two species from the Miocene of Aquitaine, that is *T. pseudogradata* COSSMANN & PEYROT (1922, Pl. 1, Figs 11-12) and *T. cestasensis* COSSMANN & PEYROT (1922, Pl. 1, Figs 15-16), but in both of them the carina is situated on whorls considerably higher. A single, rather enigmatic specimen from the Korytnica clays was described by FRIEDBERG (1928, Pl. 48, Fig. 19) as *Turritella korytnicensis* FRIEDBERG. This specimen (for the sake of comparison its new photograph is also shown by the present writer, Pl. XII, Fig. 12) has, in the lower part of whorls, a characteristic, roller-like spiral swelling, separated from the rest of whorl by a deep groove. If we treated the presence of this groove as a pathological character, the outline of whorls in the specimen described by FRIEDBERG would be very similar to that in the specimen described by the present writer. However, this problem is unsolvable in practice. Having at his disposal a single and, in addition, incomplete specimen, the writer has to confine himself to the generic assignment of *Turritella* sp. only. After possibly finding further specimens, the necessity may arise of erecting a new species.

Family MATHILDIDAE COSSMANN, 1912

Genus MATHILDA SEMPER, 1865

**Mathilda clara** BOETTGER, 1901

(Pl. XIII, Fig. 9)

1901. *Mathilda clara* n. sp.; O. BOETTGER, p. 155, No. 481.

1907. *Mathilda clara* BTTGR.; O. BOETTGER, pp. 168-169, No. 584.

1934. *Mathilda clara* BOETTGER; A. ZILCH, p. 217, Pl. 7, Figs 11-12.



**Material.** — Two juvenile specimens.

**Dimensions.** — Height and width, about 0.8 mm.

**Description.** — The two specimens found are shells of very young individuals. They consist of protoconch and a half of the first teleoconchal whorl. Protoconch relatively large, heterostrophic, consisting of two and a quarter convex and smooth whorls coiled along an axis nearly perpendicular to that of teleoconch. The boundary between proto- and teleoconch very sharp and distinct. The surface of teleoconch prominently ornamented by axial and spiral ribs. Halfway the first whorl, the number of axial ribs amounts to ten. Very thin secondary ribs, reaching also onto the base of whorl, are developed between them in the lower part of whorl. Five spiral ribs appear at first and from the very beginning markedly differ from each other in prominence. The uppermost one is fairly robust, another, situated below it, is the thinnest of all, further two almost identical and the strongest and, finally, the lowermost which, like the uppermost, is fairly robust. Delicate, roundish grains are formed at rib intersections. The base of whorl flattened. A single spiral rib runs on its periphery and three very delicate cords occur in the region of umbilicus.

**Remarks.** — Although the two specimens are shells of very young individuals, they may be assigned without any major doubts to the species *Mathilda clara* BOETTGER. They are in a complete conformity with the juvenile part of shells described by BOETTGER (1901, 1907) from Kostej, Rumania and may be considered conspecific with them. *M. clara* differs from the slightly similar species *M. praeclara* BOETTGER (and from a specimen from Czechowice, Silesia, described by KRACH, 1939 as *Fimbriatella filogranata* DOD. var. nova, which, in the present writer's opinion, is conspecific with *M. praeclara*) in more prominent axial ribs and in the presence of two spiral ribs almost equaling each other in thickness in the middle of whorls.

*M. clara* BOETTGER has not so far been known from the Miocene of Poland.

## Family SOLARIIDAE CHENU, 1859

### Genus ARCHITECTONICA BOLTEN, 1798

#### Subgenus ARCHITECTONICA (ARCHITECTONICA)

#### **Architectonica (Architectonica) carocollata (LAMARCK, 1822)**

(Pl. XIII, Figs 3-5)

1856. *Solarium carocollatum* LAM.; M. HÖRNES, pp. 462-463, Pl. 46, Figs 1-2.  
 1919. *Solarium carocollatum* LK.; M. COSSMANN & A. PEYROT, pp. 658-660, Pl. 15, Figs 18-20.  
 1923. *Solarium carocollatum* LAM.; W. FRIEDBERG, pp. 412-413, Pl. 25, Fig. 4.  
 1930. *Solarium carocollatum* LAM.; K. KOWALEWSKI, p. 148.  
 1954. *Solarium carocollatum* LK.; L. STRAUZ, p. 14, Pl. 6, Fig. 138.  
 1960. *Architectonica (Architectonica) carocollata* (LAMARCK); H. J. ANDERSON, pp. 46-47, Pl. 8, Fig. 3.  
 1960. *Architectonica (Architectonica) carocollatum* (LAMARCK); E. KOJUMDGIEVA, p. 92, Pl. 29, Fig. 15.  
 1961. *Architectonica (Architectonica) simplex* BRONN; J. MARINESCU, pp. 531-532, Pl. 5, Fig. 19.  
 1966. *Solarium carocollatum* LAMARCK; L. STRAUZ, p. 115, Pl. 52, Fig. 7.  
 1966. *Solarium simplex sobiense* STRAUZ; L. STRAUZ, pp. 116-117, Pl. 52, Figs 3-4 and 6.  
 1966. *Architectonica carocollata* LAMARCK; T. BÁLDI, p. 78, Pl. 2, Figs 7a b.  
 1972. *Architectonica carocollata* (LAMARCK); F. NORDSIECK, p. 55, Pl. 13, Fig. 30.

**Material.** — Eight specimens.

**Dimensions.** — The largest specimen, without a quarter of the last whorl, is 14.5 mm high and 27.5 mm wide. One of the specimens, preserved incomplete, is at least about 40 mm wide.

**Description.** — Shell large, fairly thick-walled, shaped like a very low cone. Protoconch relatively large, consisting of two and a half smooth whorls, coiled approximately in one plane. Its spire does not project at all above the last protoconchal whorl and its apex is directed opposite to the teleoconchal apex. Thus, only the last protoconchal whorl (Pl. XIII, Fig. 3) is visible on the apex of teleoconch, while the remaining whorls are visible only from the umbilicus. Protoconch very distinctly separated from teleoconch. Teleoconch reaching seven slightly convex whorls. Shell periphery provided with a distinct carina. Shell base strongly flattened. Ornamentation not very prominent, appearing as early as on the boundary with protoconch. Apically, it consists of five, fairly wide and flattened, spiral ribs. On the first two whorls, three ribs, one situated near upper suture and two on periphery, are robuster, on further whorls all of them are nearly uniform, but a groove separating the second from the third rib is always shallower. On early whorls, all ribs are delicate and fairly densely granulated. Granulation is most distinct behind the third whorl and further on, gradually fades out to disappear completely at the end of the fourth or fifth whorl. At the base of shell, close to the peripheral rib, there runs another rib slightly thinner than the last-named one and, in addition, a strongly crenate roller, separated from the smooth rest of base by a fairly deep groove, is situated on the edge of umbilicus. Aperture destroyed in all specimens. Umbilicus wide and very deep, with protoconch visible on its bottom and the crenate roller, mentioned above, completely coiled spirally on its wall.

**Remarks.** — The specimens described are undoubtedly conspecific with those of *Architectonica (Architectonica) carocollata* (LINNAEUS) from the Vienna Basin (HÖRNES, 1856), from Varpalota, Hungary (STRAUSZ, 1954, 1966) and from Aquitaine (COSSMANN & PEYROT, 1919), the conformity with them being complete. One of the incompletely preserved specimens from Korytnica, whose teleoconch reaches seven full whorls is about 40 mm wide and, therefore, it is one of the largest specimens of this species. Another species, *A. (A.) grateloupi* (d'ORBIGNY), very similar to *A. (A.) carocollata* and differing from it only in smooth, not granulated, spiral ribs (COSSMANN & PEYROT, 1919, Pl. 15, Figs 27-28) has been described from the Miocene of Aquitaine. The separate character of this species is not quite obvious. The shells of *A. (A.) carocollata* are somewhat similar to the undoubtedly different species *A. (A.) simplex* (BRONN). This similarity happens to be a cause of confusing (MARINESCU, 1961; STRAUZ, 1966) specimens of these species. The appearance of the last protoconchal whorl visible on the apex of shell (Pl. XIII, Figs 1 and 3) is a character which enables their distinction. It is precisely the structure of protoconch which shows that *A. (A.) simplex sobiense* (STRAUSZ), described from Szob, Hungary, cannot be considered as a subspecies of *A. (A.) simplex*, but that it actually is a juvenile specimen of *A. (A.) carocollata*. A specimen from Szokolya, Hungary, described by BÁLDI (1960) as *A. carocollata* LAM. juv. an n. sp. probably does not belong to the species in question, since its apical and basal ornamentation substantially differ from each other.

*A. (A.) carocollata* (LAMARCK) was already mentioned from the Korytnica clays by KONTKIEWICZ (1882), FRIEDBERG (1923) and KOWALEWSKI (1930). In the Miocene of Poland, this is the only locality of its occurrence.

**Architectonica (Architectonica) simplex (BRONN, 1831)**

(Pl. XIII, Figs 1-2)

1856. *Solarium simplex* BRONN; M. HÖRNES, pp. 463-465, Pl. 46, Fig. 3.  
1892. *Solarium simplex* BRONN; F. SACCO, p. 45, Pl. 1, Fig. 49.  
1919. *Solarium simplex* BRONN; M. COSSMANN & A. PEYROT, pp. 664-666, Pl. 15, Figs 33-38.  
1923. *Solarium simplex* BRONN; W. FRIEDBERG, pp. 413-414, Pl. 25, Fig. 5.  
1949. *Solarium simplex* BRONN; M. GLIBERT, p. 123, Pl. 7, Fig. 6.  
1952. *Solarium simplex* BRONN; M. GLIBERT, p. 29, Pl. 2, Fig. 14.  
1954. *Architectonica simplex* BRONN; I. CSEPREGHY-MEZNERICS, p. 18, Pl. 1, Figs 16-18.  
1960. *Architectonica (Architectonica) simplex* (BRONN); H. J. ANDERSON, pp. 47-48, Pl. 8, Fig. 2.  
1960. *Architectonica (Architectonica) simplex* (BRONN); E. KOJUMDIEVA, pp. 91-92, Pl. 29, Fig. 14.  
1966. *Solarium simplex* BRONN; L. STRAUZ, p. 116, Pl. 51, Fig. 15; Pl. 52, Fig. 1.  
1970. *Architectonica (Architectonica) simplex* (BRONN); E. CAPROTTI, p. 142, Pl. 1, Fig. 11.  
1972. *Architectonica* cf. *simplex* (BRONN); F. NORDSIECK, pp. 55-56, Pl. 13, Fig. 31.

**Material.** — Twenty specimens.

**Dimensions.** — The largest specimen (Pl. XIII, Fig. 2) is 7.5 mm high and 15.2 mm wide.

**Description.** — Shell medium-sized, not very thick-walled, shaped like a very low cone. Protoconch relatively large, ellipsoidal, consisting of two and a half smooth, lustrous and strongly convex whorls. Its spire slightly projects over the last protoconchal whorl and its apex is pointing in opposite direction to that of the teleoconchal apex and, therefore, only the last protoconchal whorl is visible on this apex. The proto-teleoconch boundary is very sharp and distinct. A very distinct carina occurs on periphery. Shell base strongly flattened. Ornamentation scant and not prominent, appearing as early as on the boundary with protoconch. Two rather flat spiral ribs, situated on the periphery of whorls, the outer one, on carina, stronger and the inner thinner and gradually fading out to disappear completely on later whorls, occur on the apical side. In some specimens, one or two narrow and shallow grooves also occur in the early part of teleoconch below the upper suture. On the first two early teleoconchal whorls, the ribs mentioned above are slightly granulated. One more rib runs on shell base close to the peripheral rib and is slightly narrower than it. A fairly deep groove, separating a prominent and strongly crenate roller, situated on the rim of umbilicus, occurs near umbilicus. The surface of base near this roller is radially wrinkled. In juvenile specimens, an additional, thin, spiral rib, usually disappearing at the end of the second whorl, runs through the middle of base (which is convex in such specimens). Aperture destroyed in all specimens. Umbilicus wide and very deep, with protoconch visible on its bottom and the roller, mentioned above, completely coiled spirally on its wall.

**Remarks.** — The specimens here described undoubtedly belong to *Architectonica (Architectonica) simplex* (BRONN), a species fairly common in the Miocene deposits. The shells of this species are fairly similar to those of *A. (A.) carocollata* (LAMARCK), particularly so when they are not yet strongly grown. The differences between these species are expressed in a varying ornamentation (this criterion may, however, turn out, in very young specimens, rather deceptive) and a different appearance of the last protoconchal whorl (Pl. XIII, Figs 1 and 3).

The presence of the shells of *A. (A.) simplex* (BRONN) in the Korytnica clays has not so far been obvious. *A. (A.) carocollata* var. *laevigata* (PUSCH), referred by HÖRNES (1856) to *A. (A.) simplex*, is mentioned from Korytnica by PUSCH (1837, Pl. 10, Fig. 11). FRIEDBERG (1923, p. 413; 1931, p. 301) and KOWALEWSKI (1930, p. 148) considered the occurrence of the species in question at Korytnica as doubtful and they maintained, in fact quite correctly, that

the illustration of PUSCH's specimen is too schematic to serve as a basis for determining its species. In the Miocene of Poland *A. (A.) simplex* was mentioned from Biskupice (ROEMER *vide* FRIEDBERG, 1923), Skoczów (KRACH, 1974) and Benczyn (KRACH, 1950a).

Subgenus **ARCHITECTONICA (PSEUDOTORINIA) SACCO, 1892**

**Architectonica (Pseudotorinia) misera berthae (BOETTGER, 1901)**

(Pl. XIII, Figs 7-8)

1901. *Solarium (Torinia) berthae* n. sp.; O. BOETTGER, p. 115, no. 367.

1934. *Solarium (Pseudotorinia) berthae* (BOETTGER); A. ZILCH, p. 217, Pl. 7, Fig. 15.

1960. *Architectonica (Pseudotorinia) berthae* (BOETTGER in COSSMANN); H. J. ANDERSON, pp. 49-50, Pl. 9, Fig. 1.

1969. *Solarium berthae* BTGR.; I. CSEPREGHY-MEZNERICS, p. 69, Pl. 1, Figs 11 and 14.

**Material.** — Nine specimens.

**Dimensions.** — The largest, but incomplete specimen (Pl. XIII, Fig. 7) is 3.4 mm high and about 7 mm wide.

**Description.** — Shell medium-sized, not very thick-walled, discoid. Protoconch relatively large, consisting of nearly two and a half convex and smooth whorls, the first of which is visible only when looking from umbilicus, while the later one and a half — on the teleoconchal apex. The boundary of protoconch distinct. Teleoconch reaching three and a quarter whorls. On periphery, shell is provided with a prominent carina above which whorls are nearly quite flat. Shell base slightly convex. Ornamentation varied, but not very prominent. On the apical side, it is formed by five or six spiral granulated ribs. Granulation results from intersecting spiral and axial ribs, the latter running slightly obliquely and in conformity with growth lines. Spiral ribs are irregular in thickness. Three of them, the upper one situated close to suture and two peripheral ones, are always thicker than the rest of them. In some specimens, a very thin rib is also developed between the two peripheral ones. Six to seven spiral ribs, usually somewhat wider, but more flattened than the ribs on the apical side, run over the base of shell. The outermost one of them is more prominent than the others. A strongly crenate roller separated from the rest of base by a groove is situated on the rim of umbilicus. Another, similar but slightly thinner and less strongly crenate roller occurs on the wall of umbilicus. Aperture destroyed in all specimens. Umbilicus wide and deep with protoconch visible on its bottom.

**Remarks.** — The specimens described are undoubtedly conspecific with those described as *Architectonica (Pseudotorinia) berthae* (BOETTGER) from Kosteĵ and Lapugy, Rumania (BOETTGER, 1901, 1906; ZILCH, 1934) and from Borsodbóta, Hungary (CSEPREGHY-MEZNERICS, 1969). However, in the present writer's opinion, there is no sufficient basis for considering *A. (P.) berthae* as a separate species, since the differences between it and *A. (P.) misera* (DUJARDIN), occurring in the Miocene of Aquitaine (COSSMANN & PEYROT, 1919, Pl. 15, Figs 62-64) and the Loire Basin (GLIBERT, 1949, Pl. 7, Fig. 7), are very small. They are expressed only in a slightly more flattened (lower) shape of shells in *A. (P.) berthae*. For this reason, the writer believes that it is more correct to regard the specimens from Korytnica and from the above mentioned localities in Rumania and Hungary as a mere subspecies, *A. (P.) misera berthae*.

*A. (P.) misera berthae* (BOETTGER) has not so far been known from the Miocene of Poland.

Subgenus **ARCHITECTONICA (CALODISCULUS) REHDER, 1935****Architectonica (Calodisculus) planulata (GRATELOUP, 1835)**

(Pl. XIII, Fig. 6)

1901. *Solarium (Torinia) marthae* n. sp.; O. BOETTGER, p. 115, No. 366.  
1919. *Solarium (Pseudotorinia) planulatum* GRAT.; M. COSSMANN & A. PEYROT, pp. 679-680, Pl. 15, Figs 57-58, 71-73? and 77?.  
1934. *Solarium (Nipteraxis) marthae* (BOETTGER); A. ZILCH, p. 217, Pl. 7, Fig. 16.  
?1949. *Solarium (Pseudotorinia) planulatum ivolasi* MAYER; M. GLIBERT, pp. 124-125, Pl. 6, Fig. 15; Pl. 7, Fig. 8.  
1960. *Architectonica (Nipteraxis) marthae* (BOETTGER); E. KOJUMDGIEVA, p. 93, Pl. 29, Fig. 17.  
?1960. *Architectonica (Pseudotorinia) planulata* (GRATELOUP); H. J. ANDERSON, pp. 48-49, Pl. 7, Fig. 4.  
1970. *Architectonica (Nipteraxis) cf. marthae* BOETTGER; G. RADO & R. MUTIU, p. 147, Pl. 6, Fig. 22.  
1972. *Architectonica (Pseudotorinia) planulata* (GRATELOUP); F. NORDSIECK, p. 55, Pl. 13, Fig. 28.

**Material.** — Twenty-eight specimens.

**Dimensions.** — The largest specimen (Pl. XIII, Fig. 6) is 1.7 mm high and 4.5 mm wide.

**Description.** — Shell small, not very thick-walled, discoid. Protoconch relatively small, composed of one and two-thirds of smooth and convex whorls, its early part, visible on the apical side of shell, being situated somewhat lower than its terminal part. Teleoconch reaching nearly three whorls bent in outline as the result of two carinae running over them, one on periphery and the other across the middle of base. Apically, shell is nearly quite flat or slightly convex. Ornamentation, prominent and varying, appears as early as on the boundary with protoconch. It is formed by many, granulated, spiral ribs. Their granulation being due to the intersecting of spiral ribs with thin axial cords, running somewhat obliquely. Six (less frequently, five) ribs, three upper ones of which situated close to suture and two peripheral ones are considerably more prominent. On the uppermost rib, grains are larger and are developed on every second or third axial cord. Peripheral ribs (the outermost one of which runs on the peripheral carina) are separated by a fairly deep groove. Six to seven (including three to four between carinae) almost uniform, also granulated ribs, of which slightly more strongly developed is only that on the carina, run over shell base. A strongly crenate roller, spiny on edge and separated from the rest of base by a fairly deep groove, is also developed on the rim of umbilicus. Aperture nearly quite round, provided with a short and shallow trough occurring in the part corresponding to the spiny roller. Umbilicus wide and deep, with protoconch visible on its bottom.

**Remarks.** — The specimens here assigned are undoubtedly conspecific with those described under the name *Architectonica marthae* (BOETTGER) from Kostež and Lapugy, Rumania (BOETTGER, 1901; ZILCH, 1934) and Opansko Bardo, Bulgaria (KOJUMDGIEVA, 1960). It seems, however, that separating this species is unjustified as it does not display any substantial differences as compared with the previously erected species *A. planulata* (GRATELOUP) known from, among other localities, the Miocene of Aquitaine (COSSMANN & PEYROT, 1919). For this reason, the name given by BOETTGER is considered by the present author as a younger synonym. On the other hand, the species under study does not include specimens from Szob, Hungary (CSEPREGHY-MEZNERICS, 1956; STRAUZ, 1966) described as *A. marthae*, since they differ from the specimens from both Kostež and Korytnica in a quite dissimilar outline of shell. *A. ivolasi* MAYER, 1900, a species described from the Loire Basin, is supposed to differ from *A. planulata* in details of its ornamentation and larger dimensions. GLIBERT (1949) believed

that these differences were not sufficient for erecting a separate species and, recognizing them to be only subspecific characters, identified the specimens from the Loire Basin as *A. planulata ivolasi*. However, even such a view may arouse doubts, especially as a certain variability in ornamentation were observed. Some of the specimens from Korytnica do not differ in sculpture from that from Pontlevoy, the Loire Basin, presented by GLIBERT (1949). Putting a question mark by the present writer in the synonymy has been induced only by the fact that the teleoconch of some specimens from the Loire Basin reached a larger number of whorls (by about one whorl).

Also controversial is the problem of the generic and subgeneric assignment of the species in question. COSSMANN (1915) assigned *A. marthae* to the subgenus *A. (Nipteraxis)* COSSMANN, 1915 and *A. planulata* (COSSMANN & PEYROT, 1919) to the subgenus *A. (Pseudotorinia)* SACCO, 1892. In the present writer's opinion, neither the specimens from Kostej and Opansko Bardo, not those from Korytnica conform with the diagnosis of *A. (Nipteraxis)* and they considerably differ from the type species *A. (N.) plicata* (LAMARCK). The writer also believes that the specimens from Aquitaine and the Loire Basin do not comply with the diagnosis of the subgenus *A. (Pseudotorinia)*. On the other hand, all of them are completely conformable with the diagnosis of the subgenus *Pseudomalaxis (Calodisculus)* REHDER, 1935 and are very similar to the type species *P. (C.) retifera* (DALL) known from the Upper Pliocene of Florida (WENZ, 1939, p. 669, Text-fig. 1,900). We may only doubt if this subgenus should be included within the genus *Pseudomalaxis* FISCHER, 1885, since in many respects it is more similar to the representatives of the genus *Architectonica* BOLTEN, 1798.

*A. (Calodisculus) planulata* (GRATELOUP) has not so far been known from the Miocene of Poland.

## Family VERMETIDAE d'ORBIGNY, 1840

### Genus PETALOCOCHUS H. & C. LEA, 1843

#### **Petalocochus intortus** (LAMARCK, 1818)

(Pl. XIV, Figs 8-10)

1856. *Vermetus intortus* LAM.; M. HÖRNES, pp. 484-485, Pl. 46, Fig. 16.  
 1896. *Petalocochus intortus* (Lk.); F. SACCO, pp. 7-10, Pl. 1, Figs 12-20.  
 1912. *Vermetus (Petalocochus) intortus* Lk.; S. CERULLI-IRELLI, p. (341), Pl. (44), Figs 80-84.  
 1914. *Vermetus intortus* LAM.; W. FRIEDBERG, pp. 323-325, Pl. 19, Figs 11-12.  
 1922. *Vermetus (Petalocochus) intortus* LAMARCK; M. COSSMANN & A. PEYROT, pp. 73-75, Pl. 3, Figs 16-17.  
 1922. *Vermetus (Petalocochus) intortus* Lk. var. *taurinensis* SACCO; M. COSSMANN & A. PEYROT, p. 75, Pl. 3, Fig. 27, Fig. 26?  
 1930. *Vermetus intortus* LAM.; K. KOWALEWSKI, pp. 146-147.  
 1949. *Vermetus (Petalocochus) intortus woodi* MÄRCH; M. GLIBERT, pp. 125-126, Pl. 7, Fig. 9.  
 1955b. *Vermetus (Petalocochus) intortus* LAMARCK, G. MOISESCU, p. 132, Pl. 11, Fig. 11.  
 1960. *Vermetus (Petalocochus) intortus* (LAMARCK); E. KOJUMDIEVA, pp. 116-117, Pl. 32, Fig. 14; Pl. 33, Fig. 2.  
 1961. *Vermetus intortus* LAM.; N. FLOREI, p. 684, Pl. 7, Fig. 53.  
 1966. *Vermetus intortus* LAMARCK; L. STRAUZ, p. 121, Pl. 77, Fig. 21.  
 1967. *Vermetus intortus* LAM.; M. BIELECKA, p. 140, Pl. 2, Fig. 3.  
 1968. *Petalocochus intortus woodi* MORCH; J. STANCU & E. ANDREESCU, p. 462, Pl. 3, Fig. 30.  
 1970. *Vermetus (Petalocochus) intortus* (LAMARCK); W. BAŁUK, p. 117, Pl. 11, Figs 3-4.  
 1970. *Petalocochus (Petalocochus) intortus* (Lk.); E. CAPROTTI, pp. 143-144, Pl. 1, Figs 6-7.

**Material.** — Several hundred fragments of an irregularly tangled tube.

**Dimensions.** — The largest tube diameter, about 6 mm.

**Description.** — Shell medium-sized, not very thick-walled, shaped like an irregularly tangled tube. Protoconch consisting of about three convex, smooth whorls, regularly coiled spirally (Pl. XIV, Fig. 10) and very clearly distinguishable from teleoconch. The surface of teleoconch ornamented by several (even to eight) longitudinal ribs, irregular in thickness and by transverse wrinkles. The occurrence of longitudinal lists, unequally developed in various specimens (comp. Remarks) is frequently observed inside the tube. In some of them (always those having a relatively small diameter of tube), the lists grow from the lower, "columellar", part of tube and are parallel to each other. The left list (a spatial orientation as in the case of pelecypods' valves) is narrower, the right thickened at its free end and bent towards the left (Pl. XIV, Fig. 9). In some others, (always those with a relatively large diameter of tube), they grow radially (Pl. XIV, Fig. 8b) from the lateral parts of tube, the left of them also being slightly narrower and sharper on edge. One more, usually considerably narrower list, only slightly projecting over the surface of tube (but very distinct), on edge sharp, smooth or provided with fine spines, runs nearly in the middle between the two list described above. Aperture broken off in all specimens.

**Remarks.** — Considering the size, manner of coiling and ornamentation, the identification of the specimens described might seem not to pose any problems. Similar specimens, fairly common in many localities of the Miocene deposits, have always been referred by the investigators to the species *Petalococonchus intortus* (LAMARCK). The structure of the internal elements of shell, that has not been paid much attention to before, arouses, however, certain doubts if such a procedure is quite correct. Specimens with parallel lists may unquestionably be referred to *P. intortus*, but the assignment to this species of specimens having two radially running lists, with another one, very thin, situated between them is rather doubtful. For, such a development of lists is, according to WENZ (1939, p. 674, Text-fig. 1924), characteristic of the species *Vermetus adansoni* DAUDIN, 1800. It is not unlikely, therefore, that the specimens described as *P. intortus* (= *Vermetus intortus* in earlier authors) include two, different species. Such a hypothesis might induce WENZ (1939) to determine the stratigraphic range of the genus *Vermetus sensu stricto* as "Pliozän (? auch älter) — Rezent". On the other hand, we cannot completely preclude the possibility of a change in the appearance of the lists in the process of ontogenetic development. The present writer did not succeed in finding in the material available of a specimen which would allow him to investigate such a change. To solve this problem it is necessary to study shells coming from various localities and, in addition, these should be both fossil and Recent specimens. Since the material from Korytnica does not entitle the writer to make any definite statements on this subject, he leaves this problem open, confining himself only to the question mark put with the specimens having radially arranged lists.

*P. intortus* (LAMARCK) was mentioned from Korytnica by KOWALEWSKI (1930) and FRIEDBERG (1938). This very common species occurs in the Miocene of Poland in the following localities: Gaszowice (KRACH, 1939), Małoszów (KRACH, 1947), Gartowice (KRACH, 1967), Chmielnik and Dwikozy (FRIEDBERG, 1938), Rybnica (KOWALEWSKI, 1950), Nawodzice (BAŁUK & RADWAŃSKI, 1968), Łychów, Węglin and Węglinek (KRACH, 1962b; BIELECKA, 1967), environs of Huta Lubycka and Huta Stara (NEY, 1963), Benczyn (KRACH, 1950a), Wieliczka (REUSS, 1867; FRIEDBERG, 1933, 1938), Bogucice (LISZKA, 1933; FRIEDBERG, 1938), Brzeźnica (KRACH, 1960), Niskowa (BAŁUK, 1970) and Babica (FRIEDBERG, 1938).

Genus **LEMINTINA** RISSO, 1826**Lemintina arenaria** (LINNAEUS, 1766)

(Pl. XIV, Figs 12-15)

1856. *Vermetus arenarius* LINN.; M. HÖRNES, pp. 483-484, Pl. 46, Fig. 15.  
 1896. *Lemintina arenaria* (L.) et var.; F. SACCO, pp. 10-13, Pl. 1, Figs 21-29.  
 1912. *Vermetus (Lemintina) arenarius* L.; S. CERULLI-IRELLI, pp. (343-344), Pl. (45), Figs 11-19.  
 1922. *Vermetus arenarius* LINNÉ et var.; M. COSSMANN & A. PEYROT, pp. 81-84, Pl. 3, Figs 1-2, 12, 15, 18-20.  
 1930. *Vermetus arenarius* L.; K. KOWALEWSKI, p. 147.  
 1938. *Vermetus arenarius* L.; W. FRIEDBERG, p. 88, Text-fig. 24.  
 1949. *Vermetus (Serpulorbis) arenarius* LINNÉ; M. GLIBERT, pp. 126-128, Pl. 8, Fig. 1.  
 1954. *Vermetus (Lemintina) arenarius taurogranosa* SACCO; I. CSEPREGHY-MEZNERICS, pp. 18-19, Pl. 1, Figs 26 and 30.  
 1955b. *Vermetus (Serpulorbis) arenarius* LINNAEUS; G. MOISESCU, pp. 131-132, Pl. 11, Fig. 13.  
 1960. *Vermetus (Serpulorbis) arenarius* (LINNAEUS); E. KOJUMDIEVA, p. 117, Pl. 33, Figs 1-2.  
 1966. *Vermetus arenarius* LINNÉ; L. STRAUZ, p. 120, Pl. 77, Fig. 22.  
 1968. *Lemintina arenaria perpustulata* SACCO; J. STANCU & E. ANDREESCU, p. 462, Pl. 3, Fig. 29.  
 1969. *Vermetus (Serpulorbis) arenaria* (LINNÉ); M. A. ATANACKOVIĆ, pp. 199-200, Pl. 9, Figs 11-12.  
 1970. *Lemintina (Lemintina) arenaria* (LINNEO); E. CAPROTTI, p. 144, Pl. 1, Fig. 8.  
 1971b. *Vermetus (Serpulorbis) arenarius* LINNÉ; M. EREMIJA, p. 36, Pl. 10, Fig. 3.

**Material.** — Twenty fragments of an irregularly tangled tube.

**Dimensions.** — The largest tangle is 60×46×35 mm, with a maximum tube diameter of 13 mm.

**Description.** — Shell large, fairly thick-walled, in the form of an irregularly coiled tangle of tube. Protoconch, preserved in two specimens only (Pl. XIV, Figs 12-13), consists of one, regularly coiled, smooth and convex whorl. Teleconch formed by an irregularly tangled tube several dozen centimeters long. Its surface is ornamented by many longitudinal ribs varying in prominence from delicate to fairly thick and frequently covered with elongate, slightly spiny and rather regularly distributed tubercles. Thinner, closely-spaced, longitudinal and usually delicately granulated cords occur between these ribs. Growth lines sharp, making the surface coarse and rough. A trace of a not very deep, V-shaped notch is marked in the trace of growth lines on the edge of aperture. Aperture destroyed in all specimens.

**Remarks.** — The assignment of the Korytnica specimens to the species *L. arenaria* (LINNAEUS) is unquestionable. A considerable variability in the particulars of ornamentation, observed in them, gives evidence that the differences in the development of ribs cannot provide a basis for separating subspecies.

*L. arenaria* (LINNAEUS) has previously been mentioned from Korytnica by KONTKIEWICZ (1882), KOWALEWSKI (1930) and FRIEDBERG (1938). In the Miocene of Poland, this species is also known from Benczyn (KRACH, 1950a) and the environs of Huta Lubycka and Huta Stara (NEY, 1963).

**Lemintina sexcarinata** (BOETTGER, 1901)

(Pl. XIV, Fig. 11)

1901. *Vermetus sexcarinatus* n. sp.; O. BOETTGER, p. 157, no. 486.  
 1934. *Vermetus sexcarinatus* BOETTGER; A. ZILCH, p. 219, Pl. 7, Fig. 24.



**Material.** — One fragmentary tube.

**Dimensions.** — Length, 14.5 mm, width, 3.2 mm, internal diameter, 1.5 mm.

**Description.** — Shell not very thick-walled, the fragment found has the form of a slightly bent tube. Ornamentation relatively prominent, but rather irregular, consisting of easily distinguishable six longitudinal, slightly twisted (like a screw-thread) ribs and transverse wrinkles running conformably to growth lines. A trace of a slit-like notch is marked in the trace of these lines on the edge of aperture. Some areas of the surface are devoid of ornamentation — these are the traces of fusing with the substrate. No shelly elements occur inside the tube.

**Remarks.** — The identification of the specimen described is not quite certain. It is fairly similar to *L. sexcarinata* (BOETTGER) a species described from Kostej, also on the basis of a single specimen only. It is, however, marked by a less regular ribbing and smaller dimensions than the holotype species (ZILCH, 1934). Despite this fact, the writer believes that the two specimens are conspecific. It is beyond any doubt that the specimen described above is a gastropod shell, as indicated by the microstructure of the shell (SCHMIDT, 1955). The necessity of assigning it to the genus *Lemintina* is also indicated by the type of its ornamentation, the lack of internal shelly elements and the trace of a slitlike notch on the edge of aperture, quite similar to that observed on the shells of *L. arenaria*.

*L. sexcarinata* (BOETTGER) has not so far been known from the Miocene of Poland. Outside Korytnica, this species occurs only at Kostej, Rumania.

#### Genus VERMICULARIA LAMARCK 1799

##### *Vermicularia milleti* (DESHAYES, 1839)

(Pl. XIV, Figs 6-7)

1856. *Vermetus carinatus* HÖRN.; M. HÖRNES, p. 486, Pl. 46, Fig. 17.

1901. *Turritella* cf. *terebralis* LMK.; O. BOETTGER, p. 153, no. 471.

1907. *Vermetus (Vermicularia) pseudoturritella* n. sp.; O. BOETTGER, p. 171, no. 591.

1922. *Vermicularia Milleti* (DESHAYES); M. COSSMANN & A. PEYROT, pp. 86-87, Pl. 3, Figs 14 and 32.

1934. *Vermetus (Vermicularia) pseudoturritella* BOETTGER; A. ZILCH, p. 220, Pl. 7, Fig. 25.

1949. *Vermetus (Vermicularia) milleti* DESHAYES; M. GLIBERT, p. 128, Pl. 7, Fig. 10.

1966. *Vermetus (Vermicularia) milleti pseudoturritella* BOETTGER; L. STRAUZ, p. 121, Pl. 3, Figs 22-23.

**Material.** — Twenty, mostly juvenile specimens.

**Dimensions.** — The largest specimen (Pl. XIV, Fig. 7) is about 20 mm high and 12.3 mm wide.

**Description.** — Shell medium-sized, fairly thick-walled, shaped like a rather irregularly coiled turret. Protoconch (incomplete in all specimens) consisting of about three smooth and convex whorls, very indistinctly separated from the rest of shell. The younger part of teleoconch (about six to eight whorls) is coiled in a regularly turretlike manner along one axis (Pl. XIV, Fig. 6). The adult part of teleoconch, that is, about three whorls in the most grown up specimen (Pl. XIV, Fig. 7), is coiled irregularly. The ornamentation of early whorls consists of three prominent, spiral ribs with fairly sharp ridges. The earliest to appear is the middle one, immediately followed, however, by the remaining two. The lowest rib runs near lower suture, which slightly conceals its presence and it is best visible each time on the last whorl of the young shell. On later whorls, ornamentation is subject to modification. The upper rib disappears

completely, the middle develops very strongly taking the shape of a prominent keel and the lower, not changing its position, in some places comes into view distinctly and in some others becomes hidden completely as the result of a less regular coiling of shell. The surface of later whorls is slightly wrinkled and, in addition, covered with closely-spaced, threadlike, spiral cords. Aperture destroyed in all specimens.

**Remarks.** — In monographs of Miocene gastropods, quite similar shells are assigned to three different species. Specimens from Steinabrunn, Vienna Basin were described by HÖRNES (1856) as *Vermetus carinatus* HÖRNES. Shells from Kosteĵ, Rumania were identified by BOETTGER (1907) and ZILCH (1934) as *Vermetus pseudoturritella* BOETTGER. Specimens from Aquitaine and the Loire Basin were assigned by COSSMANN & PEYROT (1922) and GLIBERT (1949) to *Vermetus milleti* DESHAYES. In the present writer's opinion, there is no sufficient basis for erecting three separate species. Although HÖRNES (1856) emphasizes (to which attention has already been called by STRAUZ, 1966) that the specimens from Steinabrunn have only one, robust rib (corresponding to the middle one of the specimens from Korytnica) and, apart from it, only spiral cords, but — in view of the conformity of the remaining characters and the disappearance of the upper rib observed — this seems to be a character of minor importance, giving evidence only of the range of variability. As a matter of fact, according to HÖRNES (1856), *V. carinata* also includes specimens from Lapugy, Rumania, and from the Touraine area (the Loire Basin), that is, from the regions from which both *V. milleti* and *V. pseudoturritella* were described. The present writer believes the Korytnica specimens to be conspecific with all the specimens mentioned above and treats the names *V. carinata* and *V. pseudoturritella* as younger synonyms of *V. milleti*.

*V. milleti* (DESHAYES) has not so far been known from the Miocene of Poland.

### Genus TENAGODUS GUETTARD, 1770

#### Subgenus TENAGODUS (TENAGODUS)

#### *Tenagodus (Tenagodus) anguinus miocaenicus* COSSMANN & PEYROT, 1922

(Pl. XIV, Fig. 16)

1856. *Siliquaria anguina* LINN.; M. HÖRNES, pp. 487-488, Pl. 46, Fig. 18.

1896. *Tenagodes anguinus* (L.) et var.; F. SACCO, p. 17, Pl. 2, Figs 14-18.

1922. *Tenagodes anguinus* LINNÉ, mut. *miocaenicus* nov. mut.; M. COSSMANN & A. PEYROT, pp. 88-90, Pl. 3, Fig. 23.

1949. *Tenagodus anguinus miocaenicus* COSSMANN & PEYROT; M. GLIBERT, pp. 128-129, Pl. 7, Fig. 11.

1960. *Tenagodus (Tenagodus) anguinus* var. *miocaenica* COSSMANN & PEYROT; E. KOJUMDĠIEVA, p. 118, Pl. 33, Fig. 3.

1968. *Tenagodes (Tenagodes) anguineus miocenicus* COSSMANN & PEYROT; L. HINCULOV, p. 135, Pl. 32, Figs 9-14.

**Material.** — One juvenile specimen.

**Dimensions.** — Height, about 2 mm, width, about 3 mm.

**Description.** — Shell small, fairly thick-walled, shaped like a rather irregularly coiled cone, conspicuously tierlike in outline. Protoconch not preserved. Teleoconch consisting of nearly three whorls. Whorls rounded in outline, except for their upper part, which is flattened and sloping in a tierlike manner towards the axis of colling. Surface nearly quite smooth, with only fairly sharp growth lines, locally resembling thin and closely-spaced wrinkles, observed on it. The trace of anal slit indistinct, marked only in the trace of growth lines. No groove-like depression observed. Aperture damaged.

**Remarks.** — Although the only specimen coming from the Korytnica clays is incomplete and was probably a juvenile individual, its assignment to *Tenagodus (T.) anguinus miocaenicus* COSSMANN & PEYROT does not arouse any major doubts. This specimen is particularly conformable with young specimens presented by SACCO (1896, Pl. 2, Figs 14*d* and another 14*d*) and which also lack a distinct groove. It also does not differ from apical part of specimens from Saucats, Aquitaine (COSSMANN & PEYROT, 1922, Pl. 3, Fig. 23) and from Pontlevoy, the Loire Basin (GLIBERT, 1949, Pl. 7, Fig. 11*b*), although in the two cases the trace of the onal slit is considerably more distinct.

*T. (T.) anguinus miocaenicus* COSSMANN & PEYROT has not so far been known from the Miocene of Poland.

## Family CAECIDAE GRAY, 1847

### Genus CAECUM FLEMING, 1817

#### Subgenus CAECUM (CAECUM)

#### *Caecum (Caecum) trachea* (MONTAGU, 1803)

(Pl. XIV, Figs 2-3)

1856. *Caecum trachea* MONT.; M. HÖRNES, p. 490, Pl. 46, Fig. 19.  
 1896. *Caecum trachea* MTG.; F. SACCO, p. 3, Pl. 1, Fig. 1.  
 1914. *Caecum trachea* MONT.; W. FRIEDBERG, pp. 351-352, Pl. 20, Figs 16-17.  
 1930. *Caecum trachea* MONT.; K. KOWALEWSKI, p. 147.  
 ?1959. *Caecum trachea* MONT.; P. M. STEVANOVIĆ & V. M. MILOSEVIĆ, p. 95, Pl. 3, Fig. 7.  
 1966. *Caecum trachea* MONTAGU; L. STRAUZ, p. 123, Pl. 77, Fig. 23, Text-fig. 59*a*.  
 1968. *Caecum trachea* MONT.; J. STANCU & E. ANDREESCU, p. 462, Pl. 3, Fig. 36.  
 1970. *Caecum trachea* MONTAGU; W. BALUK, p. 116, Pl. 10, Fig. 1.  
 1970. *Caecum (Caecum) trachea* (MONTAGU); A. GRECO, p. 285, Pl. 6, Fig. 12.

**Material.** — Forty specimens.

**Dimensions.** — The largest specimen, measured along a straight line, is 3.0 mm long and at the aperture 0.7 mm and at the posterior end of shell 0.5 mm in diameter.

**Description.** — Shell small, not very thick-walled, shaped like a slightly bent tube. Protoconch spirally coiled, not preserved in adult specimens, as it falls still at the animal's lifetime, along with the early part of teleoconch. The rejection of the older part takes place several times (successively). Teleoconch in the form of an arcuate tube, in younger specimens bent more, with its diameter increasing quicker than in the adults. A transverse septum, completely sealing up the tube, is developed each time in the posterior part of shell after the falling-off of the early teleoconchal part. Externally, the septum is provided with a small spiny process situated nearer the peripheral side of shell. Outer surface ornamented by not very prominent and rather irregularly distributed annular swellings, usually developed more strongly in the posterior part of shell, while the anterior one is most frequently quite smooth. In juvenile specimens, very delicate, longitudinal striae are visible in interannular spaces. Aperture round, on the edge thin, but not very sharp. Close behind the edge, the shell is slightly swollen with a distinct ring formed here sometimes.

**Remarks.** — The assignment of the specimens described to *Caecum (Caecum) trachea* (MONTAGU) seems to be beyond any doubt. Their ornamentation is, however, less prominent and more distinct in the early part, that is, somewhat differently developed than in a Recent specimen presented by WENZ (1939). However, considerable differences in the development of shell ornamentation are observed among Miocene specimens coming from various localities, which is indicative of a considerable variability of this species. The present writer considers the specimens from Korytnica as conspecific with all those mentioned in the synonymy, although certain doubts may arise in regard to specimens from Bresnica, Yugoslavia (STEVANOVIĆ, & MILOSEVIĆ 1959), having smooth shells.

*C. (C.) trachea* (MONTAGU) was mentioned from Korytnica by KOWALEWSKI (1930). In the Miocene of Poland, this species is also known from Gliwice Stare (KRACH, 1954), Wieliczka (FRIEDBERG, 1933, 1938), Brzeźnica (KRACH, 1960), and Niskowa (BAŁUK, 1970).

#### Subgenus CAECUM (BROCHINA) GRAY, 1857

#### *Caecum (Brochina) glabrum* (MONTAGU, 1803)

(Pl. XIV, Figs 4-5)

1896. *Brochina glabra* (MTG.); F. SACCO, p. 3, Pl. 1, Fig. 2.  
 1912. *Caecum glabrum* MTG.; S. CERULLI-IRELLI, pp. (354-355), Pl. (46), Figs 28-29.  
 1938. *Caecum* cf. *glabrum* MONT.; W. FRIEDBERG, p. 87, Text-fig. 23.  
 1949. *Caecum glabrum* MONTAGU; M. GLIBERT, p. 130, Pl. 8, Fig. 2.  
 1950b. *Caecum glabrum* MONT.; W. KRACH, p. 305, Pl. 2, Fig. 15.  
 1970. *Caecum (Brochina) glabrum* (MONTAGU); A. GRECO, p. 285, Pl. 6, Fig. 17.

**Material.** — Two hundred and twenty specimens.

**Dimensions.** — The largest specimen, measured along a straight line, is 2.4 mm long, while its diameter amounts to 0.55 mm at the aperture and to 0.4 mm at the posterior end of shell.

**Description.** — Shell small, not very thick-walled, in the form of an arcuate tube. Protoconch consisting of one and a half whorls coiled in nearly the same plane and of a short sector of a bent tube. Boundary with the rest of shell fairly distinct. In adult specimens protoconch is not preserved, since it falls off, together with the early part of teleoconch, still at the animal's life time (detached protoconches or very young shells with protoconches are met with in the Korytnica clays). The rejection of the early part takes place several times (successively). Teleoconch is shaped like an arcuate tube, in young specimens more strongly bent and with its diameter more rapidly increasing than in the adults. An externally convex septum develops posteriorly on the shell after the rejection of the early part. Shell surface smooth, with only growth lines visible on it. Aperture smooth, more or less oblique to the axis of tube, on the edge fairly sharp and with an annular swelling slightly developed in adult specimens close behind the edge.

**Remarks.** — No major differences are found when we compare the specimens from Korytnica with the shells of *Caecum (Brochina) glabrum* (MONTAGU), described from other localities. The Korytnica specimens reach, however, relatively large dimensions, as they are nearly twice as large as those from the Loire Basin (GLIBERT, 1949, Pl. 8, Fig. 2). They very distinctly differ from the somewhat similar species *C. (B.) banoni* BENOIST in a different development of septum.

*C. (B.) glabrum* (MONTAGU) was mentioned from Korytnica by FRIEDBERG (1938). In the Miocene of Poland, this species also occurs at Trzydnik (KRACH, 1950b) and Wieliczka (FRIEDBERG, 1938).

Genus **PARASTROPHIA** FOLIN (*in* FOLIN & PERIER), 1869**Parastrophia radwanskii** sp. n.

(Pl. XIV, Fig. 1)

*Holotype*: Pl. XIV, Fig. 1 (Z.PAL.U.W., No BkK-G 224).*Type horizon*: Lower Tortonian (= Lower Badenian).*Type locality*: Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.*Derivation of the name*: in honour of Docent ANDRZEJ RADWAŃSKI.

**Diagnosis.** — Shell in the form of a tube, coiled like a sector of a strongly stretched spiral, ornamented by delicate annular swellings. Aperture oblique to the axis of tube.

**Material.** — Four specimens.

**Dimensions.** — The largest specimen (Pl. XIV, Fig. 1) is 2.5 mm long (measured along a straight line from apex to aperture) and 0.5 mm in diameter at the aperture.

**Description.** — Shell small, thin-walled, even slightly transparent, in the form of a tube coiled like a sector of a strongly stretched spiral, with an apex curled like a crozier. Protoconch consisting of one whorl, coiled nearly in the same plane and perhaps also including an early, almost completely smooth sector (about a quarter of an entire shell) of a slightly coiled tube. In all specimens, this sector is very distinctly separated from the rest of shell. Outer surface of teleoconch ornamented by very delicate, closely-spaced annular swellings. Aperture round, with a thin and sharp edge, and markedly oblique to the axis of tube. In one of the specimens, tube is slightly extended close to aperture.

**Remarks.** — The assignment of the shells, described above, to the genus *Parastrophia* FOLIN does not arouse doubts, since they accurately correspond to its diagnosis (see WENZ, 1939). They differ from the slightly similar shells of subgenus *Caecum* (*Pseudoparastrophia*) DISTASO, 1905, in larger dimensions, disposition of protoconch (FOLIN, 1877), coiling of tube and an oblique aperture. The genus *Parastrophia* has not so far been known (WENZ, 1939) in fossil state. Its representatives live now in warm seas. *P. radwanskii* sp. n. differs from *P. challengeri* (FOLIN) in a less coiled shell and delicately ornamented surface.

## Family THIARIDAE

Genus **MELANOPSIS** FÉRUSAC, 1807**Melanopsis aquensis** GRATELOUP, 1838

(Pl. XIII, Fig. 10)

1856. *Melanopsis Aquensis* GRAT.; M. HÖRNES, pp. 597-598, Pl. 49, Fig. 11.1919. *Melanopsis aquensis* GRAT.; M. COSSMANN & A. PEYROT, pp. 690-692, Pl. 17, Figs 75-76.1969. *Melanopsis aquensis* GRAT.; I. CSEPREGHY-MEZNERICS, p. 70, Pl. 1, Fig. 29.

**Material.** — Three specimens.

**Dimensions.** — The largest specimen is about 26 mm high and 12.2 mm wide.

**Description.** — Shell large, fairly thin-walled, conical-oviform. Protoconch not preserved. Teleoconch reaching about six whorls (the specimen illustrated is preserved in the form of three later whorls), the last of them considerably larger than the spire. Whorls slightly convex or nearly flat. A slight, rounded edge, above which the whorl is somewhat concave, is developed in one of the specimens in the upper part of the last whorl. A shallow, groovelike depression runs in the uppermost part of whorls just below suture. Shell surface quite smooth, with only growth lines running over it. Aperture, slightly damaged in all specimens, is oval, strongly elongate, somewhat oblique and with a distinct siphonal furrow in the anterior part. Outer lip very thin and sharp, smooth inside. Inner lip considerably thicker, forming posteriorly a large and strongly swollen labial area. Traces of coloration in the form of yellow spots or elongate streaks are preserved on shells.

**Remarks.** — The assignment of the specimens described above is difficult, since they considerably differ from each other in shape. On the assumption that their differences in shape is a symptom of variability, the present writer has assigned the three specimens to *Melanopsis aquensis* GRATELOUP. He also believes that the specimens from Korytnica are conspecific with those from Grund in the Vienna Basin (HÖRNES, 1856), from Borsodbóta, Hungary (CSEPREGHY-MEZNERICS, 1969) and from Aquitaine (COSSMANN & PEYROT, 1919). Two of the Korytnica specimens are particularly similar to those of *M. aquensis* from Borsodbóta, Hungary and from Dax (Mandillot) in Aquitaine, although the smaller of them also slightly resembles in shape *M. subbuccinoides* d'ORBIGNY (see COSSMANN & PEYROT, 1919, Pl. 15, Figs 56-87) and, in the traces of coloration, *M. olivula* GRATELOUP (see COSSMANN & PEYROT, 1919, Pl. 16, Figs 85-87). Characteristically, the two last-named species occur together with *M. aquensis* in the same localities, including Dax (Mandillot). This may be indicative of a considerable variability of *M. aquensis* and, if such would be the case, the distinction of three separate species would not be sufficiently justified. However, the solution of this problem on the basis of the scarce material from Korytnica is impossible. The third of the Korytnica specimens is most similar to *M. aquensis* from Grund in the Vienna Basin. Gastropods of the genus *Melanopsis* live in fresh waters (WENZ, 1939, p. 690). The presence of the shells of *M. aquensis* in the marine fauna assemblage at Grund was explained by HÖRNES (1856) as the result of their being driven by currents from some desalted nearshore reservoirs or rivers emptying into the sea.

*M. aquensis* GRATELOUP has not so far been known from the Miocene of Poland.

## Family MODULIDAE FISCHER, 1885

### Genus MODULUS GRAY, 1840

#### *Modulus basteroti* BENOIST, 1873

(Pl. XV, Fig. 1)

1896. *Modulus Basteroti* (BEN.) et var.; F. SACCO, p. 4, Pl. 1, Figs 2-4.  
 1922. *Modulus Basteroti* BENOIST; M. COSSMANN & A. PEYROT, pp. 319-321, Pl. 5, Figs 6-10.  
 1928. *Modulus Basteroti* BEN.; W. FRIEDBERG, p. 603, Pl. 38, Figs 17-18.  
 1960. *Modulus basteroti* BENOIST; E. KOJUMDGIEVA, p. 111, Pl. 32, Figs 1-2.  
 1961. *Gibbula (Gibbula) buchi* DUB.; N. FLOREI, p. 681, Pl. 6, Figs 38-39 (sic!).  
 1966. *Modulus basteroti* BENOIST; L. STRAUSZ, pp. 126-127, Pl. 53, Fig. 14-15.

**Material.** — One young specimen.

**Dimensions.** — Height, about 5 mm, width, about 4.5 mm.

**Description.** — Shell small, not very thick-walled, conical. Protoconch not preserved. Teleoconch reaching slightly more than four whorls. Peripherally, whorls are provided with a prominent carina, with a fairly thick spiral rib running along it. Another, similar rib runs somewhat below carina. Whorls are coiled so that the two ribs are visible on all of them. Above carina, whorls are flat, rooflike. Shell base slightly convex. In addition, to the ribs mentioned above, the ornamentation of the rooflike part of shell is made up of four delicate, spiral cords, between which smaller, secondary ribs are developed on the fourth whorl. Besides, beginning with the third whorl, not very prominent, but fairly wide and low axial ribs are formed on the rooflike part. Shell base ornamented by six spiral ribs, irregular in thickness. Aperture destroyed.

**Remarks.** — Although the shell found in the Korytnica clays belongs to juvenile specimen and, moreover, it is slightly damaged, its assignment to the species *Modulus basteroti* BENOIST is beyond argument. This specimen resembles to the greatest extent the young part of a specimen from the Miocene of Urovene, Bulgaria (KOJUMDIEVA, 1960, Pl. 32, Fig. 2).

*M. basteroti* BENOIST has not so far been known from the Miocene of Poland. FRIEDBERG (1928a) described this species from Zborów, Podolia.

## Family POTAMIDIDAE

Genus **PIRENELLA** GRAY, 1847

**Pirenella moravica** (HÖRNES, 1856)

(Pl. XV, Figs 9-15)

1856. *Cerithium Moravicum* HÖRN.; M. HÖRNES, pp. 402-403, Pl. 42, Fig. 7.  
 ?1910. *Potamides (Pirenella) inconstans* BASTEROT, var. *deminuta* nova; L. VIGNAL, pp. 176-177, Pl. 9, Fig. 35.  
 ?1922. *Pirenella inconstans deminuta* (VIGNAL); M. COSSMANN & A. PEYROT, p. 272, Pl. 6, Figs 6-7.  
 1937. *Pirenella moravica* HÖRNES; R. SIEBER, p. 483, Pl. 24, Figs B1, 2, Pl. 25, Fig. E1 (?).  
 1954. *Potamides (Pirenella) bicinctus* BR.; L. STRAUZ, p. 17, Pl. 2, Fig. 26.  
 1966. *Potamides (Pirenella) moravicus* HÖRNES; L. STRAUZ, pp. 147-148, Pl. 7, Figs 23-29, Pl. 8, Figs 5, 10-11, Pl. 10, Figs 9-10.  
 1966. *Potamides (Pirenella) moravicus variabilis* FRIEDB.; L. STRAUZ, p. 149, Pl. 7, Figs 30-35.  
 1966. *Potamides (Pirenella) moravicus pseudonympha* STRAUZ; L. STRAUZ, p. 150, Pl. 8, Fig. 12-14.  
 1966. *Pirenella moravica* (HÖRNES); J. KÓKAY, p. 41, Pl. 4, Fig. 6.

**Material.** — Fifty specimens.

**Dimensions.** — The largest specimen, preserved without early whorls and with a damaged aperture (Pl. XV, Fig. 10) is 20 mm high and 7 mm wide.

**Description.** — Shell medium-sized, not very thin-walled, shaped like a slender turret. Protoconch (preserved in one specimen only) consists of about two smooth and convex whorls, without a distinct boundary with the rest of shell. Teleoconch reaching about 12 to 13 whorls. A single spiral cord runs at the very bottom of two first whorls. Two further cords are developed on the third whorl and afterwards, not far away, one secondary cord appears each between the main ones (less frequently, a secondary cord is also visible under the lower main one and, rather exceptionally, tertiary cords also appear). On two to three early whorls, the cords men-

tioned above are quite smooth in all specimens. In some specimens, they remain smooth on further six to eight whorls and, in some others, more or less prominent tubercles, situated one above another, are formed on the upper two cardinal cords. On later whorls, such tubercles occur in all specimens on all the three cardinal cords (the lower one being sometimes hidden). The number of tubercles on the last whorl varies from 14 to 17. In addition, other four tuberculate cords (the lower two of them considerably less strongly developed), with very thin secondary cords running between them, occur on the rounded base of shell. Aperture oval (in all specimens, more or less damaged), anteriorly extended to form a short, slightly bent siphonal furrow and posteriorly with both lips converging at a very acute angle. Both lips thin, varix lacking. In many specimens, tubercles are orange-colored.

**Remarks.** — The variability, observed among here assigned specimens, is relatively extensive. It is expressed in a more or less slender shape of shell, varying prominence of spiral cords, presence or absence of tertiary cords and various moments of the appearance of tubercles. Despite these differences all the specimens here discussed should be assigned to one and the same species, since specimens displaying transitional characters occur between them. Separating specimens with conspicuously tuberculate cords on the early whorls from those having cords devoid of tubercles would make up a very artificial division. The specimens from the Korytnica clays presented above are undoubtedly conspecific with those of *P. moravica* (HÖRNES), described from the environs of Znojno, Moravia (HÖRNES, 1856, Pl. 42, Fig. 7). This species is also relatively abundantly represented in the Miocene of Varpalota, Hungary (STRAUSZ, 1954, 1966). Judging by the specimens, illustrated by STRAUZ (1966), the range of variability of the Varpalota specimens is similar or even yet more extensive. However, separating several subspecies is undoubtedly groundless, since even STRAUZ himself (1966, Pl. 7, Figs 28-29, Pl. 8, Figs 5 and 10-11) presents specimens with transitional characters and calls them transitional forms between the nominal subspecies and three other subspecies. After PAPP (1952), STRAUZ (1966) calls one of them *P. variabilis* FRIEDBERG, which is incorrect, since the specimens, described by FRIEDBERG (1914) as *P. variabilis*, are different and cannot be considered as a subspecies of *P. moravica* HÖRNES. A similar, if not identical, species, *P. inconstans* (BASTEROT), also marked by a considerable variability, is known from the Miocene of Aquitaine. Specimens identified as *P. inconstans deminuta* (VIGNAL) are particularly similar (see COSSMANN & PEYROT, 1922, Pl. 6, Figs 6-7) to those from Korytnica.

*P. moravica* (HÖRNES) has not so far been known from the Miocene of Poland.

### ***Pirenella tabulata* (HÖRNES, 1856)**

(Pl. XV, Figs 5-6)

1856. *Melanopsis tabulata* HÖRN.; M. HÖRNES, pp. 600-601, Pl. 49, Fig. 15.

1914. *Potamides variabilis* FRIEDB.; W. FRIEDBERG, pp. 282-283, Pl. 17, Figs 27-28.

1930. *Potamides* aff. *variabilis* FRIEDB.; K. KOWALEWSKI, p. 141.

?1952. *Pirenella moravica variabilis* (FRIEDBERG); A. PAPP, pp. 113-114, Pl. 3, Figs 2/11-17.

**Material.** — Eight specimens.

**Dimensions.** — The largest specimen preserved without early whorls, is 27 mm high and 11.5 mm wide.



**Description.** — Shell medium-sized, fairly thick-walled, shaped like a slender turret, sometimes steplike in outline. Protoconch and earlier teleoconchal whorls not preserved in any of the specimens. In the two specimens illustrated, teleoconch consists of five and a half whorls. Whorls nearly quite flat, the last one slightly convex. Shell surface ornamented by not very prominent spiral cords, each of them provided with closely-spaced, not very conspicuous tubercles quadrangular in outline. Two of such cords occur on early whorls, with the third one, at first very thin, developed later between them. Three or four tuberculate cords (the fourth developed at the bottom of whorl) run over the last but one whorl and eight to ten on the last whorl, the upper six of them being stronger than the rest. Thin, threadlike, smooth secondary cords occur between some of the cardinal ones. The tubercles of particular cords are arranged in axial, slightly bent (conformably to growth lines) rows. Aperture oval, slightly oblique, anteriorly having a short and narrow notch for the inhalant siphon. Both lips thin, the outer one sharp on edge. Varix lacking. A yellow-orange coloration of tubercles preserved in all specimens.

**Remarks.** — In the present writer's opinion, the specimens from Korytnica described above should be considered conspecific with those of two so far differently called species, that is, *Melanopsis tabulata* HÖRNES (1856, Pl. 49, Fig. 15) and *Potamides variabilis* FRIEDBERG (1914, Pl. 17, Figs 27-28). It seems to be beyond any doubt that specimens described by HÖRNES (1856) from Grund, Vienna Basin, and by FRIEDBERG (1914) from Małoszów belong to one and the same species. Under such circumstances, the specific name used by HÖRNES has a priority as an earlier one. The assignment of this species to the genus *Melanopsis* seems, however, to the present writer to be incomprehensible, the more so that no explanation in this respect is offered by HÖRNES (1856). The specimens in question resemble in size, shape, type of ornamentation and appearance of aperture the representatives of the family Potamididae (which was quite obvious to FRIEDBERG, 1914 in regard to the specimens from Małoszów) and, therefore, the present writer assigns them to the genus *Pirenella* GRAY. PAPP'S (1952) and STRAUZ'S (1966) view that *P. variabilis* FRIEDBERG is supposedly a subspecies of *P. moravica* HÖRNES seems to be unacceptable.

*P. tabulata* HÖRNES was mentioned from Korytnica by KOWALEWSKI (1930) under the name *Potamides* aff. *variabilis*. In the Miocene of Poland, this species occurs at Małoszów (FRIEDBERG, 1914, 1938; KOWALEWSKI, 1930; KRACH, 1947).

### ***Pirenella picta mitralis* (EICHWALD, 1850)**

(Pl. XV, Fig. 8)

1853. *Cerithium mitrale* n.; E. EICHWALD, pp. 153-154, Pl. 7, Fig. 10.  
 1856. *Cerithium pictum* BAST.; M. HÖRNES, pp. 394-395, Pl. 41, Figs 15-16.  
 1914. *Potamides mitralis* EICHW.; W. FRIEDBERG, pp. 271-275, Pl. 17, Figs 1-7.  
 ?1937. *Pirenella picta* DEFR. var. *mitralis* EICHW.; R. SIEBER, pp. 485-486, Pl. 24, Figs C5, 6.  
 1950. *Potamides mitralis* EICHWALD; I. CSEPREGHY-MEZNERICS, pp. 26-27, Pl. 1, Fig. 10.  
 1954. *Potamides (Pirenella) mitralis* EICHWALD; L. STRAUZ, p. 17, Pl. 2, Fig. 25.  
 1955b. *Potamides (Pirenella) mitralis* EICHW.; G. MOISESCU, pp. 120-121, Pl. 10, Fig. 8.  
 1954. *Pirenella mitralis* (EICHWALD); J. ŠVAGROVSKY, pp. 14-18, Pl. 1, Figs 38-43, 50-51.  
 1959. *Potamides mitralis* (EICHW.); P. M. STEVANOVIĆ & V. M. MILOSEVIĆ, p. 94, Pl. 3, Fig. 5.  
 1966. *Potamides (Pirenella) pictus mitralis* EICHWALD; L. STRAUZ, pp. 145-146, Pl. 8, Figs 16-18.  
 1968. *Pirenella picta mitralis* (EICHWALD); L. HINCULOV, p. 124, Pl. 28, Figs 23-24.

1970. *Potamides (Pirenella) pictus mitralis* (EICHWALD); W. BAŁUK, p. 117, Pl. 10, Fig. 6.  
 1971a. *Pirenella picta mitralis* (EICHWALD); M. EREMIJA, p. 68, Pl. 7, Fig. 14.  
 1973. *Pirenella picta mitralis* (EICHWALD); M. BOHN-HAVAS, p. 1045, Pl. 3, Figs 20-21.

**Material.** — Ten specimens.

**Dimensions.** — The largest specimen is 10.5 mm high and 4.5 mm wide.

**Description.** — Shell medium-sized, not very thin-walled, turretlike. Protoconch not preserved in any of the specimens. Teleoconch reaching about eight whorls. Three very thin spiral cords form the ornamentation of the earliest whorls. On further whorl, roundish tubercles (11 to 13 of them on the last whorl) are developed on the uppermost cord. The middle and the lower cords are less strongly developed, narrower and less prominent, but varying in particular specimens. Only small swellings, somewhat stronger on the lower cord, are marked on them. In some specimens, the spaces between cords are ornamented by delicate spiral grooves. Shell base rounded, with two smooth spiral cords running on its periphery, the rest of base being covered with spiral grooves. Aperture oval, slightly oblique, with a fairly wide siphonal furrow situated anteriorly. Both lips rather thin, meeting posteriorly at a very acute angle, the outer one sharp on edge. Varix lacking. Coloration preserved in all specimens in the form of orange-colored spots on tubercles and cord swellings.

**Remarks.** — The subspecies *P. picta mitralis* (EICHWALD), which undoubtedly includes the shells described above, is frequently met with in the Miocene deposits. It is particularly typical of brackish deposits. The Korytnica may probably did not provide exactly the best conditions for its development and this may explain the fact that its shells, found in the Korytnica clays, are relatively small, nearly by half smaller than those of the specimens from other localities.

*P. picta mitralis* (EICHWALD) has not so far been known from Korytnica. In the Miocene of Poland, it was recorded in many localities, including Przeciszów (KRACH, 1963), Gartatowice (KRACH, 1967), Szydłów, Chmielnik and Dwikozy (FRIEDBERG, 1914, 1938), Rybnica (KOWALEWSKI, 1950), Nawodzice (BAŁUK & RADWAŃSKI, 1968), Łychów, Zdziechowice, Węglinek and Kraśnik (KRACH, 1962b; BIELECKA, 1967), environs of Józefów and Modliborzyce (AREŃ, 1962), Bogucice (LISZKA, 1933; FRIEDBERG, 1938) and Niskowa (FRIEDBERG, 1914, 1938; SKOCZYLAŚÓWNA, 1930; BAŁUK, 1970).

### *Pirenella gamlitzensis* (HILBER, 1879)

(Pl. XV, Fig. 7)

1879. *Cerithium gamlitzense* HILBER; V. HILBER, pp. 437-438, Pl. 4, Figs 2-3.  
 1952. *Pirenella gamlitzensis gamlitzensis* (HILBER); A. PAPP, pp. 114-115, Pl. 3, Figs 1/1-5.  
 1954. *Potamides (Pirenella) gamlitzensis* HILB.; L. STRAUZ, p. 17, Pl. 2, Fig. 27.  
 1966. *Potamides (Pirenella) gamlitzensis* HILBER; L. STRAUZ, pp. 153-154, Pl. 7, Figs 43-46; Pl. 8, Figs 1-4.  
 1968. *Pirenella gamlitzensis gamlitzensis* (HILBER); L. HINCULOV, p. 125-126, Pl. 29, Figs 11-12.

**Material.** — Twelve specimens.

**Dimensions.** — The largest specimen (Pl. XV, Fig. 7) is 9.5 mm high and 3.7 mm wide.

**Description.** — Shell medium-sized, not very thin-walled, shaped like a conical turret. Protoconch not preserved in any of the specimens. Teleoconch reaching about nine whorls.

The earliest of the whorls preserved (the last protoconchal whorl?) is smooth, the further two having first two and then three thin, spiral cords running on them. The upper and middle cord strongly developed on further whorls, the middle one either develops only very slightly or disappears. In addition, nine to eleven fairly thin axial ribs, which intersecting cords, form fine tubercles, occur on early whorls. Following the disappearance of the middle cord on later whorls, the axial ribs, usually lose their continuous character. The roundish tubercles continue to develop and, since their number is not subject to change (mostly nine per whorl), they are large if not very conspicuous. Shell base rounded, with two or three spiral cords varying in width running on it. Aperture oval, slightly oblique, anteriorly provided with a fairly wide but short siphonal furrow. Both lips thin, the outer one fairly sharp on edge. Varix lacking.

**Remarks.** — Since the writer has at his disposal relatively few and mostly incomplete specimens, varying in shape and ornamentation, their specific assignment is not quite certain. Of fairly numerous similar forms, the most similar seem to be the specimens of *P. gamlitzensis* (HILBER), described by STRAUZ (1966, Pl. 7, Figs 43-46) from Varpalota, Hungary.

*P. gamlitzensis* (HILBER) has not so far been known from the Miocene of Poland.

### Genus **TEREBRALIA** SWAINSON, 1840

#### **Terebralia bidentata** (DEFRANCE *in* GRATELOUP, 1840)

(Pl. XV, Figs 16-17)

1853. *Cerithium lignitarum* m.; E. EICHWALD, p. 146, Pl. 7, Fig. 20.  
 1856. *Cerithium lignitarum* EICHW.; M. HÖRNES, pp. 398-399, Pl. 42, Figs 1-3.  
 1895. *Cerithium lignitarum* EICHWALD; V. J. PROCHÁZKA, pp. 81-82, Text-fig. 15.  
 1899. *Clava bidentata* (DEFRANCE) GRATELOUP; G. DOLLFUS & PH. DAUTZENBERG, pp. 199-201, Pl. 9, Figs 1-2.  
 1914. *Terebralia bidentata* DEFR.; W. FRIEDBERG, pp. 295-299, Pl. 18, Figs 5-7, Text-fig. 65.  
 1922. *Terebralia bidentata* (DEFRANCE *in* GRATELOUP); M. COSSMANN & A. PEYROT, pp. 262-264, Pl. 6, Figs 4-5.  
 1922. *Terebralia bidentata* (DEF.) var. aff. *margaritacea* SACCO; M. COSSMANN & A. PEYROT, pp. 264-265, Pl. 5, Fig. 56.  
 1928a. *Terebralia bidentata* DEFR.; W. FRIEDBERG, pp. 600-601, Text-fig. 86a.  
 1936b. *Terebralia bidentata* DEFR. (GRAT.); W. FRIEDBERG, pp. 469-479, Pl. 22, Figs 1-8.  
 1949. *Terebralia bidentata* DEFRANCE; M. GLIBERT, p. 139, Pl. 9, Fig. 5.  
 1950. *Terebralia bidentata* (DEFR. *in* GRAT.) *margaritifera* SACCO; I. CSEPREGHY-MEZNERICS, pp. 29-30, Pl. 1, Fig. 17.  
 1954. *Terebralia bidentata* GRAT.; L. STRAUZ, p. 16, Pl. 1, Fig. 21; Pl. 3, Fig. 21.  
 1959. *Terebralia bidentata* (DEFR.); P. M. STEVANOVIC & V. M. MILOŠEVIC, p. 95, Pl. 3, Fig. 6.  
 1960. *Terebralia (Terebralia) bidentata* var. *lignitarum* (EICHWALD); E. KOJUMDŽIEVA, p. 109, Pl. 31, Fig. 22.  
 ?1966. *Potamides (Terebralia) bidentatus margaritifera* SACCO; L. STRAUZ, pp. 160-161, Pl. 6, Figs 10-14; Pl. 10, Figs 12-13.  
 1968. *Terebralia bidentata bidentata* (DEFRANCE *in* GRATELOUP); L. HINCULOV, pp. 127-128, Pl. 30, Figs 10-11.  
 ?1968. *Terebralia lignitarum lignitarum* (EICHWALD); L. HINCULOV, p. 128, Pl. 30, Figs 12-13.  
 1970. *Terebralia bidentata* (DEFRANCE); W. BALUK, p. 117, Pl. 10, Figs 2-3.  
 1971. *Terebralia bidentata bidentata* DEFR.; J. STANCU, M. D. GHEORGIAN & A. POPESCU, p. 125, Pl. 8, Fig. 11.  
 1973. *Terebralia bidentata margaritifera* SACCO; M. BOHN-HAVAS, p. 1044.

**Material.** — Eight specimens.

**Dimensions.** — The largest specimen preserved without early whorls and aperture (Pl. XV, Fig. 17), is 60 mm high and 23 mm wide.

**Description.** — Shell large, thick-walled, shaped like a not very slender, slightly fusiform turret. Protoconch, early whorls and a half of the last whorl not preserved in any of the

specimens. The teleoconch of the largest shell consists of about nine very slightly convex whorls. The last whorl devoid of carina; shell base rounded. Surface ornamentation prominent, formed by many, somewhat arcuate, axial and four or five spiral ribs. The latter, running across axial ribs, form on the prominent, slightly flattened tubercles square or rectangular in outline. The lowermost spiral rib is visible not on all whorls, sometimes being hidden by an underlying (next) whorl. Grooves between spiral ribs are fairly deep but somewhat narrower than these ribs. The number of axial ribs fluctuates within limits of 18 and 23 per whorl. Some of them, usually two or three per whorl, are stronger, that is, considerably wider and somewhat more prominent. They form varices. On the last whorl, in addition to the five spiral ribs mentioned above, there also occur nine to ten other ones, the upper five of them stronger and tuberculate and the rest considerably thinner and smooth. Aperture destroyed in all specimens. Two, usually bifid, tuberculate "teeth" are developed on the inner surface of whorls under varix. Two spiral folds, locally, more prominent, with a troughlike depression marked between them, run on columella.

**Remarks.** — It is beyond any doubt that the specimens from Korytnica are conspecific with those from Grund and Baden in the Vienna Basin, presented by HÖRNES (1856, Pl. 42, Figs 1-3), who described them under the name *T. lignitarum* (EICHWALD) considering this name as a synonym of *T. bidentata* (DEFRANCE). Since, however, EICHWALD described and illustrated his specimens as late as 1853, DEFRANCE's name as used earlier (1840) has a priority. In later years, after the publication of a work by DOLLFUS & DAUTZENBERG (1899), the view became predominant that *T. bidentata* and *T. lignitarum* were separate species. And despite the fact that FRIEDBERG (1936*b*), who also several times changes his mind (FRIEDBERG, 1909, 1914, 1928*a*, 1936*b*), proved the correctness of HÖRNES's (1856) view, there is still a considerable confusion in regard to the name of the species under study. Exceptional in this respect is the nomenclature used by HINCULOV (1968). This authoress includes the holotype of *T. lignitarum* (EICHWALD, 1853, Pl. 7, Fig. 20) in *T. bidentata bidentata* (which, in the present writer's opinion, is correct). This, however, does not prevent her from distinguishing separate taxons, *T. lignitarum lignitarum* EICHWALD, 1853 and *T. bidentata lignitarum* EICHWALD, 1830 (sic!). In the case of the last-named taxon, she gives a different date of introducing the name, but she means only an earlier work of EICHWALD, in which this name was used without description.

Following SACCO (1895) the Hungarian authors (CSEPREGHY-MEZNERICS, 1950, 1954, 1956; STRAUZ, 1954, 1966; BOHN-HAVAS, 1973) separate, as *T. bidentata margaritifera* SACCO, specimens which are more dumpy and have five to seven spiral ribs. STRAUZ (1966) includes in this subspecies only one of the specimens presented by HÖRNES (1956, Pl. 43, Fig. 1) and, of Polish specimens, only one from Korytnica (FRIEDBERG, 1928*a*, Text-fig. 86*a*), whereas the specimen from Niskowa (FRIEDBERG, 1914, Pl. 18, Fig. 5) belongs, in his opinion, to *T. bidentata bidentata*. The present writer, having at this disposal specimens from both Korytnica and Niskowa, has found that the differences between them are rather small and that separating them would be pronouncedly artificial. In his opinion, the Hungarian specimens from Varpalota (STRAUZ, 1966, Pl. 6, Figs 10-14, Pl. 10, Figs 12-13) could in fact be separated, but then they could not be considered consubspecific with the specimens from either Vienna Basin or Poland. More pertinent, however, seems to regard the differences observed as a symptom of variability. *T. bidentata* is a fairly variable species which occurs in both brackish and marine deposits. Specimens found in the company of those typical of normal salinity are usually more dumpy.

*T. bidentata* (DEFRANCE) was mentioned from the Korytnica clays by FRIEDBERG (1914, 1928*a*, 1936*b*, 1938) and KOWALEWSKI (1930). In the Miocene of Poland, this species also occurs at Gaszowice and Libiąż (KRACH, 1939), Przeciszów (KRACH, 1963), Małoszów (FRIEDBERG,

1938; KRACH, 1947), Gartatowice (KRACH, 1967), Rybnica (KOWALEWSKI, 1930, 1950; FRIEDBERG, 1938), Nawodzice (BALUK & RADWAŃSKI, 1968), Bogucice (LISZKA, 1933), Zgłobice (FRIEDBERG, 1938) and Niskowa (FRIEDBERG, 1914, 1938; SKOCZYŁASÓWNA, 1930; BALUK, 1970).

***Terebralia duboisi* (HÖRNES, 1856)**

(Pl. XV, Fig. 4)

1856. *Cerithium Duboisi* HÖRN.; M. HÖRNES, pp. 399-400, Pl. 42, Figs 4-5.  
 1899. *Tympanotomus lignitarum* EICHWALD; G. DOLLFUS & PH. DAUTZENBERG, pp. 201-202, Pl. 9, Figs 3-4.  
 1901. *Tympanotomus Duboisi* M. HOERN.; R. HOERNES, p. 322, Pl. 1, Fig. 7.  
 1907. *Tympanotomus Duboisi* M. HÖRN. (?); W. FRIEDBERG, p. 12, Pl. 1, Fig. 4.  
 1914. *Terebralia Duboisi* HOERN.; W. FRIEDBERG, pp. 299-301, Pl. 18, Fig. 8.  
 1922. *Terebralia lignitarum* (EICHWALD); M. COSSMANN & A. PEYROT, pp. 265-267, Pl. 7, Figs 10-11.  
 1928a. *Terebralia lignitarum* EICHW.; W. FRIEDBERG, pp. 601-602, Text-fig. 86b.  
 1930. *Terebralia lignitarum* EICHW.; K. KOWALEWSKI, p. 141.  
 1937. *Terebralia lignitarum* (EICHW.); R. SIEBER, pp. 488-489.  
 1938. *Terebralia Duboisi* HOERN.; W. FRIEDBERG, p. 103.  
 1949. *Terebralia lignitarum* EICHWALD; M. GLIBERT, pp. 140-141, Pl. 9, Fig. 7.  
 1950. *Terebralia lignitarum* (EICHWALD); I. CSEPREGHY-MEZNERICS, pp. 28-29, Pl. 1, Fig. 18.  
 1954. *Terebralia lignitarum* (EICHWALD); J. ŠVAGROVSKÝ, pp. 24-28, Pl. 3, Figs 3-21.  
 1968. *Terebralia bidentata lignitarum* (EICHWALD); L. HINCULOV, pp. 128-129, Pl. 30, Fig. 14.  
 1973. *Terebralia lignitarum* (EICHWALD), M. BOHN-HAVAS, p. 1044, Pl. 4, Fig. 5.

**Material.** — A specimen preserving about eight middle whorls.

**Dimensions.** — Height, 27 mm, width, 10.5 mm.

**Description.** — Shell large (?), not very thick-walled, shaped like a slender turret. Protoconch and earlier teleoconchal whorls not preserved. Teleoconchal whorls nearly flat, the last of them devoid of carina, but its base is slightly flattened. Ornamentation consisting of many (20 to 22), somewhat arcuate, axial and four spiral ribs. The latter, intersecting axial ribs, form on them slightly flattened tubercles square in outline. Axial ribs nearly uniform in width, except for one situated on the last whorl which is twice as wide and makes up a varix. On the last whorl, six other, much narrower ribs run below the four spiral ribs mentioned above. The uppermost one of them, distinctly tuberculate, is partly visible also on previous whorls. Aperture destroyed; a small, tuberculate "tooth" occurs under varix; columella smooth, without folds.

**Remarks.** — The specimen described, although somewhat similar to the shells of *T. bidentata*, markedly differs from them in a considerably slenderer, turrtlike shape, thinner axial ribs, the presence of one varix only, with one "tooth" only occurring under it, and, finally, in a smooth columella. This is probably a not fully grown-up individual, but it is in such a complete conformity with the younger part of a specimen from Grund, Vienna Basin (HÖRNES, 1856, Pl. 42, Fig. 4) that its assignment to *T. duboisi* HÖRNES is beyond any doubt. Later on, many authors (including FRIEDBERG, 1928a, pp. 601-602) described analogous shells as *T. lignitarum* EICHWALD, as they assumed that *T. lignitarum* and *T. bidentata* were separate species. As, however, shown later by FRIEDBERG (1936b), the two names (considered already by HÖRNES, 1856, as synonyms) concern one and the same species and, therefore, the name *T. duboisi* has to be restored for the specimen from Grund.

*T. duboisi* (HÖRNES) was mentioned from Korytnica by KONTKIEWICZ (1882), FRIEDBERG

(1907, 1928*a*, 1938) and KOWALEWSKI (1930). This species is also known from Przeciszów (KRACH, 1963) and, according to KOWALEWSKI (1930, 1950) it also occurs at Rybnica, but it is not unlikely that the last-named mention concerns *T. bidentata*.

## Family DIASTOMIDAE COSSMANN, 1895

### Genus SANDBERGERIA BOSQUET, 1860

#### *Sandbergeria perpusilla* (GRATELOUP, 1838)

(Pl. XV, Fig. 2)

1856. *Chemnitzia perpusilla* GRAT.; M. HÖRNES, p. 540, Pl. 43, Fig. 19. *partim*.  
 1895. *Sandbergeria perpusilla* GRAT. et var.; F. SACCO, p. 76, Pl. 2, Figs 125-128.  
 1901. *Sandbergeria perpusilla* (GRAT.); O. BOETTGER, p. 134, no. 414.  
 1901. *Sandbergeria cylindrata* n. sp.; O. BOETTGER, p. 134, no. 416.  
 1914. *Sandbergeria perpusilla* GRAT.; W. FRIEDBERG, pp. 319-320, Pl. 19, Fig. 6.  
 ?1914. *Sandbergeria striatula* EICHW.; W. FRIEDBERG, p. 322, Pl. 19, Fig. 10.  
 1922. *Sandbergeria perpusilla* GRATELOUP; M. COSSMANN & A. PEYROT, pp. 315-317, Pl. 6, Figs 21-24; Pl. 7, Figs 81-82.  
 1934. *Sandbergeria cylindrata* BOETTGER; A. ZILCH, p. 227, Pl. 9, Fig. 64.  
 1949. *Sandbergeria perpusilla* GRATELOUP; M. GLIBERT, pp. 131-132, Pl. 9, Figs 1*a, b*.  
 1956. *Sandbergeria perpusilla* (GRAT.); I. CSEPREGHY-MEZNERICS, p. 387, Pl. 1, Figs 36-39.  
 1960. *Sandbergeria perpusilla* GRATELOUP; J. ŠVAGROVSKÝ, p. 89, Pl. 8, Figs 10-11.  
 1964. *Sandbergeria perpusilla* (GRAT.); J. ŠVAGROVSKÝ, p. 80, Pl. 16, Fig. 8.  
 1966. *Sandbergeria perpusilla* GRATELOUP; L. STRAUZ, p. 173, Pl. 4, Figs 7-8.  
 1970. *Sandbergeria spirialissima* (DUB.); G. RADO & R. MUTIU, p. 148, Pl. 5, Figs 8 and 20.  
 ?1970. *Sandbergeria cylindrata* BOETTGER; G. RADO & R. MUTIU, p. 148, Pl. 5, Figs 14 and 19.  
 1970. *Sandbergeria perpusilla* (GRATELOUP); W. BAŁUK, p. 117, Pl. 9, Fig. 7.

**Material.** — A hundred and fifty specimens.

**Dimensions.** — The largest specimen is 4.3 mm high and 1.5 mm wide.

**Description.** — Shell small, fairly thin-walled, shaped like a slender, somewhat cylindrical turret. Protoconch consisting of about two smooth and convex whorls, not very distinctly separated from the rest of shell. Teleoconch reaching seven convex whorls, separated from each other by fairly deep sutures. The last whorl rounded at the base, devoid of carina. Ornamentation consisting of not very prominent axial and spiral ribs. The latter appear just behind the protoconchal boundary two in number, followed by two more, slightly less robust, developed one each above the upper and below the lower of the former two. All these ribs gradually extend and, at the same time, become flatter, so that the spaces between them contract and take the form of narrow and shallow grooves. On the third or fourth teleoconchal whorl, a groove dividing in two each of both early ribs, by now already considerably flattened, is developed in their middle. The later whorls are usually provided with five or six spiral grooves. Less frequently, due to the appearance of accessory grooves, their number may slightly increase. Five to seven more grooves run at the base of shell. In addition, fairly narrow axial ribs, most prominent on middle whorls, occur on the shell. Their number mostly amounts to 20 to 25 on the early and to 24 to 28 on the later whorls. Aperture oval, posteriorly very slightly contracted. Outer lip thin, inside smooth. Inner also thin slightly turned onto the columella. Umbilicus lacking.

**Remarks.** — *Sandbergeria perpusilla* (GRATELOUP), to which the present writer assigns the specimens described above, is a species common in the Miocene deposits. It is marked by a considerable variability and prominence of ornamentation. COSSMANN & PEYROT (1922) expressed the view that distinguishing separate species or subspecies on the basis of differences in the characters mentioned above is groundless. In this connection, the fact that these authors did not recognize the conspecificity of the specimens of *S. cylindrata* BOETTGER from Kostej and Lapugy, Rumania and of those of *S. perpusilla*, seems to be an inconsistency. In the present writer's opinion, the differences between *S. cylindrata* and *S. perpusilla* are insignificant and, therefore, they should not be separated. Likewise, poorly founded seems to be the distinction of *S. striatula* EICHWALD as a separate species.

*S. perpusilla* (GRATELOUP) has not so far been known from the Korytnica clays. The occurrence of this species in the Miocene of Poland was found at Gliwice Stare (KRACH, 1954), Małoszów (KRACH, 1947), Rybnica (KOWALEWSKI, 1950), Mniszek (KRACH, 1962*b*), Bogucice (LISZKA, 1933; FRIEDBERG, 1938), Brzeźnica (KRACH, 1960) and Niskowa (SKOCZYLAŚOWNA, 1930; BAŁUK, 1970).

### *Sandbergeria spiralissima* (DUBOIS, 1831)

(Pl. XV, Fig. 3)

1831. *Melania spiralissima* nov.; F. DUBOIS DE MONTPEREUX, p. 46, Pl. 3, Figs 30-31.  
 1901. *Sandbergeria densesulcata* n. sp.; O. BOETTGER, p. 134, no. 415.  
 1914. *Sandbergeria spiralissima* (DUB.); W. FRIEDBERG, pp. 320-321, Pl. 19, Figs 7-8.  
 1934. *Sandbergeria densesulcata* BOETTGER; A. ZILCH, p. 226, Pl. 9, Fig. 63.  
 1954. *Sandbergeria spiralissima* DUBOIS; I. CSEPREGHY-MEZNERICS, pp. 20-21, Pl. 1, Fig. 19.  
 1960. *Sandbergeria spiralissima* (DUBOIS); E. KOJUMGDIEVA, p. 111, Pl. 31, Fig. 21.  
 1966. *Sandbergeria spiralissima* DUBOIS; L. STRAUZ, pp. 173-174, Pl. 4, Fig. 9.  
 1966. *Sandbergeria spiralissima* DUBOIS; J. KÓKAY, p. 43, Pl. 4, Figs 11-12.  
 1970. *Sandbergeria spiralissima* (DUBOIS); W. BAŁUK, p. 117, Pl. 9, Fig. 8.

**Material** — Twenty-four specimens.

**Dimensions.** — The largest specimen is 4.5 mm high and 2.0 mm wide.

**Description.** — Shell small, not very thin-walled, turretlike. Protoconch consisting of slightly more than two convex and smooth whorls, its boundary with teleoconch being distinct in some specimens only. Teleoconch reaching seven fairly strongly convex whorls separated from each other by deep sutures. The last whorl rounded at the base, devoid of carina. On early teleoconchal whorls, ornamentation is made up of spiral ribs. Two of them appear at first, followed subsequently by two more, somewhat less prominent ones which occur one above the upper, and the other below the lower. The ribs gradually extend and, at the same time, flatten so that the intercostal spaces take the form of narrow and shallow grooves. Beginning with the third or fourth whorl, a secondary groove dividing a rib in two, appears in the middle of each rib. On further whorls, the ribs become once again divided in a similar manner. As a result, 14 to 16 nearly identical grooves run on later whorls. Ten to twelve similar grooves are also developed at the base of shell. In addition to the spiral sculpture, beginning with the fourth whorl, there also occur not very prominent axial ribs, usually more robust in the upper parts of whorls and not reaching the lower suture. On earlier whorls, their number varies within limits of 19 and 25 and on later whorls of 25 and 35. Aperture oval, posteriorly slightly contracted. Both lips thin, the inner one anteriorly slightly turned onto columella. Umbilicus lacking.

**Remarks.** — The specimens described are probably conspecific with both *Sandbergeria spiralissima* (DUBOIS) and *S. densesulcata* BOETTGER. In the present writer's opinion the latter, described from Kosteĵ, Lapugy and Bujtur, Rumania (BOETTGER, 1901; ZILCH, 1934) should be, therefore, considered as a younger synonym. *S. spiralissima* differs from *S. perpusilla* in a somewhat less slender shape, more closely-spaced and more numerous axial ribs and spiral grooves. The writer is not, however, quite sure if these differences represent a sufficient basis for distinguishing two separate species. Perhaps, it would be more proper to treat them as subspecific characters.

*S. spiralissima* (DUBOIS) was mentioned from Korytnica by FRIEDBERG (1938). In the Miocene of Poland, it also occurs at Libiąż (KRACH, 1939), Wieliczka (FRIEDBERG, 1933, 1938), Bogucice (LISZKA, 1933; FRIEDBERG, 1938) and Niskowa (BAŁUK, 1970).

## Family LITIOPIDAE

Genus **ALABA** H. & A. ADAMS, 1862

***Alaba costellata anomala*** (EICHWALD, 1850)

(Pl. XVI, Figs 1-4)

1853. *Rissoa anomala* m.; E. EICHWALD, pp. 271-272, Pl. 10, Fig. 14.  
 1856. *Rissoa costellata* GRAT.; M. HÖRNES, pp. 575-576, Pl. 48, Fig. 21.  
 1901. *Alaba costellata* (GRAT.); O. BOETTGER, p. 147, no. 453.  
 1901. *Alaba paucivaricosa* n. sp.; O. BOETTGER, p. 148, no. 454.  
 1907. *Rissoina costellata* GRAT.; W. FRIEDBERG, pp. 16-17, Text-fig. 3.  
 1923. *Alaba costellata* GRAT. var. *anomala* EICHW.; W. FRIEDBERG, pp. 362-363, Pl. 21, Figs 5-6.  
 1934. *Alaba (Gibborissoa) paucivaricosa* (BOETTGER); A. ZILCH, p. 220, Pl. 8, Fig. 28.  
 1956. *Alaba costellata anomala* (EICHWALD); I. CSEPREGHY-MEZNERICS, pp. 386-387, Pl. 3, Figs 10-11.  
 1957. *Alaba costellata* GRAT.; M. PAVLOVSKY, p. 53, Pl. 1, Fig. 1.  
 1960. *Alaba costellata anomala* (EICHWALD); J. ŠVAGROVSKY, p. 70, Pl. 6, Figs 7-10.  
 1966. *Alaba costellata anomala* EICHWALD; L. STRAUZ, p. 128, Pl. 13, Fig. 3, Pl. 45, Fig. 19.  
 1966. *Alaba paucivaricosa* BOETTGER, J. KÓKAY, p. 44, Pl. 4, Fig. 15.  
 1968. *Alaba (Alaba) costellata anomala* (EICHWALD); L. HINCULOV, p. 130, Pl. 30, Figs 19-20.  
 1969. *Alaba costellata anomala* (EICHWALD); M. A. ATANACKOVIĆ, p. 195, Pl. 8, Figs 14-15.  
 1970. *Alaba costellata anomala* (EICHWALD); W. BAŁUK, p. 117, Pl. 9, Figs 1-2.

**Material.** — Two hundred specimens.

**Dimensions.** — The largest complete specimen is 6.3 mm high and 2.8 mm wide. The width of one of the incomplete specimens amounts to 3.3 mm.

**Description.** — Shell small or medium-sized, fairly thin-walled, shaped like a more or less slender turret. Protoconch probably consisting of three to three and a half convex and quite smooth whorls. No distinct boundary with teleoconch is observed, but the protoconchal whorls differ from early teleoconchal ones in a more purely white coloration and in a rather sudden change in the height of whorl. Teleoconch reaching about seven slightly convex whorls, the last of them being either rounded or having a slight carina on periphery. The surface of shell smooth, except for few, usually more grown-up, specimens which develop on later whorls a few (three to five) very slight spiral cords. In addition, irregularly distributed varices, in some specimens more numerous (even to three per whorl) and in some others only sporadic or absent at all run on whorls, in particular on later ones. Aperture oval, posteriorly slightly contracted,



anteriorly somewhat elongate and fairly wide. Both lips thin, the outer one frequently reinforced by varix somewhat behind the edge and smooth inside. Umbilicus lacking.

**Remarks.** — A considerable variability, expressed in a more or less slender shape of shell, unequal convexity of whorls and a varying number of varices, is observed among the specimens here assigned. The specimens from Korytnica are undoubtedly conspecific with those of *Alaba costellata anomala* (EICHWALD), described from many localities of the Miocene deposits (see synonymy). Specimens of *A. costellata* (GRATELOUP) from the Vienna Basin (HÖRNES, 1856) are also referred to this subspecies. In the present writer's opinion, the Korytnica specimens are also conspecific with *A. paucivaricosa* BOETTGER, described from Kostej and Lapugy, Rumania and Soos, Vienna Basin (BOETTGER, 1901). Many of the specimens from Korytnica are exactly in conformity with the lectotype of *A. paucivaricosa*, but distinguishing them as a separate species is superfluous, since the difference observed between them and *A. costellata anomala* are within limits of variability. The generic assignment of the subspecies under study is a controversial problem. Earlier author (EICHWALD, 1853; HÖRNES, 1856) assigned it to the genus *Rissoa*, while later ones — to the genus *Alaba* H. & A. ADAMS, but they included it, together with the entire family Litiopidae, in either the superfamily Rissoacea, or superfamily Cerithiacea. In the present writer's opinion, the assignment of these specimens to the genus *Alaba* is not quite obvious, since their protoconch is entirely smooth, whereas the first two whorls of the representatives of this genus are supposed to be smooth and further two delicately ornamented by axial ribbing (according to WENZ, 1940, pp. 753-754).

*A. costellata anomala* (EICHWALD) has already been mentioned from Korytnica by FRIEDBERG (1938). In the Miocene of Poland, it also occurs at Gliwice Stare (KRACH, 1954), Brzeźnica (KRACH, 1960) and Niskowa (FRIEDBERG, 1923, 1938; SKOCZYŁASÓWNA, 1930; BAŁUK, 1970).

### *Alaba elata* BOETTGER, 1901

(Pl. XVI, Figs 5-6)

1901. *Alaba elata* n. sp.; O. BOETTGER, p. 148, no. 455.

1934. *Alaba (Gibborissoa) elata* (BOETTGER); A. ZILCH, p. 220, Pl. 8, Fig. 29.

**Material.** — Seven specimens.

**Dimensions.** — The largest specimen, without protoconch and with damaged aperture, is 4.0 mm high and 1.6 mm wide.

**Description.** — Shell small, fairly thin-walled, shaped like a very slender turret. Protoconch, fragmentarily preserved in two specimens only, consisting of more than three convex whorls, the first of them smooth, the further two delicately ribbed axially. Teleoconch reaching about seven convex whorls, the last of them peripherally rounded. Teleoconchal surface in principle smooth, except for the later whorls (especially so on the base) on which delicate, spiral grooves are developed. In addition, irregularly distributed varices (sometimes, even three per whorl) occur in some specimens. Aperture oval, anteriorly provided with a shallow and fairly wide notch. Both lips thin, the outer one sometimes reinforced with a varix occurring somewhat behind the edge.

**Remarks.** — It is beyond any doubt that the specimens described are conspecific with those of *Alaba elata* BOETTGER from Kostej and Lapugy, Rumania (BOETTGER, 1901). They

are in each respect conformable with the lectotype of this species (ZILCH, 1934). They differ from *A. costellata anomala* (EICHWALD) in a very distinctly more slender shape of shell, grooves on the last whorl and ribbed protoconchal whorls. The last-named character gives evidence that the species under study may be, in contradiction to *A. costellata anomala*, be assigned without reservation to the genus *Alaba*.

*Alaba elata* BOETTGER has not so far been known from the Miocene of Poland. Outside of Korytnica, it was mentioned only from Kostej and Lapugy, Rumania.

## Family CERITHIIDAE FLEMING, 1828

### Genus BITTIUM LEACH *in* GRAY, 1847

#### Subgenus BITTIUM (BITTIUM)

#### *Bittium (Bittium) reticulatum* (DA COSTA, 1779)

(Pl. XVI, Figs 10-15)

1856. *Cerithium scabrum* OLIVI; M. HÖRNES, pp. 410-412, Pl. 42, Fig. 1.  
 1895. *Bittium reticulatum* (DA COSTA) et var.; F. SACCO, pp. 38-39, Pl. 2, Figs 105-114.  
 1914. *Bittium reticulatum* DA COSTA; W. FRIEDBERG, pp. 302-304, Pl. 18, Figs 10-11.  
 1922. *Bittium reticulatum* (DA COSTA) mut. *exferrugineum* SACCO; M. COSSMANN & A. PEYROT, pp. 282-284, Pl. 7, Figs 51-52.  
 1937. *Bittium (Bittium) reticulatum* (DA COSTA); R. SIEBER, pp. 489-490, Pl. 25, Figs A1, 3, B1.  
 1949. *Bittium reticulatum* DA COSTA; M. GLIBERT, pp. 141-143, Pl. 9, Figs 8a-d.  
 1954. *Bittium reticulatum* DA COSTA; I. CSEPREGHY-MEZNERICS, p. 21, Pl. 3, Fig. 8.  
 1954. *Bittium reticulatum* COSTA; L. STRAUZ, p. 18, Pl. 2, Fig. 28.  
 1966. *Bittium reticulatum* COSTA; L. STRAUZ, pp. 140-141, Pl. 6, Figs 17-21.  
 1969. *Bittium (Bittium) deforme* (EICHWALD); M. A. ATANACKOVIĆ, p. 197, Pl. 8, Figs 21-22.  
 1970. *Bittium (Bittium) reticulatum* DA COSTA; E. CAPROTTI, p. 145, Pl. 5, Figs 10-15.  
 1973. *Bittium reticulatum* (COSTA); M. BOHN-HAVAS, p. 1046, Pl. 4, Fig. 6.

**Material.** — A hundred and fifty specimens.

**Dimensions.** — The largest specimen is 9.0 mm high and 3.0 mm wide.

**Description.** — Shell medium-sized, not very thin-walled, shaped like a fairly slender, conical turret. Protoconch consisting of about two convex and smooth whorls with a not very distinct boundary with the rest of shell. Teleoconch reaching ten slightly convex or nearly flat whorls, separated from each other by fairly deep sutures. Shell base flattened. Ornamentation formed by relatively narrow spiral and axial ribs. Not very prominent, roundish or slightly spiny tubercles occur at intersections. Two spiral ribs run on the first teleoconchal whorl and the third of them, which rapidly reaches the thickness of the two former ones, appears above the upper one of them on the second or third teleoconchal whorl. Still later, the fourth rib develops between the two upper ones, but the moment of its appearance is strongly variable, as it may develop either as early as the fourth whorl (Pl. XVI, Fig. 14) or only on the eighth (Pl. XVI, Fig. 12). If the latter is the case, it remains very thin, considerably differing from the rest of them. Two smooth cords run on the last whorl just below the tuberculate spiral ribs, the upper one of them sometimes partly also on preceding whorls. Three to five more smooth, closely-spaced spiral cords occur on the base of shell as early as the beginning of siphonal furrow. Twelve to thirteen axial ribs occur on the early and 18 to 23 on the later whorls. In

addition, there also occur prominent varices, which are either numerous (even two per whorl) or only one on the last whorl. Aperture oval, slightly oblique, with a not very long and rather shallow siphonal furrow developed anteriorly.

**Remarks.** — The variability observed among the shells of *Bittium* (*Bittium*) *reticulatum* (DA COSTA), abundantly occurring at Korytnica, is expressed in a more or less slender shape, variable number of varices and mostly in the place of the appearance of the fourth spiral rib. Despite these differences, all the specimens are assigned by the present writer to one and the same species, although those in which the fourth rib appears very late resemble another species, *B. (B.) deforme* (EICHWALD). The separate character of the last-named species is, as a matter of fact, rather debatable. HÖRNES (1856) does not separate it from the Viennese specimens of *B. scabrum* (OLIVI) (= *B. reticulatum*) and according to ŠVAGROVSKY (1971), *B. deforme* is a subspecies of *B. reticulatum*.

*B. (B.) reticulatum* (DA COSTA) was mentioned from Korytnica by FRIEDBERG (1938), along with the species *B. (B.) deforme* (EICHWALD), but three specimens assigned to the latter species are young and erroneously identified, which the present writer could find seeing them in FRIEDBERG'S collection. KOWALEWSKI (1930) mentions his finding a specimen of *B. deforme* in the Korytnica clay (at Chomentów). This specimen was larger than those found by the present author, had more whorls (12) and was devoid of varices and the fourth spiral rib. It is rather doubtful if this specimen could be considered as conspecific with those here described. In the Miocene of Poland, *B. (B.) reticulatum* was recorded at Gliwice Stare (KRACH, 1954), Libiąż (KRACH, 1939), Małoszów (KRACH, 1947), Mniszek (KRACH, 1962*b*), Benczyn (KRACH, 1950*a*), Skoczów (KRACH, 1974), Brzeźnica (KRACH, 1960) and Bogucice (LISZKA, 1933).

#### Subgenus BITTIUM (SEMIBITTIUM) COSSMANN, 1896

##### *Bittium* (*Semibittium*) *multiliratum* BRUSINA, 1877

(Pl. XVI, Figs 8-9)

1877. *Bittium multiliratum* BRUSINA; S. BRUSINA, pp. 380-382.

1914. *Seila multilirata* BRUSINA; W. FRIEDBERG, pp. 315-316, Pl. 19, Fig. 1.

1937. *Seila (Seila) multilirata* (BRUSINA); R. SIEBER, p. 507, Pl. 25, Fig. C2.

1956. *Seila multilirata* (BRUSINA); I. CSEPREGHY-MEZNERICS, p. 388, Pl. 1, Figs 40-41.

1966. *Seilla multilirata* BRUSINA; L. STRAUZ, p. 169, Pl. 5, Figs 28-29.

**Material.** — Eighty-five specimens.

**Dimensions.** — The largest specimen is 6.0 mm high and 2.0 mm wide.

**Description.** — Shell small or medium-sized, fairly thin-walled, shaped like a slender turret. Protoconch consisting of about two convex and smooth whorls, without a distinct boundary with the rest of shell. Teleoconch reaching nine to ten whorls, the early ones of which are bent in outline (with upper parts rooflike) and further ones slightly convex or, sometimes, flat. The last whorl has on its periphery a slight, rounded carina. Shell base slightly flattened. Thin spiral ribs are the main ornamental elements. Two of them appear on the first teleoconchal whorl, followed, on the second or third whorl, by further three developed above them (on the rooflike part) and, on the fourth or fifth whorl, by one more rib which always occurs between the two uppermost ones. Thus, six spiral ribs always run over the middle and later whorls, the first two of them somewhat more prominent than the rest. Two more spiral ribs (the upper one some-

times also visible on preceding whorls) run over shell base, accompanied, at a certain distance by two and, less frequently, three or four spiral cords. In addition, not very prominent axial ribs, always developed on the earlier whorls only and disappearing on the later, occur on shell. However, there are also specimens having axial ribs on all whorls as well as those in which, after disappearance, such ribs reappear on the later two whorls. The number of axial ribs on early whorls amounts to 12 to 14 and on later whorls even to 25. Aperture oval, slightly oblique, anteriorly provided with a short and shallow siphonal furrow. Both lips thin on edge, the outer one provided with a fairly wide varix occurring somewhat behind the edge. Sometimes, another varix occurs at a distance equalling one-third or a quarter of the length of whorl, very rarely followed by one more varix, developed at an approximately identical distance. No varices occur on other whorls.

**Remarks.** — Although the specimens here assigned differ from each other even to a considerable extent in both size and ornamentation, all of them have to be considered as one and the same species, since a very extensive range of transitional forms is observed between extreme specimens. Erecting the species under study, BRUSINA (1877) assigned it to the genus *Bittium* LEACH in GRAY, 1847. Later investigators (FRIEDBERG, 1914; SIEBER, 1937) transferred it to the genus *Seila* A. ADAMS, 1861 or even to the subgenus *Seila* (*Seila*). This was, however, erroneous, since the structure of protoconch, here consisting of about two smooth whorls, gives evidence that this species does not belong to the genus *Seila*, the ornamentation in the form of smooth spiral ribs being a character of only a minor importance. The representatives of the genus *Seila* have a different protoconch, which is slender, sharply separated from teleoconch and consisting of about five whorls (WENZ, 1940). In the present writer's opinion, the species in question belongs to the subgenus *Bittium* (*Semibittium*) COSSMANN, 1896 and, consequently, to another family. However, it should be emphasized that, although the shells of gastropods of the subgenus *B.* (*Semibittium*) in principle do not display varices, in some specimens they are observed, but only on the last whorl, e.g., in *Semibittium duvergieri* COSSMANN & PEYROT (1922, Pl. 7, Fig. 96).

*B. (S.) multiliratum* BRUSINA has not so far been known from Korytnica. In the Miocene of Poland, this species occurs at Małoszów (KRACH, 1947), Skoczów (KRACH, 1974) Bogucice (LISZKA, 1933) and Wieliczka (BRUSINA, 1877; FRIEDBERG, 1938).

### *Bittium* (*Semibittium*) *turritella* (EICHWALD, 1853)

(Pl. XVI, Fig. 7)

1853. *Rissoa turritella* m.; E. EICHWALD, p. 275, Pl. 10, Fig. 27.  
 1914. *Seila turritella* EICHW.; W. FRIEDBERG, pp. 314-315, Pl. 18, Fig. 27.  
 1937. *Seila (Seila) turritella* EICHW.; R. SIEBER, pp. 506-507, Pl. 25, Fig. B4.  
 1956. *Seila turritella* (EICHWALD); I. CSEPREGHY-MEZNERICS, p. 389, Pl. 1, Figs 34-35.  
 1966. *Seila turritella* EICHWALD; L. STRAUZ, p. 169, Pl. 5, Figs 26-27.  
 1970. *Seila schwartzi* HÖRNES; W. BAŁUK, p. 118, Pl. 9, Fig. 9.

**Material.** — Sixty-five specimens.

**Dimensions.** — The largest specimen is 4.2 mm high and 1.4 mm wide.

**Description.** — Shell small, fairly thin-walled, shaped like a more or less slender turret. Protoconch consisting of about two smooth and convex whorls, without a distinct boundary

with the rest of shell. Teleoconch reaching seven to eight whorls, more or less convex in outline (only two early whorls are bent in a rooflike manner in their upper part). The last whorl peripherally rounded, its base only slightly flattened. Ornamentation formed by smooth spiral ribs. Two of them appear on the first teleoconchal whorl, followed immediately by two more developed above the former ones and later by one, two or even three others, each of the newly formed ribs appearing between the two upper, already existing, ribs. Thus, five to seven ribs run over later whorls. At the base, there also occur six or seven more spiral ribs, the uppermost one being usually visible in part on preceding whorls and the third of them being mostly considerably less robust than the rest. Aperture oval, slightly oblique, anteriorly extended to form a short and shallow siphonal furrow. Both lips thin, the outer one provided with a prominent, although not very wide varix occurring somewhat behind the edge. Sometimes, two or three, variously spaced varices occur on the last whorl. No varices occur on other whorls.

**Remarks.** — The specimens here assigned are marked by a small variability, expressed in a more or less slender shape and varying number of spiral ribs. They are undoubtedly conspecific with specimens of *Bittium* (*Semibittium*) *turritella* (EICHWALD) from Volhynia and Podolia (EICHWALD, 1853; FRIEDBERG, 1914), from the Vienna Basin (SIEBER, 1937) and Hungary (CSEPREGHY-MEZNERICS, 1956; STRAUZ, 1966). On the average, the Korytnica specimens are, however, somewhat more slender. This species also includes all specimens, described earlier by the present writer (BALUK, 1970) as *Seila schwartzi* (HÖRNES). The species under study has previously been assigned by all authors to the genus *Seila* A. ADAMS, 1861 and by SIEBER (1937) even to the subgenus *Seila* (*Seila*). The same as in the case of *B. (S.) multiliratum* (see p. 142), such a standpoint is incorrect. The ornamentation consisting of smooth spiral ribs is here a character of a minor importance only, while the structure of protoconch is a decisive factor, distinctly different in this species than in the genus *Seila* (see WENZ, 1940).

*B. (S.) turritella* (EICHWALD) has not so far been known from Korytnica. In the Miocene of Poland, it was recorded at Skoczów (KRACH, 1974), Wieliczka (FRIEDBERG, 1933, 1938), Brzeźnica (KRACH, 1960) and Niskowa (BALUK, 1970).

#### Genus **CERITHIUM** BRUGUIÈRE, 1789

##### Subgenus **CERITHIUM (THERICIUM)** MONTEROSATO, 1890

##### **Cerithium (Thericium) vulgatum miospinosum** SACCO, 1895

(Pl. XVII, Figs 13-16)

1837. *Cerithium Zeuschneri*; G. PUSCH, pp. 148-149 Pl. 12, Fig. 14 (non Fig. 13), *partim*.

1856. *Cerithium vulgatum* BRUG. var.; M. HÖRNES, pp. 386-388, Pl. 41, Figs 1-4.

1895. *Cerithium vulgatum* var. *miospinosa* SACC.; F. SACCO, p. 9.

1914. *Cerithium vulgatum* BRUG.; W. FRIEDBERG, pp. 253-254, Pl. 16, Fig. 1.

1914. *Cerithium vulgatum* BRUG. var. *miospina* SACCO; W. FRIEDBERG, p. 254, Pl. 16, Fig. 2.

1969. *Cerithium (Thericium) vulgatum* BRUGUIÈRE; M. A. ATANACKOVIĆ, p. 196, Pl. 8, Fig. 19.

**Material.** — Thirteen specimens.

**Dimensions.** — The largest specimen, with a partly damaged last whorl, is 53 mm high and 23 mm wide. Another, preserved in the form of four later whorls (Pl. XVII, Fig. 14) is 47 mm high and 26 mm wide.

**Description.** — Shell large, fairly thick-walled, turretlike. Protoconch not preserved in any of the specimens. Teleoconch reaching about 13 to 14 whorls. Ornamentation very prominent. Three thin spiral cords occur on the first whorl preserved (the second or third teleoconchal whorl) in a juvenile specimen (Pl. XVII, Fig. 15). Secondary cords appear on further two whorls. They are followed by axial ribs (eight to ten per whorl), at first developed very thin and becoming later thicker and thicker, every third (or, less frequently, second) of them being yet more prominent. The number of spiral cords increases due to the appearance of tertiary cords. The three initial ones and one, situated at the very top of whorl, are distinctly different than the rest of them. Beginning with the eighth or ninth whorl, spiny tubercles are formed at intersections of axial ribs with the middle main cord, while the ribs themselves gradually lose their elongate shape. Fine tubercles, considerably smaller but more numerous (16 to 18) than spiny ones, situated above them, are developed on three or four later whorls on the lowermost cord. On the last whorl, ornamentation becomes less regular, axial ribs disappear completely and tubercles in both rows are uniform in size. Two thick spiral ribs, also provided with tubercles, run at the base. Aperture (only very rarely preserved, Pl. XVII, Fig. 14) oval, oblique, anteriorly extended to form a fairly short, bent siphonal furrow. Posteriorly, its roller-like swelling on inner lip separates a distinctly outlined trough of an exhalant siphon. Both lips fairly thick, the terminal sector of the last whorl somewhat swollen, with a strong varix occurring at a distance equalling about two-thirds of a whorl from the apertural edge.

**Remarks.** — The specimens described are undoubtedly conspecific with those from Steinabrunn, Vienna Basin (HÖRNES, 1856) and Miljevići, Yougoslavia (ATANACKOVIĆ, 1969). The Viennese specimens were identified by HÖRNES (1856) as *C. vulgatum* BRUGUIÈRE var. They indeed differ from the Recent species *C. vulgatum* to such an extent that it is necessary to separate them at least as a subspecies. The name *C. vulgatum miospinosum* was suggested for them by SACCO (1895). The variability, observed, among the Korytnica specimens, is expressed in a varying ornamentation of the early whorls. Unfortunately, however, precisely these whorls are usually very strongly abraded. A relatively distinct ornamentation of early whorls is observed in a specimen shown in Pl. XVII, Fig. 13. This ornamentation (described above in detail) is identical with that in a juvenile specimen in Pl. XVII, Fig. 15. Another juvenile specimen (Pl. XVII, Fig. 16), which also should be assigned to the subspecies in question, has a slightly different sculpture, as its axial ribs appear earlier and the middle cord is more prominent and, consequently, its spiny tubercles occur as early as on the fourth or fifth whorl.

*C. (T.) vulgatum miospinosum* SACCO was mentioned from Korytnica by PUSCH (1837), MURCHISON (1845), EICHWALD (1853), KONTKIEWICZ (1882), FRIEDBERG (1914, 1938) and KOWALEWSKI (1930). In the Miocene of Poland, it also occurs at Małoszów (KRACH, 1947). The specimen presented by FRIEDBERG (1914, Pl. 16, Fig. 1) differs in the presence of one more row of tubercles situated at the very top of whorls. This specimen is supposed to come from Korytnica, but in the present writer's opinion its state of preservation considerably departs from the appearance of shells found in the Korytnica clays.

### *Cerithium (Theridium) vulgatum europaeum* MAYER, 1878

(Pl. XVII, Figs 1-3)

1856. *Cerithium minutum* SERR.; M. HÖRNES, pp. 390-391, Pl. 41, Figs 8-9.

1878. *Cerithium Europaeum* MAYER; C. MAYER, pp. 89-90, Pl. 2, Fig. 5.

1895. *Cerithium europaeum* MAY.; F. SACCO, p. 31, Pl. 1, Fig. 43.

1910. *Cerithium (Theridium) vulgatum* BRUGUIÈRE var. *miocenica* nov. var.; L. VIGNAL, pp. 141-143, Pl. 7, Fig. 2.  
 1914. *Cerithium europaeum* MAY.; W. FRIEDBERG, pp. 254-256, Pl. 16, Figs 3-4.  
 1932. *Cerithium (Vulgocerithium) vulgatum* BRUGUIÈRE, mut. *miocaenicum* VIGNAL; M. COSSMANN & A. PEYROT, pp. 188-190, Pl. 5, Figs 33-34.  
 1949. *Cerithium (Vulgocerithium) vulgatum miocaenicum* VIGNAL; M. GLIBERT, pp. 147-148, Pl. 9, Fig. 12.  
 1949. *Cerithium (Vulgocerithium) vulgatum europaeum* MAYER; M. GLIBERT, pp. 148-149, Pl. 9, Fig. 13.  
 1950. *Cerithium (Vulgocerithium) europaeum* MAY.; I. CSEPREGHY-MEZNERICS, p. 32, Pl. 2, Fig. 3.  
 1954. *Cerithium (Vulgocerithium) europaeum* MAY.; L. STRAUZ, p. 16, Pl. 3, Fig. 48.  
 1954. *Cerithium europaeum* MAYER; I. CSEPREGHY-MEZNERICS, pp. 21-22, Pl. 2, Figs 13-15.  
 1960. *Cerithium (Vulgocerithium) europeum* MAYER; E. KOJUMDGIEVA, pp. 104-105, Pl. 31, Figs 1-2.  
 1961. *Cerithium (Theridium) europaeum* MAY.; N. FLOREI, p. 682, Pl. 7, Fig. 47.  
 1966. *Cerithium vulgatum europaeum* MAYER; L. STRAUZ, pp. 130-131, Pl. 9, Figs 19-26.  
 1970. *Cerithium (Vulgocerithium) europaeum* MAYER; W. BALUK, p. 118, Pl. 10, Fig. 18.  
 1973. *Cerithium (Vulgocerithium) europaeum* MAYER; M. BOHN-HAVAS, p. 1043, Pl. 4, Fig. 10.

**Material.** — Fourteen specimens.

**Dimensions.** — The largest specimen, with a destroyed aperture (Pl. XVII, Fig. 2) is 38 mm high and 14.5 wide. Another, complete, specimen (Pl. XVII, Fig. 3) is 27 mm high and 11.5 mm wide.

**Description.** — Shell medium-sized, not very thick-walled, shaped like a more or less fusiform turret. Protoconch and the earliest teleoconchal whorls not preserved. Teleoconch reaching about 11 to 12 whorls. Like in *C. (T.) vulgatum miospinosum*, the ornamentation of early whorls is fairly variable. It is formed by spiral cords, two of which (probably, cardinal ones) are markedly more prominent than the rest of them (secondary and tertiary ones). The upper cardinal cord runs nearly through the middle of whorl, which above it is flat and sloping in a rooflike manner. In addition, the ornamentation is composed of axial ribs which, intersecting the upper cardinal cord, form small, spiny tubercles (eight to twelve per whorl). Sometimes, axial ribs are rarely visible on early whorls and, consequently, their tubercles are tiny. On middle and later whorls, spiral cords are very numerous, axial ribs lose their elongate character and there only remain spiny tubercles (12 to 16 per whorl, the middle row). In addition, a small spiral swelling, with many (25 to 30) fine tubercles rather irregular in outline (the upper two) occurring on it, is developed at the top. A similar, although somewhat less strongly developed row of tubercles also runs at the very bottom of whorls (this is a lower row, which may sometimes be hidden by the next whorl). Sometimes, one more row of tubercles, however considerably less strongly developed than the three remaining ones, may also appear between the middle and the lower row. An almost quite smooth, or only slightly crenate spiral rib and below it many spiral cords, two or three of them being thicker than the rest, occur at the base of shell. Aperture (preserved in one specimen only, Pl. XVII, Fig. 3) oval, oblique, with a short siphonal furrow. Both lips not very thick, the inner one sharp on edge. The terminal sector of the last whorl distinctly "swollen", with a not very prominent varix occurring at a distance equalling about two-thirds of the whorl from the edge of aperture.

**Remarks.** — A considerable variability is observed among the above described shells, which are relatively rare at Korytnica. The variability is expressed in their size, shape and details of ornamentation. The variability in the ornamentation of their surface consists in a varying prominence of axial ribs on early whorls, in the degree of sharpness of the spiny tubercles and in an unequal prominence of particular rows of tubercles. This extensive range of variability also observed by other investigator among specimens from other localities was the reason why they were variously identified. The specimens from Korytnica are undoubtedly conspecific

with those occurring in the Vienna Basin and described by HÖRNES (1856) as *C. minutum*. This rather incorrect assignment was changed by later authors who, however, applied various names to the specimens which differed in shape. More dumpy of them were called *C. europaeum* MAYER, 1878 and more slender — *C. vulgatum miocenicum* VIGNAL, 1910. In the present writer's opinion, such a division is pronouncedly artificial. GLIBERT (1949, pp. 148-149) also seems to be quite convinced of the lack of a valid basis for such a division. It is beyond any doubt that the specimens here described are to such an extent related to the Recent species *C. vulgatum* BRUGUIÈRE that they may be safely treated as its subspecies, *C. (T.) vulgatum europaeum* MAYER.

This species has previously been mentioned from Korytnica by FRIEDBERG (1914, 1938), KOWALEWSKI (1930) and, of yet earlier authors, also HÖRNES (1856). In the Miocene of Poland, it also occurs at Gliwice Stare (KRACH, 1954), Łychów and Węglin (KRACH, 1962*b*), Bogucice (LISZKA, 1933), Skoczów (KRACH, 1974), Brzeźnica (KRACH, 1960), Niskowa (FRIEDBERG, 1938; BAŁUK, 1970) and Babica (FRIEDBERG, 1938).

### ***Cerithium (Theridium) michelottii* HÖRNES, 1856**

(Pl. XVII, Figs 6-8)

1856. *Cerithium Michelottii* HÖRN; M. HÖRNES, pp. 389-390, Pl. 41, Fig. 7.  
 1895. *Pithocerithium Michelottii* (HOERN.) et var.; F. SACCO, pp. 33-34, Pl. 2, Fig. 82-84.  
 1928*a*. *Cerithium Michelottii* HOERN.; W. FRIEDBERG, pp. 594-595, Pl. 38, Fig. 7.  
 1930. *Cerithium Michelottii* HOERN.; K. KOWALEWSKI, p. 140.  
 1954. *Cerithium michelottii* M. HÖRNES; I. CSEPREGHY-MEZNERICS, p. 21, Pl. 2, Figs 10-12.  
 1954. *Cerithium (Vulgocerithium) michelottii* HÖRN.; L. STRAUZ, p. 16, Pl. 3, Fig. 49.  
 1960. *Cerithium (Vulgocerithium) michelottii* HOERNES; E. KOJUMDGIEVA, p. 105, Pl. 31, Fig. 5.  
 1966. *Cerithium michelottii* HÖRNES; L. STRAUZ, p. 134, Pl. 9, Fig. 29.

**Material.** — Four specimens.

**Dimensions.** — The largest specimen is 22 mm high and 11.5 mm wide.

**Description.** — Shell medium-sized, not very thin-walled, shaped like either slender (Pl. XVII, Fig. 6) or rather dumpy (Pl. XVII, Fig. 8) turret. Protoconch and the earliest teleoconchal whorls not preserved. Teleoconch reaching about eight to ten whorls. Of the whorls preserved, the early ones are ornamented by closely-spaced spiral ribs and a single row of spiny tubercles (eight to eleven per whorl), the latter being situated somewhat nearer the upper suture. Another row of similar tubercles is developed on further whorls (that is, on three later whorls) above the first row just below the upper suture. The last whorl displays two rows of spiny tubercles (ten to eleven of them in each row) and, below them, four rows of more closely-spaced (15 to 16 in each row), roundish tubercles. The lowermost row is markedly less strongly developed than the rest of them and, in one of the specimens, lacking at all. Very numerous spiral cords also run along the rows of tubercles. They are irregular in width and some of them, in particular those running between the rows, are slightly wider. Aperture (somewhat damaged in all specimens) oval, oblique, anteriorly terminating in a short, bent siphonal furrow, varices lacking. One of the specimens displays tubercles and thicker cords colored red.

**Remarks.** — The specimens here assigned are undoubtedly conspecific with those from the Vienna Basin (HÖRNES, 1856), Hungary (STRAUZ, 1954, 1966; CSEPREGHY-MEZNERICS, 1954) and Bulgaria (KOJUMDGIEVA, 1960). The differences observed are rather small. As com-



pared with the specimen from Baden (HÖRNES, 1856, Pl. 41, Fig. 7), those from Korytnica have less numerous spiny tubercles and have not tubercles on cords situated on the siphonal furrow. The variability of the Korytnica specimens is expressed only in the differences in shell shape.

*C. (T.) michelottii* HÖRNES has previously been mentioned from Korytnica (one and the same specimen) by FRIEDBERG (1928a) and KOWALEWSKI (1930). Korytnica is the only Miocene locality in Poland in which this species occurs.

### ***Cerithium (Thericium) aff. zelebori* HÖRNES, 1856**

(Pl. XVII, Figs 4-5)

1856. *Cerithium Zeleborei* HÖRN.; M. HÖRNES, pp. 391-392, Pl. 41, Fig. 10.

1928a. *Cerithium cf. Zeleborei* HÖRN.; W. FRIEDBERG, p. 595, Pl. 38, Fig. 8.

**Material.** — Twelve specimens.

**Dimensions.** — The largest specimen (Pl. XVII, Fig. 5) is 37 mm high and 14 mm wide.

**Description.** — Shell medium-sized, fairly thick-walled, shaped like a not very slender turret. Protoconch and the earliest teleoconchal whorls not preserved. Teleoconch reaching about nine to ten slightly convex whorls. The ornamentation of the first of the preserved whorls (probably the fourth to fifth teleoconchal whorls) consists of many spiral cords (two or three of them more robust than the rest) and seven to nine axial ribs, usually not reaching the top part of whorl. A roller-like swelling, provided with many (17 to 23) rounded tubercles, is developed on the upper parts of middle whorls. Axial ribs lose their elongate character and become transformed into two rows of tubercles, the tubercles of the upper row being slightly spiny. In addition, one more (the fourth) row of fine tubercles, sometimes completely hidden by the next whorls, runs at the bottom of whorls. Four rows of tubercles (the uppermost one being the strongest) and between them one or two spiral cords each run over the last whorl. One or two more tuberculate spiral ribs and many cords varying in width occur at the base. Aperture destroyed in all specimens.

**Remarks.** — The identification of the specimens described is difficult. They are somewhat similar to *C. (T.) vulgatum europaeum*, but can fairly easily be distinguished from them. The difference consists in a different ornamentation of later whorls, on which the most prominent is the uppermost row of tubercles, and in the presence of distinct cords between the rows. It seems that they can be considered conspecific with a specimen described from Korytnica by FRIEDBERG (1928a) as *C. cf. zeleborei* HÖRNES, but since this specimen was destroyed during the last war, it is impossible to compare them now. The assignment of the Korytnica specimens to *C. (T.) zeleborei* is, therefore, rather uncertain, the more so as specimens presented by HÖRNES (1856, Pl. 41, Fig. 10) differ from those from Korytnica in having the uppermost row of tubercles, which is very prominent even on early whorls.

*C. (T.) zeleborei* was mentioned from the Korytnica clays (one and the same specimen) by FRIEDBERG (1928a) and KOWALEWSKI (1930). In other Miocene localities of Poland, it is unknown.

**Cerithium (Thericium) turonicum** MAYER, 1878

(Pl. XVII, Figs 9-12)

1856. *Cerithium doliolum* BROCC.; M. HÖRNES, pp. 392-393, Pl. 41, Figs 11-13.  
 1878. *Cerithium Turonicum* MAYER; C. MAYER, pp. 181-182, Pl. 4, Fig. 9.  
 1895. *Pithocerithium doliolum* var. *exdoliolum* SACC.; F. SACCO, p. 29.  
 1914. *Cerithium exdoliolum* SACCO; W. FRIEDBERG, pp. 265-266, Pl. 16, Fig. 14.  
 1922. *Cerithium (Vulgocerithium) turonense* MAYER; M. COSSMANN & A. PEYROT, pp. 194-195, Pl. 5, Figs 43-44.  
 1928a. *Cerithium exdoliolum* SACCO; W. FRIEDBERG, pp. 596-597, Pl. 38, Fig. 10.  
 1937. *Cerithium (Pithocerithium) turonicum* MAYER; R. SIEBER, pp. 500-501, Pl. 25, Fig. E2.  
 ?1949. *Cerithium (Vulgocerithium) turonicum* MAYER; M. GLIBERT, p. 149, Pl. 9, Fig. 14.  
 1950. *Cerithium (Vulgocerithium) exdoliolum* SACCO; I. CSEPREGHY-MEZNERICS, pp. 31-32, Pl. 2, Fig. 4.  
 1960. *Cerithium (Vulgocerithium) exdoliolum* SACCO; E. KOJUMDGIEVA, p. 106, Pl. 31, Fig. 8.  
 1966. *Cerithium exdoliolum* SACCO; L. STRAUZ, pp. 131-132, Pl. 9, Figs 27-28, Pl. 10, Fig. 2.  
 1968. *Cerithium (Thericium) turonicum* MAYER; L. HINCULOV, p. 132, Pl. 31, Figs 9-11.

**Material.** — Seventeen specimens.

**Dimensions.** — The largest specimen preserved complete (Pl. XVII, Fig. 10) is 22.5 mm high and 10.5 mm wide. Other specimens reach 28 mm in height.

**Description.** — Shell medium-sized, fairly thick-walled, shaped like a not very slender, somewhat fusiform turret. Protoconch not preserved in any of the specimens. Teleoconch reaching about eight to ten whorls. The earlier teleoconchal whorls are usually strongly abraded. The juvenile specimen (Pl. XVII, Fig. 12) may be only tentatively assigned to the species in question. The early whorls (beginning with the third?) are ornamented by many, almost uniform spiral cords and eight to eleven axial ribs. On further whorls, some of the spiral cords become more robust (including that running at the very top of whorl), with more and more distinct, roundish tubercles formed at their intersections with ribs, which gradually lose their elongate form. The uppermost cord, mentioned above, is separated from the rest of whorl by a shallow, troughlike depression. Three or four (very rarely only two) rows of roundish tubercles, the varying number of rows resulting from the manner of coiling (the mutual adhesion of whorls) are visible on the last but one whorl. The specimen, illustrated in Pl. XVII, Fig. 9, displays three rows of tubercles on the apertural side of the last whorl and four on the opposite side. The most numerous (15 to 20) and usually the largest are the tubercles of the uppermost row, while the most strongly projecting, but most widely-spaced (11 to 12) are those in the second row from the top. One more, similar although less strongly developed, row of tubercles and, under it, several nearly quite smooth or only slightly crenate cords varying in width, occur below the four rows of tubercles described above on the base of the last whorl. Two to four thin, smooth cords occur in each space between the rows of tubercles. Aperture oval, somewhat oblique, with an obliquely oriented siphonal furrow situated in its anterior part and with a distinctly separated trough of the exhalant siphon occurring posteriorly at the convergence of both lips. The last-named are fairly thin, the outer lip sharp on edge. The terminal sector of the last whorl markedly "swollen". A not very prominent varix is situated at a distance equalling about a half of whorl from the apertural edge. In most specimens, tubercles have a red-orange coloration.

**Remarks.** — A considerable variability in shape (comp. Pl. XVII, Fig. 10 and 11) and details of ornamentation is observed among the relatively few specimens found by the present writer in the Korytnica clays. The variability in the sculpture of shell is expressed in a varying

number of the rows of tubercles, as well as in the number, shape and size of tubercles in particular rows. As mentioned above, the number of rows depends on the manner of coiling. It is very frequently that the second half of the last whorl encircles the last but one whorl to a smaller extent than the first half. The separation of more slender from more dumpy specimens and those having three rows from those with four rows would be, in the present writer's opinion, pronouncedly artificial. Quite similar specimens, having nearly the same range of variability, occur in the Vienna Basin. Three of them were illustrated by HÖRNES (1856) and described by him either (HÖRNES, 1856, Pl. 41, Fig. 11, a specimen from Ebersdorf) as *C. doliolum* (BROCCHI), or (HÖRNES, 1856, Pl. 41, Fig. 12, a specimen from Steinabrunn and, Fig. 3, a specimen from Mikulov) as unnamed varieties of the same species. The present writer is quite convinced that all the specimens belong to one and the same species (which was already obvious to FRIEDBERG, 1914) and are conspecific with those from Korytnica. The specific name used by HÖRNES (1856) is inappropriate and, therefore, other names: *C. turonicum* MAYER, 1878 and *C. exdoliolum* SACCO, 1895 were suggested by later authors. In the present writer's opinion, the two names are synonyms and, consequently, the first of them has a priority as an earlier one. The investigators of Miocene gastropods face many difficulties caused by the considerable variability of the species under study. The attitude of individual authors towards the specimens illustrated by HÖRNES (1856) is very strange. Using the name *C. turonicum*, SIEBER (1937) and HINCULOV (1968) include in its synonymy only the specimens shown in Figs 11 and 13, which, on the other hand, are included by CSEPREGHY-MEZNERICS (1950) and KOJUMDGIEVA (1960) in the synonymy of *C. exdoliolum*. None of the authors mentioned above expresses his opinion on the specimen illustrated in Fig. 12 and they variously interpret the relation of *C. turonicum* to *C. exdoliolum*. Yet more varying view is represented by STRAUZ (1966), who assigns to *C. exdoliolum* precisely the specimen from Fig. 12 and does not express his opinion in regard to the remaining two. COSSMANN & PEYROT (1922) and GLIBERT (1949) do not associate HÖRNES's Viennese specimens with *C. turonicum*, although their conspecificity was obvious to MAYER (1878).

*C. (T.) turonicum* MAYER has not so far been known from Korytnica. On the other hand, it was recorded (as *C. exdoliolum*) from Gaszowice (KRACH, 1939), Małoszów (KRACH, 1947) and Zgłobice (FRIEDBERG, 1914).

### ***Cerithium (Theridium) obliquistoma attritum* (BOETTGER 1907)**

(Pl. XVIII, Figs 10-11)

1907. *Cerithium (Pithocerithium) attritum* n. sp.; O. BOETTGER, p. 140, no. 485.

1934. *Cerithium (Theridium) attritum* (BOETTGER); A. ZILCH, p. 221, Pl. 8, Fig. 30.

1966. *Cerithium rubiginosum pseudobliquistoma* SZALAI; L. STRAUZ, pp. 132-133, Pl. 9, Figs 14-17, non Figs 11-13, *partim*.

**Material.** — Four specimens.

**Dimensions.** — The largest specimen is 9.0 mm high and 5.0 mm wide.

**Description.** — Shell medium-sized, not very thin-walled, turretlike or oviform. Protoconch and the earliest teleoconchal whorls not preserved. In the best preserved specimen (Pl. XVIII, Fig. 11), teleoconch consists of seven whorls, its younger part being rather slender and adult dumpy. Ornamentation formed by many spiral cords and axial ribs. Spiral cords, almost uniform in width, are closely-spaced and separated by narrow grooves. A very shallow secondary groove runs along the middle of some cords. Axial ribs, ten to eleven of them per whorl in

particular specimens, are fairly prominent. Three more or less distinctly separated tubercles, arranged in spiral rows (the largest of them in the middle row), occur on each of these ribs. In the terminal part of the last whorl, axial ribs fade out first by the disappearance of the tubercles of the lower and then of the middle row (the tubercles of the upper row do not disappear). Shell base provided with many spiral cords, four of which are somewhat wider and more protruding. Aperture oval, characteristically very oblique, anteriorly having a short and very oblique (nearly perpendicular to shell axis) siphonal furrow. The thickness of lips varying in particular shells; the terminal sector of the last whorl slightly "swollen"; a not very prominent varix situated at a distance equalling a half of whorl from the apertural edge.

**Remarks.** — The specimens described above are considered by the present writer as conspecific with those described from Kosteĵ and Lapugy, Rumania (BOETTGER, 1907) as *C. attritum* BOETTGER. The specimen recognized by ZILCH (1934) as a lectotype of this species is very similar to that from Korytnica shown here in Pl. XVIII, Fig. 11, although its axial ribs are less strongly developed. The lectotypical specimen is a shell of a younger individual having about one whorl less. Judging by BOETTGER's (1907) description the variability in shape and ornamentation among the specimens from Kosteĵ and Lapugy was also extensive and much the same as that observed in the Korytnica shells. The same species should also include some of the specimens from Varpalota, Hungary, described by STRAUZ (1966) as *C. rubiginosum pseudobliquistoma* SZALAI. The present writer is quite sure that under this name STRAUZ (1966) presented the shells of two different species. Only some of them (STRAUSZ, 1966, Pl. 9, Figs 14-17) may be considered as conspecific with the specimens from Korytnica. Others (STRAUSZ, 1966, Pl. 9, Figs 11-13) differ from them in larger dimensions and, primarily, shape of aperture. Erecting the species *C. attritum*, BOETTGER (1906) pointed out to its similarity to *C. obliquistoma* SEGUENZA. This similarity is in fact so very great that it seems to the present writer more correct to treat *C. attritum* only as a subspecies of *C. obliquistoma*, but even such a solution may arouse some doubts, since the fundamental difference is expressed in larger dimensions of shells in *C. obliquistoma obliquistoma*. However, since in many species of the *Cerithium* the differences in shell size are considerable, even here this character may be deceptive. The fact that one of the specimens from Varpalota (STRAUSZ, 1966, Pl. 9, Fig. 17) is almost of the same size as those of *C. obliquistoma obliquistoma* SEGUENZA from the Tortonian of Northern Italy (ROBBA, 1968, Pl. 40, Fig. 5) may support such a supposition.

*C. (T.) obliquistoma attritum* BOETTGER has not so far been known from the Miocene of Poland.

#### Subgenus CERITHIUM (TIARACERITHIUM) SACCO, 1895

##### *Cerithium (Tiaracerithium) zeuschneri* PUSCH, 1837

(Pl. XVIII, Figs 6-9)

1837. *Cerithium Zeuschneri* m.; G. PUSCH, pp. 148-149, Pl. 12, Fig. 13, non Fig. 14, *partim*.

1856. *Cerithium Zeuschneri* PUSCH; M. HÖRNES, pp. 388-389, Pl. 41, Figs 5-6.

1914. *Cerithium Zejszneri* PUSCH; W. FRIEDBERG, pp. 257-258, Pl. 16, Fig. 6.

1922. *Cerithium (Tiaracerithium)* cf. *Zeuschneri* PUSCH; M. COSSMANN & A. PEYROT, pp. 187-188, Pl. 5, Fig. 14.

1937. *Cerithium (Tiaracerithium) Zeuschneri* PUSCH; R. SIEBER, p. 492.

1937. *Cerithium (Tiaracerithium) Zeuschneri* PUSCH var. *ancestralis* n. v.; R. SIEBER, pp. 492-493, Pl. 24, Fig. D4.

1960. *Cerithium (Vulgocerithium) zeuschneri* PUSCH; E. KOJUMDĠIEVA, pp. 105-106, Pl. 31, Figs 6-7.

1960. *Cerithium (Tiaracerithium) zeuschneri* PUSCH; T. BÁLDI, p. 61, Pl. I, Fig. 10.

1966. *Cerithium zeuschneri* PUSCH; L. STRAUZ, pp. 134-135, Pl. 10, Fig. 3, Pl. 11, Fig. 2.

1966. *Cerithium zeuschneri letkesensis* STRAUZ; L. STRAUZ, p. 135, Pl. 10, Figs 1 and 4.

**Material.** — Twenty specimens.

**Dimensions.** — The largest specimen (Pl. XVIII, Fig. 6) is 28 mm high and 13 mm wide.

**Description.** — Shell medium-sized, not very thin-walled, shaped like a turret whose apical part is conical and terminal rather cylindrical. Protoconch not preserved in any of the specimens. Teleoconch reaching about 11 to 13 whorls. The ornamentation of the early, conspicuously conical part of shell, consisting of eight to nine whorls, is quite different (Pl. XVIII, Fig. 8) than that of the later whorls. Two thin spiral cords, with two others developed close above them, occur on the earliest of the whorls preserved (the second?). They are markedly flattened and considerably wider than the grooves which separate them. On further whorls the number of cords increases as the result of the splitting of each of them, which takes place two or three times. In addition, not very prominent (and irregular in particular specimens) axial ribs occur in this part of shell. Three of them (every second, third or fourth) are always stronger. They are regularly distributed at intervals equalling one-third of whorl so that the early part of shell, viewed abapically, is distinctly triangular in outline. A row of strong, spiny tubercles (eight to ten per whorl) is developed in the upper part of three (less frequently, four and only exceptionally two) later whorls. Two more rows of somewhat more numerous (13 to 14) smaller, but also spiny, tubercles (the upper one of them may be also partially visible on the last but one whorl) run on the last whorl. Shell base is provided with very numerous, closely-spaced spiral cords. Aperture (only exceptionally preserved, see Pl. XVIII, Fig. 6) oval, oblique, anteriorly extended to form a short, oblique siphonal canal and posteriorly having a distinctly separated trough of the exhalant siphon. The terminal sector of the last whorl strongly "swollen", with a not very prominent varix situated at a distance of about two-thirds of whorl from the apertural edge.

**Remarks.** — The species *C. (Tiaracerithium) zeuschneri* PUSCH was erected (PUSCH, 1837) on the basis of specimens from Korytnica (type locality). Specimens from the Vienna Basin (Steinabrunn and Baden), presented by HÖRNES (1856) differ from the Korytnica ones in the presence of a strong spiny tubercle which occurs on the last whorl between two upper rows of less strong tubercles. The specimens from Varpalota, Hungary (STRAUSZ, 1966) have the lowermost row of tubercles somewhat less strongly developed. These differences are only a symptom of variability. Among the specimens from Korytnica, the variability is expressed in the difference in the shape of shell (comp. Pl. XVIII, Figs 6 and 7), in the prominence of axial ribs on earlier whorls and in the place of the appearance of the spiny tubercles. In one of the specimens (Pl. XVIII, Fig. 9), the tubercles are very poorly developed and occur only on the last one and a half whorls. The separation of this specimen from other ones would be pronouncedly artificial. It is, however, very similar to a specimen from Niederleis, Austria, which was described by SIEBER (1937) as *C. (Tiaracerithium) zeuschneri ancestralis* SIEBER, as well as to a specimen from Letkés, Hungary, on the basis of which the subspecies *C. (Tiaracerithium) zeuschneri letkesensis* STRAUZ was erected by STRAUZ (1966). In the present writer's opinion, the separation of subspecies is in both these cases unjustified.

*C. (Tiaracerithium) zeuschneri* PUSCH was mentioned from Korytnica by PUSCH (1837), KONTKIEWICZ (1882) and FRIEDBERG (1914, 1938). It is the only locality of the occurrence of this species, in the Miocene of Poland. The specimen from Niskowa, assigned by FRIEDBERG (1914, 1938) to this species, does not in fact belong to it.

Subgenus **CERITHIUM (PTYCHOCERITHIUM) SACCO, 1895****Cerithium (Ptychocerithium) procrenatum SACCO, 1895**

(Pl. XVII, Figs 17-19)

1856. *Cerithium crenatum* BROCC. var.; M. HÖRNES, pp. 408-409, Pl. 42, Figs 13-14.  
 1895. *Ptychocerithium procrenatum* SACC.; F. SACCO, p. 19, Pl. 2, Fig. 1.  
 1914. *Cerithium procrenatum* SACCO; W. FRIEDBERG, pp. 264-265, Pl. 16, Fig. 13.  
 1928a. *Cerithium procrenatum* SACCO; W. FRIEDBERG, p. 592, Pl. 38, Fig. 9.  
 1937. *Cerithium (Ptychocerithium) procrenatum* SACCO; R. SIEBER, pp. 493-494, Pl. 24, Figs E2, 4, F1-4.  
 1950. *Cerithium (Vulgocerithium) procrenatum* SACCO; I. CSEPREGHY-MEZNERICS, p. 31, Pl. 2, Fig. 1.  
 1955b. *Cerithium (Ptychocerithium) crenatum* BROCCHI var.; G. MOISESCU, p. 119, Pl. 10, Fig. 10.  
 1956. *Cerithium (Ptychocerithium) procrenatum* SACCO; J. ŠVAGROVSKÝ, pp. 313-317, Text-fig. 27.  
 1964. *Cerithium crenatum procrenatum* SACCO; J. ŠVAGROVSKÝ, p. 80, Pl. 16, Fig. 4.  
 1966. *Cerithium crenatum procrenatum* SACCO; L. STRAUZ, p. 136, Pl. 9, Figs 4-6.  
 1968. *Cerithium (Ptychocerithium) crenatum procrenatum* SACCO; L. HINCULOV, p. 131, Pl. 31, Fig. 6.  
 1969. *Cerithium (Ptychocerithium) procrenatum* (SACCO); M. A. ATANACKOVIĆ, p. 196, Pl. 8, Fig. 20.  
 1970. *Cerithium (Ptychocerithium) procrenatum* SACCO; W. BAŁUK, p. 118, Pl. 10, Fig. 17.  
 1971a. *Cerithium crenatum procrenata* (SACCO); M. EREMIJA, pp. 66-67, Pl. 7, Fig. 6-7.

**Material.** — Three specimens.

**Dimensions.** — The largest specimen, preserved in the form of six later whorls (Pl. XVII, Fig. 18) is 39 mm and high 13 mm wide.

**Description.** — Shell large, not very thin-walled, slender, turretlike. Protoconch not preserved. Teleoconch reaching about fifteen whorls. Two spiral cords occur on the first (?) whorl and on the third whorl two further cords and axial ribs (nine to ten) are developed above them. Beginning with the fifth whorl, the number of cords considerably increases due to the appearance of secondary and tertiary cords. Four of the early cords distinctly differ from the rest of them. This particularly concerns the uppermost one of them, which is relatively wide and another, situated under it, which, intersecting with axial ribs, forms on them at first sharp and then rounded tubercles. Three rows of roundish tubercles run on the middle (beginning with the 8th to the 9th) and later whorls. In the upper row, tubercles are the smallest but most numerous (16 to 20), in the middle one (which corresponds to two of the four early spiral cords), they are the largest and most prominent (13 to 14), while in the lower row they are of the same size as in the upper and their number equals that in the middle one. A narrow cord runs between each two rows of tubercles. One more, fourth row of tubercles (partly visible also on the last but one whorl) is also situated directly (not separated by a cord) below the lower row on the last whorl. Five prominent spiral cords, the uppermost one of them tuberculate, run at the base of shell. Aperture destroyed. A not very sharply separated varix occurs at a distance of about two-thirds of whorl from the apertural edge.

**Remarks.** — The assignment of the specimens described to *C. (P.) procrenatum* SACCO seems to be beyond any doubt, although they slightly differ in a more prominent ornamentation from both the specimens from the Vienna Basin (HÖRNES, 1856; SIEBER, 1937) and from other localities. The identical development and composition of the elements of sculpture gives, in the present writer's opinion, evidence that the difference observed is only a symptom of variability. Very similar specimens from the region of Cserhat Mts. were described by CSEPREGHY-MEZNERICS (1954) as *C. (P.) podhorcense* HILBER. Also similar, if not identical specimen from Varpalota was recognized by STRAUZ (1966) as a transitional form between

*C. crenatum procrenatum* SACCO and *C. crenatum podhorcense* HILBER. It is, however, very likely that in both these cases the specimens belong to *C. procrenatum*. For, the holotype of the species *C. podhorcense*, whose photograph is given by FRIEDBERG (1914, Text-fig. 57), is much more slender.

*C. (P.) procrenatum* SACCO was recorded from Korytnica (as a single, destroyed specimen) only by FRIEDBERG (1914). In the Miocene of Poland, this species occurs also at Błonie (FRIEDBERG, 1914) and Niskowa (FRIEDBERG, 1914, 1938; SKOCZYLAŚÓWNA, 1930; BALUK, 1970).

Genus **HEMICERITHIUM** COSSMANN, 1893

Subgenus **HEMICERITHIUM (HEMICERITHIUM)**

**Hemicerithium (Hemicerithium) banaticum** (BOETTGER, 1901)

(Pl. XVIII, Figs 4-5)

1901. *Cerithium (Conocerithium) banaticum* n. sp.; O. BOETTGER, pp. 118-119, no. 375.  
 ?1922. *Hemicerithium saubottense* VIGNAL; M. COSSMANN & A. PEYROT, pp. 229-230, Pl. 5, Figs 47-49, non Figs 45-46, *partim*.  
 1934. *Cerithium (Conocerithium) banaticum* BOETTGER; A. ZILCH, p. 221, Pl. 8, Fig. 33.  
 1938. *Tritonium (?) zboroviense* FRIEDB.; W. FRIEDBERG, p. 113, Text-fig. 34.  
 1954. *Cerithium (Conocerithium) banaticum* BOETTGER; I. CSEPREGHY-MEZNERICS, p. 23, Pl. 1, Figs 6-7 and 13-14.  
 1966. *Conocerithium banaticum* BOETTGER; L. STRAUZ, p. 139, Pl. 10, Figs 6-7.  
 1966. *Cerithium (Conocerithium) banaticum* BOETTGER; J. KÓKAY, p. 45, Pl. 4, Figs. 19-20.

**Material.** — Two hundred specimens.

**Dimensions.** — The largest specimen is 18 mm high and 7.5 mm wide. Average specimens are smaller by half.

**Description.** — Shell medium-sized, not very thin-walled, conical, turretlike. Protoconch consisting of about three convex, smooth and lustrous whorls, distinctly separated from the rest of shell. A thin, sharp and prominent list sometimes occurs on the boundary. Teleoconch reaching ten whorls, the last of which is devoid of carina. Shell base rounded, in younger specimen slightly flattened. Two thin, spiral cords, the upper one situated halfway the whorl, appear on the first teleoconchal whorl. The secondary and tertiary cords are developed beginning with the second whorl. Two early ones are on all whorls considerably more prominent than the rest of them. Axial wrinkles varying in prominence from scarcely visible to fairly robust ones which can already play the role of axial ribs also occur on whorls. The presence of wrinkles is the reason why two cardinal spiral cords are crenate or tuberculate. In addition, the whorls display prominent, roller-like varices, usually three or, less frequently, two of them per whorl, situated approximately at intervals equalling about one-third of whorl, but only rarely arranged regularly one over another on the whorls. As a rule, they start to develop as early as on the fourth or fifth whorl and only exceptionally as late as on the last one (Pl. XVIII, Fig. 4). On the last whorl occur three more prominent spiral cords (the lowest of them sometimes also visible on preceding whorls), while axial wrinkles are much less strongly developed or even absent at all. Shell base ornamented by spiral cords only. Aperture oval, outer lip in all specimens broken-off as far as the last varix, inner lip very thin, in particular posteriorly, siphonal canal short, slightly bent.

**Remarks.** — The conspecificity of the specimens from Korytnica with shells described by BOETTGER (1901) from Kostej and Lapugy, Rumania as *Cerithium (Conocerithium) banaticum* BOETTGER is beyond any doubt. No essential differences are observed between specimens from these localities. In the Korytnica clays, this species is relatively common. Some of its shells are more grown-up (consist of more whorls), which makes them twice as high than those from Kostej. On the average, however, their dimensions are much the same. A specimen from Sámsonháza, Hungary (CSEPREGHY-MEZNERICS, 1954; STRAUZ, 1966) is also conspecific. BOETTGER (1901, 1907) and ZILCH (1934), as well as CSEPREGHY-MEZNERICS (1954), KÓKAY (1966) and STRAUZ (1966) assign this species to subgenus *Cerithium (Conocerithium)* SACCO, 1895. The correctness of this view seems, however, to be doubtful. This species is strongly related to the Eocene *Hemicerithium imperfectum* (DESHAYES), which is a type species of the genus *Hemicerithium* COSSMANN, 1893 and this is the reason why the present writer assigns the species in question to *Hemicerithium*. It was BOETTGER (1901, p. 119) himself who considered *H. banaticum* as a descendant of *H. imperfectum*. Specimens from Zborów, Podolia, described by FRIEDBERG (1938) as *Tritonium(?) zboroviense* FRIEDBERG also belong without any question to *H. banaticum*. Also a similar, if not identical, is probably the species *H. saubottense* VIGNAL, described from the Miocene of Aquitaine (COSSMANN & PEYROT, 1922). The variability observed among the specimens from Korytnica is expressed in a more or less slender shape of shells, prominence of axial wrinkles and the number and places of appearance of varices. It is very likely that another species, described by BOETTGER (1901) from Kostej, that is, *H. evae* (BOETTGER) was separated erroneously. The differences between it and *H. banaticum* are rather minor and it is not unlikely that they might be included in the range of variability. The lack of specimens quite similar to *H. evae* among those from Korytnica, induces the present writer to be rather cautious in this respect.

*H. banaticum* (BOETTGER) has not so far been known from the Miocene of Poland.

### ***Hemicerithium (Hemicerithium) subcostatum* sp. n.**

(Pl. XVIII, Figs 1-3)

?1914. *Cerithium* sp. *an fallax* GRAT.; W. FRIEDBERG, p. 271, Text-fig. 58.

*Holotype*: Pl. XVIII, Fig. 1 (Z.PAL.U.W., No BkK-G 285).

*Type horizon*: Lower Tortonian (= Lower Badenian).

*Type locality*: Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.

*Derivation of the name*: Lat. *subcostatum*, after not very prominent axial ribs.

**Diagnosis.** — A shell with whorls ornamented by many spiral cords and not very prominent axial ribs. An indistinctly separated, narrow strip and, above it, fine, tuberculate elevations are situated at the top of later whorls.

**Material.** — Eighteen specimens.

**Dimensions.** — The largest specimen (Pl. XVIII, Fig. 3) is 9.5 mm high and 5.0 mm wide.

**Description.** — Shell medium-sized, rather thin-walled, shaped like a not very slender and even somewhat dumpy turret. Protoconch not preserved in any of the specimens. Teleoconch reaching about seven whorls, the last of them being markedly rounded at the base without any traces of carina. Three early teleoconchal whorls display two spiral cords; further on, the number of cords considerably increases and the first two are almost indistinguishable from



the others. Cords are flattened, closely-spaced and separated by narrow and shallow grooves. Not very prominent axial ribs (10 to 14), the most robust one in the middle part of whorl and not reaching its top (that is, suture), are developed beginning with the third whorl. Some of them (and not in all specimens) are somewhat stronger and form varices. The uppermost part of two or three later whorls is separated from the rest of whorl by a shallow depression and small, tuberculate elevations, slightly more numerous than axial ribs, are developed on thus separated narrow strip. On the last whorl, axial ribs disappear and three of the spiral cords become somewhat more prominent. Shell base also ornamented by spiral cords. Aperture (preserved only exceptionally, Pl. XVIII, Fig. 3) oval, slightly oblique, anteriorly extended in the form of a short and only slightly bent siphonal furrow. Both lips fairly thin. The terminal sector of the last whorl somewhat "swollen". No typical varix observed. The specimen with the preserved aperture, mentioned above, has, halfway the last whorl, a very distinct trace of an earlier aperture.

**Remarks.** — In the present writer's opinion, the specimens shown above cannot be assigned to any of so far described species. A certain similarity to them is displayed by FRIEDBERG (1914, Text-fig. 58) as *Cerithium* sp. an *fallax* GRATELOUP. However, it differs from the specimen, considered by the present writer as a holotype of *H. subcostatum* sp. n., in twice as large dimensions with a similar height-width proportions of shell and much the same ornamentation. If it is likely that the shell from Zborów mentioned above is conspecific with the specimens from Korytnica, its assignment to *H. fallax* (GRATELOUP) is out of the question. Specimens of this species, known from the Miocene of Aquitaine (COSSMANN & PEYROT, 1922, Pl. 5, Figs 78-83 and 89) are marked by a distinctly different shape of shells.

## Family CERITHIOPSIDAE H. & A. ADAMS, 1854

### Genus CERITHIOPSIS FORBES & HANLEY, 1849

#### Subgenus CERITHIOPSIS (CERITHIOPSIS)

#### *Cerithiopsis* (*Cerithiopsis*) *tubercularis* (MONTAGU, 1803)

(Pl. XIX, Figs 1-5)

1856. *Cerithium pygmaeum* PHIL.; M. HÖRNES, pp. 415-416, Pl. 42, Fig. 21.  
 1914. *Cerithiopsis astensis* COSSM.; W. FRIEDBERG, pp. 307-308, Pl. 18, Figs 15-17.  
 1922. *Cerithiopsis Vignali* nov. sp.; M. COSSMANN & A. PEYROT, pp. 292-293, Pl. 7, Figs 70-71.  
 1937. *Cerithiopsis* (*Cerithiopsis*) *tubercularis* MONTAGU; R. SIEBER, pp. 504-505.  
 1938. *Cerithiopsis Vignali* COSSM. & PEYR.; W. FRIEDBERG, p. 104.  
 1949. *Cerithiopsis vignali* COSSMANN & PEYROT; M. GLIBERT, pp. 151-152, Pl. 10, Fig. 3.  
 1950b. *Cerithiopsis vignali* COSSM. & PEYR.; W. KRACH, p. 305, Pl. 1, Fig. 2.  
 1954. *Cerithiopsis astensis* COSSM.; L. STRAUZ, p. 18, Pl. 2, Fig. 32.  
 1960. *Cerithiopsis tubercularis astensis* COSSMANN; J. ŠVAGROVSKÝ, pp. 84-85, Pl. 8, Fig. 13.  
 1966. *Cerithiopsis tubercularis astensis* COSSMANN; L. STRAUZ, pp. 164-165, Pl. 8, Figs 22-26.  
 ?1970. *Cerithiopsis* (*Cerithiopsis*) *zboroviensis* FRIEDB.; G. RADO & R. MUTIU, p. 147, Pl. 5, Figs 5-6, 15.

**Material.** — A hundred and seventy specimens.

**Dimensions.** — The largest specimen, with an incomplete protoconch, is 6.0 mm high and 1.6 mm wide.

**Description.** — Shell small or medium-sized, not very thin-walled, shaped like a slender turret, or somewhat cylindrical and, sometimes, even fusiform in outline. Protoconch very slender, pointed, consisting of about five smooth and slightly convex whorls. A fairly distinctly angular bend near the lower suture is marked only at the end of the last whorl. Boundary with teleoconch very distinct. Teleoconch reaching 12 to 13 nearly quite flat whorls. Shell base slightly rounded or somewhat flattened. Ornamentation, starting as early as the boundary with protoconch, consists of three conspicuously granulated spiral ribs. The lower rib is the thickest and runs along the extension of the bend visible on the protoconchal whorl. The upper rib, at first very thin, becomes nearly the same as the middle one as early as the second whorl, while beginning with the fifth whorl all ribs are uniform in thickness. The space between the two upper ribs is somewhat smaller in all specimens. In addition, the shell has not very prominent axial ribs, whose number on early whorls amounts to 12 to 14 and on later ones to 17 to 19, while on the last whorl it increases suddenly to 21 to 24. On the last whorl, spiral ribs are considerably wider and axial ones narrower, which considerably increases the length of tubercles occurring at intersections. Two more (less frequently one only), but smooth ribs occur below the granulated ones. Aperture oval, slightly oblique, anteriorly extended in the form of a short, but fairly wide and bent siphonal canal. Both lips thin, varix lacking.

**Remarks.** — Considerable differences in the shape and size of shells, and, at the same time, a nearly identical ornamentation, pose difficulties in a proper identification of here assigned specimens. Specimens conspecific with the shells from Korytnica described above are fairly common in the Miocene and Pliocene deposits (see synonymy). They are usually determined as either *C. (C.) astensis* SACCO, or *C. (C.) vignalii* COSSMANN & PEYROT. It seems, however, that these specimens should not be separated from the Recent species *C. (C.) tubercularis* (MONTAGU) and, consequently following SIEBER's (1937) example, the present writer assigns the Korytnica specimens to the last-named species. All the differences observed are probably the symptom of the specific variability only.

*C. (C.) tubercularis* (MONTAGU) has not so far been known from Korytnica. However, in the Miocene of Poland it is a fairly frequent species. It was recorded (under the names *C. astensis* or *C. vignalii*) at Libiąż (KRACH, 1939), Małoszów (KRACH, 1947), Trzydnik (KRACH, 1950*b*), Mniszek (KRACH, 1962*b*), Benczyn (KRACH, 1950*a*), Bogucice (LISZKA, 1933) and Brzeźnica (KRACH, 1960). On the other hand, the specimen from Niskowa (BAŁUK, 1970) does not belong here.

### ***Cerithiopsis (Cerithiopsis) elsae* BOETTGER, 1901**

(Pl. XIX, Figs 6-8)

1901. *Cerithiopsis elsae* n. sp.; O. BOETTGER, pp. 127-128, no. 398.

1934. *Cerithiopsis elsae* BOETTGER; A. ZILCH, p. 222, Pl. 8, Fig. 37.

1966. *Cerithiopsis irmae* BOETTGER; L. STRAUZ, pp. 165-166, Pl. 8, Figs 27-28, non Fig. 29, *partim*.

**Material.** — Twelve specimens.

**Dimensions.** — The largest specimen (without protoconch) is 4.4 mm high and 1.4 mm wide.

**Description.** — Shell small, not very thin-walled, turretlike. Protoconch slender, pointed, consisting of about five smooth and slightly convex whorls, distinctly separated from the rest of shell. Teleoconch reaching about nine nearly quite flat whorls. Shell base only slightly

flattened. Ornamentation appearing as early as on the boundary with protoconch. Two prominent spiral ribs occur on the first whorl. The upper one of them is slightly less strongly developed, with a very delicate, shallow groove gradually more and more distinct and dividing the rib in two, which runs from the beginning through its middle. Thus, three ribs occur on further whorls, two upper ones situated somewhat nearer each other, but on the last whorl this difference is very small. In addition, many axial ribs occur on the shell. Roundish granules are developed at the intersections of ribs of the two types. The number of axial ribs amounts to 12 to 15 on the early and to 16 to 20 on the later whorls. The fourth, smooth rib runs on the last whorl just below three other, granulated spiral ribs. One more smooth cord occurs on shell base. Aperture oval, somewhat quadrilateral in outline, anteriorly extended in the form of a short, bent siphonal canal.

**Remarks.** — In their shape, size and ornamentation the shells described above strongly resemble a specimen recognized by ZILCH (1934) as a lectotype of *C. (C.) elsae* BOETTGER. The conspecificity of the specimens from Korytnica with those from Kostej and Bujtur, Rumania (BOETTGER, 1901) seems to be unquestionable. FRIEDBERG (1938) was inclined to include in this species *C. zboroviensis*, a species he erected earlier (FRIEDBERG, 1914).

*C. (C.) elsae* BOETTGER has not so far been known from the Miocene of Poland.

### **Cerithiopsis (Cerithiopsis) ulricae** BOETTGER, 1901

(Pl. XIX, Fig. 12)

1901. *Cerithiopsis ulricae* n. sp.; O. BOETTGER, pp. 126-127, no. 396.

1907. *Cerithiopsis ulricae* BTGR.; O. BOETTGER, p. 145, no. 503.

1934. *Cerithiopsis ulricae* BOETTGER; A. ZILCH, p. 222, Pl. 8, Fig. 35.

**Material.** — Four specimens.

**Dimensions.** — The largest specimen, without protoconch (Pl. XIX, Fig. 12), is 5.6 mm high and 1.5 mm wide.

**Description.** — Shell small, fairly thin-walled, shaped like a very slender, conical turret. Protoconch as a whole not preserved in any of the specimens. Its last, slightly convex and quite smooth, whorl is visible in one specimen only. Teleoconch reaching twelve nearly quite flat whorls, separated from each other by fairly deep sutures. Shell base slightly flattened. Ornamentation formed by three spiral and many axial ribs, which intersecting each other produce roundish granules. On the first whorl, the upper rib is very thin, but, beginning with the fourth or fifth whorl, all spiral ribs are nearly identical. The space between two upper ones is smaller and, although this difference gradually decreases, it is visible up to the last whorl. The number of axial ribs fluctuates within limits of 12 and 14 on the early and of 17 to 21 on the later whorls. One more rib, which in contrast to the remaining ones is nearly quite smooth, runs on the last whorl below the three spiral ribs. Shell base smooth. Aperture oval, slightly oblique, anteriorly terminating in a short, bent siphonal canal. Both lips fairly thin. Varices lacking.

**Remarks.** — In their size, shape and ornamentation the specimens here assigned are in a complete conformity with a specimen considered by ZILCH (1934) as a lectotype of *C. (C.) ulricae* BOETTGER and thus their conspecificity with those from Kostej is beyond any doubt.

*C. (C.) ulricae* BOETTGER has not so far been known from the Miocene of Poland. Outside of Korytnica, it has hitherto been found only at Kostej, Rumania.

**Cerithiopsis (Cerithiopsis) aff. johannae BOETTGER, 1901**

(Pl. XIX, Fig. 13)

1901. *Cerithiopsis johannae* n. sp.; O. BOETTGER, p. 127, no. 397.1907. *Cerithiopsis johannae* BOETTGER; O. BOETTGER, p. 146, no. 504.1934. *Cerithiopsis johannae* BOETTGER; A. ZILCH, p. 222, Pl. 8, Fig. 36.**Material.** — Two specimens.**Dimensions.** — The larger specimen, preserved in the form of nine early (?) whorls and without protoconch (Pl. XIX, Fig. 13) is 6.0 mm high and 1.8 mm wide.**Description.** — Shell medium-sized, not very thin-walled, shaped like a slender, conical turret. Protoconch and the earliest teleoconchal whorls not preserved. In the more complete specimen, teleoconch consisting of nine flat whorls separated from each other by fairly deep sutures. Shell base flattened. Ornamentation prominent, consisting of spiral and, slightly thicker, axial ribs, which, intersecting each other, form relatively large, roundish tubercles. Two spiral and eleven axial ribs run on the first of the preserved whorls. On further whorls, the third rib appears above the upper one of the two spiral ribs and rapidly reaches their thickness. The fourth rib, having less strongly developed tubercles, occurs on the last whorl below the three tuberculate spiral ribs. In this place, the number of axial ribs amounts to 18. Only one, very thin spiral cord, which in fact is situated as far as on the siphonal canal, as well as the traces of radial striae, are developed on the base. Aperture oval, somewhat quadrilateral, anteriorly extended and forming a short, bent siphonal canal.**Remarks.** — The identification of here assigned specimens may arouse certain doubts. For, although their ornamentation is nearly in a complete conformity with BOETTGER'S (1901, 1907) description and although the light test he recommended (BOETTGER, 1907) yields positive results, but the two specimens from Korytnica are considerably more slender. In the slenderness of shell they resemble more *C. ulricae* BOETTGER, but, induced by easily seen differences in ornamentation, the present writer has separated the two specimens from other ones.*C. (C.) johannae* BOETTGER has not so far been known from the Miocene of Poland. Outside of Korytnica, this species occurs only at Kosteĵ and Lapugy, Rumania.**Cerithiopsis (Cerithiopsis) pseudomanzoni BOETTGER, 1907**

(Pl. XIX, Figs 22-24)

1901. *Cerithiella manzoniana* (COCC.); O. BOETTGER, p. 132, no. 409.1907. *Cerithiopsis pseudomanzoni* n. sp.; O. BOETTGER, p. 149, no. 516.1914. *Cerithiopsis Januszkiewiczzi* FRIEDB.; W. FRIEDBERG, p. 310-311, Pl. 18, Fig. 22.1934. *Cerithiopsis pseudomanzoni* BOETTGER; A. ZILCH, p. 223, Pl. 8, Figs 41-43.1966. *Cerithiopsis pseudomanzoni* BOETTGER; J. KÓKAY, p. 46, Pl. 4, Fig. 23.?1970. *Cerithiopsis (Cerithiopsis) januszkiewiczzi* FRIEDB.; G. RADO & R. MUTIU, p. 147, Pl. 5, Fig. 4.**Material.** — Twelve specimens.**Dimensions.** — The largest specimen, preserved in the form of four incomplete later whorls (Pl. XIX, Fig. 24) is 4.4 mm high and 2.0 mm wide.

**Description.** — Shell small or medium-sized, not very thin-walled, shaped like a very slender turret. Protoconch relatively large, slender, not preserved complete in any of the specimens. Its later whorls are quite smooth, very slightly convex. A very delicate bend, situated somewhat nearer the upper suture, is marked on the last whorl. Boundary with teleoconch very distinct. Judging by shell fragments, varying in width, it reaches 12 to 14 very slightly convex whorl. The last whorl (?) strongly flattened at the base. Ornamentation fairly prominent, first appearing on the boundary with protoconch. It consists of three spiral and many axial ribs, which, intersecting each other, form roundish granules. On the first teleoconchal whorl, the upper spiral rib, at first very thin, gradually becomes wider and wider, but remains to the end distinctly less robust than nearly identical other two ribs. The middle rib is developed as an extension of the above mentioned bend on the last protoconchal whorl. The number of axial ribs amounts to 18 to 20 on the early and to 27 to 30 on the later whorls. One more (the fourth) spiral rib, visible in part also on a few preceding whorls, runs on the last whorl. Intercostal spaces delicately grooved spirally. Aperture oval, quadrilateral in outline, anteriorly extending to form a short and bent siphonal canal.

**Remarks.** — The specimens from Korytnica described above are in a complete conformity with the description and illustrations of those of *C. (C.) pseudomanzoni* BOETTGER from Kostej, Rumania and Soos, Vienna Basin (ZILCH, 1934) and, therefore, their conspecificity is unquestionable. In the writer's opinion, they are also conspecific with *C. januszkiewiczi* FRIEDBERG and for this reason the latter name should be considered as a synonym of *C. pseudomanzoni*.

*C. (C.) pseudomanzoni* BOETTGER has not so far been known from Korytnica. In the Miocene of Poland, this species, identified as *C. januszkiewiczi*, was mentioned from Benczyn (KRACH, 1950a) and Bogucice (LISZKA, 1933; FRIEDBERG, 1938).

#### Subgenus CERITHIOPSIS (CERITHIOPSIDA) BARTSCH, 1911

##### *Cerithiopsis (Cerithiopsida) irmae* (BOETTGER, 1901)

(Pl. XIX, Figs 9-11)

1901. *Cerithiopsis irmae* n. sp.; O. BOETTGER, p. 126, no. 395.

1907. *Cerithiopsis irmae* BOETTGER O. BOETTGER, p. 145, no. 502.

1934. *Cerithiopsis irmae* BOETTGER; A. ZILCH, p. 221, Pl. 8, Fig. 34.

1966. *Cerithiopsis irmae* BOETTGER; L. STRAUSZ, pp. 165-166, Pl. 8, Fig. 29, non Figs 27-28 *partim*.

**Material.** — Ten specimens.

**Dimensions.** — The largest specimen, with an incomplete protoconch (Pl. XIX, Fig. 11) is 4.0 mm high and 1.1 mm wide.

**Description.** — Shell small, not very thin-walled, shaped like a slender turret, whose early part is conical and later cylindrical. Protoconch (preserved complete in two specimens) consisting of about four whorls, the first one and a half of which are smooth and convex, and further ones provided with a spiral rib situated nearer the lower suture and several very thin axial ribs running above the spiral one. Boundary with teleoconch very distinct. Teleoconch reaching eleven nearly quite flat whorls. Shell base flattened. Ornamentation rather prominent. Two spiral ribs, the upper one at first considerably thinner than the lower, situated in the extension of the protoconchal rib, occur on the first whorl. The difference between these ribs gradually decreases. Beginning with the fourth whorl, a delicate groove, appearing in the middle

of the upper rib, starts to divide it in two. Three ribs, two upper ones of which are closer to each other, run on the later whorls. In addition, slightly oblique, posteriorly running axial ribs occur on the shell. Fairly prominent, roundish or somewhat spiny granules are formed at the intersections. The number of axial ribs amounts to 12 or 13 on the early and to 15 or 16 on the later whorl. Two smooth cords (the upper one also visible in part on the preceding whorls) are also observed on the last whorl below the granulated ribs. Aperture relatively small, roundish, anteriorly extended to form a short and bent siphonal canal.

**Remarks.** — A complete conformity in size, shape and ornamentation of the shells described above with a specimen recognized by ZILCH (1934) as a lectotype of *C. irmae* BOETTGER gives evidence that the conspecificity of the Korytnica specimens with those described by BOETTGER (1907) from Kostej and Lapugy, Rumania does not arouse any doubt. Despite what STRAUZ (1966) maintains, *C. irmae* differs from *C. elsae* to such an extent that these species cannot be associated with each other. Moreover, in the present writer's opinion, they belong to different subgenera. The discrepancies in the structure of protoconch make up a fundamental difference, the shape and ornamentation of teleoconch, although remotely resemblant, being also different. Only one of the specimens illustrated from Varpalota, Hungary (STRAUSZ, 1966, Pl. 8, Fig. 29) might possibly be assigned to *C. irmae*, the other undoubtedly belonging to *C. elsae*. The protoconch preserved in the specimens from Korytnica seems to indicate that the species under study should be referred to the subgenus *C. (Cerithiopsida)* BARTSCH, 1911.

*C. (Cerithiopsida) irmae* (BOETTGER) has not so far been known from the Miocene of Poland.

#### Subgenus **CERITHIOPSIS (METAXIA)** MONTEROSATO, 1884

#### **Cerithiopsis (Metaxia) metaxae** (DELLE CHIAJE, 1826)

(Pl. XIX, Figs 15-16)

1901. *Cerithiopsis (Metaxia) metaxae* (D. CH.); O. BOETTGER, p. 131, no. 406.  
 1907. *Cerithiopsis (Metaxia) metaxae* (D. CH.); O. BOETTGER, p. 147, no. 511.  
 1907. *Cerithiopsis (Metaxia) compacta* n. sp.; O. BOETTGER, pp. 147-148, no. 512.  
 1914. *Cerithiopsis metaxa* DELLA CHIAJE; W. FRIEDBERG, pp. 309-310, Pl. 18, Figs 20-21.  
 1934. *Cerithiopsis (Metaxia) compacta* BOETTGER; A. ZILCH, p. 224, Pl. 9, Fig. 49.  
 ?1949. *Cerithiopsis turoniense* nov. sp.; M. GLIBERT, pp. 153-154, Pl. 10, Fig. 6.  
 1950b. *Cerithiopsis metaxa* DELLA CHIAJE; W. KRACH, p. 306, Pl. 1, Figs 3 and 5.  
 1954. *Cerithiopsis metaxa* CHIAJE; L. STRAUZ, p. 18, Pl. 2, Fig. 30.  
 1966. *Cerithiopsis (Metaxia) rugulosa metaxae* CHIAJE; L. STRAUZ, p. 167, Pl. 8, Fig. 21.

**Material.** — Twenty-five specimens.

**Dimensions.** — The largest specimen, preserved in the form of eight early whorls and without protoconch (Pl. XIX, Fig. 15) is 3.8 mm high and 1.1 mm wide. Other fragmentary, specimens reach 1.4 mm in width.

**Description.** — Shell small, fairly thin-walled, shaped like a very slender turret. Protoconch slender, somewhat pointed, consisting of about four and a half slightly convex whorls, with a bent, situated somewhat nearer the lower suture, marked on the last of them. Judging by fragments, teleoconch reached 12 to 14 strongly convex whorls, separated by fairly deep sutures. Shell base flattened, even slightly concave in part. Ornamentation, appearing on the boundary with protoconch, consists of four spiral and fairly numerous axial ribs, which, intersecting each

other, form fairly sharp tubercles. Two lower spiral ribs are at first more prominent, but gradually this difference between them and two upper two upper ones decreases, so that on later whorls the ribs are nearly identical. In some specimens, axial ribs are prominent even beginning with the first whorl, while in some others they are at first very poorly developed and become more distinct only beginning with the third whorl. In all cases, they are stronger in the middle and lower part of whorl but, on the other hand, they hardly reach the upper suture and, consequently, the uppermost spiral rib is frequently nearly quite smooth. The number of axial ribs amounts to 11 to 12 on the early and to 15 to 17 on the later whorls. Aperture destroyed in all the specimens.

**Remarks.** — Specimens quite similar or strongly related to those described above are known from many localities of the Miocene deposits. Most frequently, they are assigned to *C. (M.) metaxae* (DELLE CHIAJE). This Recent species has in fact (see GLIBERT, 1949, Pl. 10, Fig. 4) a shell slightly different in the shape of whorls, depth of sutures and prominence of ornamentation, but these differences are so small that they may be treated as symptoms of variability. Among the specimens from Kostej shells with slightly lower whorls and more prominent spiral ribs were separated by BOETTGER (1907), who erected for them a new species called *C. (M.) compacta* BOETTGER. Similar shells also occur at Korytnica, but the present writer does not separate them, since in his opinion, the differences observed are unworthy of being considered as specific characters. Of the species recorded in the Miocene of the Loire Basin, *C. (M.) turoniense* GLIBERT may be conspecific with the Korytnica specimens, although it has slightly wider ribs.

*C. (M.) metaxae* (DELLE CHIAJE) has not so far been mentioned from Korytnica. In the Miocene of Poland, this species is known from Trzydnik (KRACH, 1950*b*) and Brzeźnica (KRACH, 1960).

#### Subgenus CERITHIOPSIS (DIZONIOPSIS) SACCO, 1895

#### *Cerithiopsis (Dizoniopsis) bilineata* (HÖRNES, 1856)

(Pl. XIX, Fig. 21)

1856. *Cerithium bilineatum* HÖRN.; M. HÖRNES, P. 416, Pl. 42, Fig. 22.  
 1901. *Cerithiopsis (Dizoniopsis) bilineata*, et var. *exilis* n.; O. BOETTGER, p. 130, no. 403.  
 ?1901. *Cerithiopsis (Dizoniopsis) ventricosa* BRUS. var. *subventricosa* n.; O. BOETTGER, p. 131, no. 405.  
 1910. *Cerithiopsis (Dizoniopsis) bilineata* HOERNES; L. VIGNAL, p. 184, Pl. 9, Fig. 43.  
 1914. *Cerithiopsis bilineata* HOERN.; W. FRIEDBERG, pp. 308-309, Pl. 18, Fig. 17.  
 1922. *Cerithiopsis (Dizoniopsis) aquitaniensis* nov. sp.; M. COSSMANN & A. PEYROT, pp. 295-297, Pl. 7, Figs 53-56.  
 1934. *Cerithiopsis (Dizoniopsis) bilineata exilis* BOETTGER; A. ZILCH, p. 223, Pl. 8, Fig. 44.  
 ?1934. *Cerithiopsis (Dizoniopsis) ventricosa subventricosa* BOETTGER; A. ZILCH, p. 223, Pl. 8, Fig. 45.  
 1937. *Cerithiopsis (Dizoniopsis) bilineata* (HÖRN.); R. SIEBER, pp. 505-506, Pl. 25, Fig. B2.  
 1949. *Cerithiopsis (Dizoniopsis) bilineata* HÖRNES; M. GLIBERT, pp. 152-153, Pl. 10, Fig. 5.  
 1956. *Cerithiopsis bilineata* M. HÖRNES; I. CSEPREGHY-MEZNERICS, p. 388, Pl. 3, Figs 13-14.  
 1966. *Cerithiopsis bilineata* HÖRNES; L. STRAUZ, p. 166, Pl. 8, Figs 30-32.  
 1970. *Cerithiopsis (Cerithiopsis) bilineata exilis* BOETTGER; G. RADO & R. MUTIU, p. 147, Pl. 5, Fig. 13.  
 1970. *Cerithiopsis (Dizoniopsis) bilineata* (HÖRNES); A. GRECO, p. 287, Pl. 3, Figs 8-9.

**Material.** — Fifty specimens.

**Dimensions.** — The largest specimen, without protoconch (Pl. XIX, Fig. 21), is 4.6 mm high and 1.5 mm wide.

**Description.** — Shell small, not very thin-walled, shaped like a not very slender turret. Protoconch not preserved complete in any of the specimens. Its last but one whorl is slightly convex and the last provided with a robust spiral rib running somewhat nearer the lower suture. Teleoconch reaching eleven nearly quite flat whorls. Shell base rounded or insignificantly flattened. Ornamentation consisting of two, strong spiral ribs, the lower one of which (running in the extension of the protoconchal rib) is more robust on early whorls. On middle whorls, they are identical and on later whorls the upper rib becomes more prominent. In addition, there occur not very wide axial ribs. Prominent granules, at first roundish and then oval, are formed at the intersections of ribs of the two types. The number of axial ribs amounts to 13 to 15 on early and 16 to 22 on later whorls. On the last whorl, both spiral ribs are considerably wider and axial slightly narrower, which gives the granules a strongly elongate shape. Sometimes, a slight trace of their dichotomy may be observed on both spiral ribs. Three or four prominent smooth spiral cords (the uppermost one also partly visible on earlier whorls) run here below the granulated ribs. Aperture quadrilateral in outline, posteriorly extended in the form of a short, bent siphonal canal.

**Remarks.** — The identification of here assigned specimens is rather difficult and, in the present writer's opinion, not quite obvious. For, although they are probably conspecific with those described by BOETTGER (1901), FRIEDBERG (1914), SIEBER (1937), GLIBERT (1949), CSEPREGHY-MEZNERICS (1956), STRAUZ (1966) and GRECO (1970) as *C. (D.) bilineata* (HÖRNES), but they considerably differ from the specimen from Steinabrunn, Vienna Basin, presented by HÖRNES (1856, Pl. 42, Fig. 22), which is incomparably more slender (according to HÖRNES, 8 mm high and 1 mm wide). Although such a great variability is unimaginable, but — trusting SIEBER (1937) — it should be accepted. COSSMANN & PEYROT (1922) had similar doubts. Presenting the specimens from Aquitaine, undoubtedly conspecific with those from Korytnica, and identified by their predecessors as *C. bilineata*, these authors also pointed out their dissimilarity to the specimen from Steinabrunn and erected for them a new species, *C. aquitaniensis* COSSMANN & PEYROT. The differences between the specimens from Kostej, described by BOETTGER (1901, 1907) as *C. (D.) bilineata exilis* BOETTGER and *C. (D.) ventricosa subventricosa* BOETTGER are also not quite obvious to the present author. Among the whorls from Korytnica, there are also the specimens which could be considered conspecific with both taxons mentioned above, but the differences between them are so insignificant that separating them from each other and from *C. (D.) bilineata bilineata* would be groundless.

*C. (D.) bilineata* (HÖRNES) has not so far been known from Korytnica. In the Miocene of Poland, this species was mentioned from Małoszów (KRACH, 1947), Benczyn (KRACH, 1950a) Skoczów (KRACH, 1974) and Brzeźnica (KRACH, 1960).

### **Cerithiopsis (Dizoniopsis) pusilla** BOETTGER, 1901

(Pl. XIX, Figs 17-20)

1901. *Cerithiopsis (Dizoniopsis) ventricosa* BRUS., var. *pusilla* n.; O. BOETTGER, p. 131, no. 405.

1907. *Cerithiopsis (Dizoniopsis) ventricosa* BRUS., var. *electa* n.; O. BOETTGER, p. 147, no. 510.

1934. *Cerithiopsis (Dizoniopsis) ventricosa pusilla* BOETTGER; A. ZILCH, p. 223, Pl. 8, Fig. 46.

1934. *Cerithiopsis (Dizoniopsis) ventricosa electa* BOETTGER; A. ZILCH, p. 224, Pl. 8, Fig. 47.

**Material.** — Twenty specimens.

**Dimensions.** — The largest specimen, without protoconch, is 4.0 mm high and 1.5 mm wide.



**Description.** — Shell small, fairly thick-walled, shaped like a not very slender, more or less rotund turret. Protoconch very slender, pointed, very distinctly differing in shape from the rest of shell and composed of about five, slightly convex whorls, the first two of which are smooth and the rest very delicately ribbed axially. Teleoconch reaching six nearly quite flat whorls. Shell base rounded. Two spiral ribs, the upper one considerably less strongly developed, form the ornamentation of the first teleoconchal whorl. A delicate groove gradually more and more distinctly dividing in two the upper rib appears beginning with the second whorl, so that three almost identical ribs are visible on later whorls. In addition, the shell is ornamented by axial ribs which, intersecting with spiral ones, form roundish tubercles. The number of axial ribs varies from 13 on the early whorls to 18 to 20 on the last whorl. Two (or, less frequently, one) smooth spiral cords, the lower of them considerably thinner and situated almost on the siphonal canal, run on the last whorl. Aperture relatively small, oval. Siphonal canal short and bent.

**Remarks.** — A fairly considerable variability in the shape and size of shells and the prominence of ornamentation is observed among the specimens here assigned, which include those completely conformable with the specimens described by BOETTGER (1901, 1907) as both *C. (D.) ventricosa pusilla* BOETTGER, 1901 and *C. (D.) ventricosa electa* BOETTGER, 1907. Since there are also specimens marked by transitional characters, it seems that treating the two taxons separately is groundless. The first of the names mentioned above, as used earlier, has a priority. Due to considerable differences as compared with other subspecies of *C. (D.) ventricosa*, in particular with the nominal subspecies, the present writer considers *C. (D.) pusilla* BOETTGER as a separate species. *C. (D.) pusilla* differs from *C. (D.) bilineata* in a more dumpy shape of shell, in the upper spiral rib distinctly dichotomous on the two later whorls and in the presence of only one or two smooth, spiral cords on shell base.

*C. (D.) pusilla* BOETTGER has not so far been known from the Miocene of Poland.

#### Subgenus **CERITHIOPSIS (KRACHIA)** subgen. nov.

**Diagnosis.** — Protoconch consisting of two and a quarter strongly convex whorls, the first of which is quite smooth and the second densely ribbed axially and grooved spirally, the grooves occurring in intercostal spaces. Teleoconch having the same size, shape and ornamentation as those in *Cerithiopsis (Cerithiopsis)*.

*Type species: Cerithiopsis (Krachia) korytnicensis* sp. n.

*Derivation of the name: Krachia* — in honour of Professor WILHELM KRACH.

#### **Cerithiopsis (Krachia) korytnicensis** sp. n.

(Pl. XIX, Fig. 14)

*Holotype:* Pl. XIX, Fig. 14 (Z.Pal.U.W., No BkK-G 311).

*Type horizon:* Lower Tortonian (= Lower Badenian).

*Type locality:* Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.

*Derivation of the name: korytnicensis* — after the locality Korytnica.

**Diagnosis.** — Protoconch — see the subgeneric diagnosis. Teleoconch turretlike, whorls flat, ornamentation in the form of three spiral intersecting many axial ribs.

**Material.** — Three specimens.

**Dimensions.** — The largest specimen (established as holotype) is 5.0 mm high and 1.7 mm wide.

**Description.** — Shell consisting of two and a quarter convex whorls, the first of them smooth, the second densely ribbed axially and grooved spirally. Grooves visible in intercostal spaces. The boundary of protoconch very sharp and distinct. Teleoconch reaching about eight nearly quite flat whorls. Ornamentation, appearing as early as on the boundary of protoconch, consists of three spiral and many axial ribs (slightly oblique and directed posteriorly). Roundish tubercles are developed at intersections of the two types. The upper spiral rib is the thinnest on the first teleoconchal whorl and the lower the strongest. Further, these differences disappear so that on later whorls the ribs are identical, except for the space between the two upper ribs which on all whorls remains somewhat smaller. Two smooth cords (the upper one slightly thicker and partly visible also on preceding whorls) occur on the last whorl just under the granulated spiral ribs. The rest of base smooth. The number of axial ribs amounts to 13 to 15 on early (except for the first teleoconchal whorl of the holotype specimen which has 18 ribs) and 18 to 20 on later whorl. Aperture oval, slightly quadrilateral, anteriorly extended and forming a short, oblique siphonal canal. Both lips fairly thin, varices lacking.

**Remarks.** — Each of the specimens here assigned has protoconch preserved complete. Its size, shape and ornamentation are very characteristic. In gastropods of the genus *Cerithiopsis* FORBES & HANLEY, 1849, protoconch may be variously developed (WENZ, 1940), the differences being expressed in the shape, number and outline of whorls, as well as in the appearance of surface. In none of the subgenera of *Cerithiopsis* protoconch has, however, such a structure as that observed in the Korytnica specimens described above. For this reason, the present writer erects a new subgenus, that is, *Cerithiopsis* (*Krachia*) subgen. nov., in which *C. (K.) korytnicensis* sp. n. is a type species. The structure of teleoconch in this new species slightly resembles that in *C. (C.) tubercularis* (MONTAGU), but differs from it in a somewhat less slender shape and narrower ribs, both axial and spiral. This causes that the tubercles at intersections are slightly smaller and "windows" slightly larger. In addition, smooth spiral cords on the last whorl are more closely-spaced and are situated in the peripheral part of base, while the rest of base is smooth. Nonetheless, the identification of specimens not having the protoconch preserved, may pose a certain problem.

Genus **CERITHIELLA** VERRILL, 1882

?**Cerithiella christinae** BOETTGER, 1901

(Pl. XIX, Fig. 25)

1901. *Cerithiella christinae* n. sp.; O. BOETTGER, p. 133, no. 411.

1907. *Cerithiella christinae* BITGR.; O. BOETTGER, p. 150, no. 518.

1934. *Cerithiella christinae* BOETTGER; A. ZILCH, p. 225, Pl. 9, Fig. 54.

**Material.** — One specimen.

**Dimensions.** — Height, 8.5 mm, width, 2.6 mm.

**Description.** — Shell medium-sized, not very thin-walled, turretlike. Protoconch preserved only fragmentarily. Its three later whorls are convex and ornamented by very thin axial riblets (23 of the occurring on the last whorl). Protoconchal boundary very sharp and distinct. Teleoconch

reaching nine, only very slightly convex whorls. Shell base slightly flattened. Ornamentation prominent and varied. Three spiral, intersecting with axial ribs (13 or 14 of them per whorl) and forming at intersections roundish tubercles, run on three early whorls. One more spiral rib, gradually reaching the thickness of the rest of them, appears at the beginning of the fourth whorl between the middle and upper of the three ribs mentioned above. On middle and later whorls, the upper rib differs from the rest of them in having roundish tubercles whose number considerably exceeds that of axial ribs, which occur 11 to 12 in number, while on the upper rib there are 18 to 22 per whorl. A robust, fairly thick and wide varix is situated on the last whorl at a distance, equalling about two-thirds of whorl, before aperture. Axial ribs fade out behind varix and, instead, there appear secondary spiral ribs. Two more spiral ribs, the lower of them considerably thinner and many (10) thin, spiral cords run at shell base. Aperture destroyed, anteriorly extended and forming a fairly long and bent siphonal canal.

**Remarks.** — The conspecificity of the Korytnica specimen with *C. christinae* BOETTGER is unquestionable. The ornamentation of shell is so characteristic that any possibility of error is out of the question. The Korytnica specimen is considerably more strongly developed than that from Kosteĵ, Rumania, which was recognized by ZILCH (1934) as a lectotype of this species. It is also larger (having more whorls) than any other specimen of *C. christinae* ever known. The single (last) protoconchal whorl preserved in it, having axially ribbed surface, brings in question its assignment to the genus *Cerithiella* VERRILL, 1882, in which, according to WENZ (1940), protoconch is different that is, having smooth whorls.

*C. christinae* BOETTGER has not so far been known from the Miocene of Poland. Outside of Korytnica, this species also occurs at Kosteĵ, Rumania only.

### ?*Cerithiella kostejana* BOETTGER, 1901

(Pl. XIX, Figs 26-27)

1901. *Cerithiella kostejana* n. sp.; O. BOETTGER, pp. 132-133, no. 410.

1907. *Cerithiella kostejana* BOETTGER; O. BOETTGER, p. 150, no. 517.

1934. *Cerithiella kostejana* BOETTGER; A. ZILCH, pp. 224-225, Pl. 9, Fig. 52.

1937. *Cerithiopsis (Cerithiopsis) forchtenauensis* AUING. (in coll.); R. SIEBER, p. 501, Pl. 25, Fig. A2.

1973. *Cerithiella kostejana* BOETTGER; M. BOHN-HAVAS, Pp. 1046-1047, Pl. 3, Figs. 18-19.

**Material.** — Two specimens.

**Dimensions.** — The larger specimen, preserved in the form of six early whorls together with part of protoconch (Pl. XIX, Fig. 27), is 4.0 mm high and 1.7 mm wide.

**Description.** — Shell small (?), not very thick-walled, turretlike. Protoconch not preserved as a whole. In one of the specimens, its last whorl is convex and ornamented by many thin axial riblets. Intercostal spaces smooth. Boundary with teleoconch distinct. Teleoconch reaching nearly seven whorls. The base of the last whorl strongly flattened, but the two specimens found are not fully grown-up. Three identical spiral ribs and 13 axial ribs occur on the first teleoconchal whorl. Roundish tubercles are developed at intersections of ribs of both types. Beginning with the second whorl, the upper spiral rib grows slightly thicker and, at the same time, the groove separating it from the remaining ribs, widens. On further whorls, one more spiral rib is developed in this groove. First it is very thin, but gradually widens and is always different than the remaining ones. The number of axial ribs on later whorls increases to 17 to 19. Aperture quadrilateral in outline, anteriorly extending and forming a short, bent siphonal canal.

**Remarks.** — The two specimens found in the Korytnica clay have identical ornamentation, but considerably differ in the shape of shell. It is only the specimen shown in Pl. XIX, Fig. 27 which may be assigned without reservation to *C. kostejana* BOETTGER. The identification of the other one (Pl. XIX, Fig. 26) may arouse some doubts, but the scarce material available makes the studies on the range of variability of this species utterly impossible. In the present writer's opinion, the specimens from Korytnica and Kostej are conspecific with those from Forchtenau, Vienna Basin, described by SIEBER (1937) under the name *Cerithiopsis (Cerithiopsis) fortchenauensis* AUINGER (in coll.). Since the last-mentioned name was first published as late as only 1937, it should be considered as a younger synonym of *C. kostejana*. Much the same as with *C. christinae* BOETTGER, it is also in this case that the assignment to the genus *Cerithiella* is not obvious to the present writer.

*C. kostejana* BOETTGER has not so far been known from the Miocene of Poland.

### Genus SEILA A. ADAMS, 1861

#### Subgenus SEILA (SEILA)

#### *Seila (Seila) trilineata* (PHILIPPI, 1836)

(Pl. XX, Figs 8-11)

1856. *Cerithium trilineatum* PHIL.; M. HÖRNES, p. 413, Pl. 42, Fig. 19.  
 1895. *Seila trilineata* (PHIL.) var. *crassicincta* SACC.; F. SACCO, p. 73, Pl. 3, Fig. 94.  
 1895. *Seila turritissima* SACC.; F. SACCO, p. 73.  
 1910. *Cerithiopsis (Seila) trilineata* PHILIPPI; L. VIGNAL, pp. 184-185, Pl. 9, Fig. 44.  
 1914. *Seila trilineata* PHIL.; W. FRIEDBERG, pp. 312-313, Pl. 18, Figs 24-25.  
 1922. *Newtoniella (Seila) trilineata* PHIL. var. *crassicincta* SACCO; M. COSSMANN & A. PEYROT, p. 300, Pl. 7, Figs 57-60.  
 1922. *Newtoniella (Seila) turritissima* SACCO; M. COSSMANN & A. PEYROT, pp. 298-299, Pl. 7, Figs 77-78 and 92.  
 1925. *Newtoniella (Seila) trilineata* PHIL.; F. KAUTSKY, p. 84, Pl. 7, Fig. 31.  
 1937. *Seila (Seila) trilineata* (PHIL.); R. SIEBER, pp. 507-508.  
 1949. *Seila (Seila) trilineata* PHILIPPI; M. GLIBERT, pp. 155-156, Pl. 10, Fig. 10.  
 1954. *Seila trilineata* PHIL.; L. STRAUZ, p. 18, Pl. 1, Fig. 19.  
 1966. *Seila trilineata* PHILIPPI; L. STRAUZ, pp. 167-168, Pl. 5, Figs 22 and 24.

**Material.** — Forty, mostly fragmentary shells.

**Dimensions.** — The largest specimen, preserved without protoconch and early teleoconchal whorls (Pl. XX, Fig. 11) is 5.6 mm high and 2.0 mm wide.

**Description.** — Shell medium-sized, fairly thick-walled, shaped like a slender, slightly cylindrical turret. Protoconch, distinctly separated from the rest of shell, consisting of about five whorls, the first four of them smooth and convex and the fifth with a bend, which rapidly transforms into a spiral rib. Two very thin spiral cords appear over the rib at the end of this whorl. Teleoconch reaching about 18 (?) flat whorls. Sutures almost completely obscured by ornamentation. Shell base flattened. On all whorls, ornamentation is formed by three prominent, smooth, spiral ribs, the lower of them running in the extension of a protoconchal rib. All the three ribs are uniform in thickness, except for the lower one, which is thicker on the first two whorls. The space between the two upper ribs is very slightly narrower. Two more, somewhat thinner spiral ribs, the lower of them situated on the base, run on the last whorl. Thin and fairly closely-spaced axial cords occur in troughlike intercostal spaces. Aperture (damaged in all specimens) quadrilateral in outline, anteriorly extended and forming a short and bent siphonal canal.

**Remarks.** — The differences in shape observed among the specimens here assigned are not very extensive but rather quite distinct. Some shells (Pl. XX, Fig. 10) are very slender and cylindrical, others (Pl. XX, Fig. 11) also very slender, but somewhat dumpy. Some investigators (SACCO, 1895; COSSMANN & PEYROT, 1922) were inclined to treat separately the shells slightly differing in shape and with prominent ornamentation. They also believed that these shells differed from the Recent species *S. (S.) trilineata* (PHILIPPI). The present writer is, however, convinced, like most authors (see synonymy) that the differences described are so small that they may be considered as an expression of specific variability. The specimen, illustrated by ANDERSON (1960, Pl. 11, Fig. 6) and assigned to this species has a quite differently developed protoconch and cannot be considered as conspecific with the Korytnica specimens.

*S. (S.) trilineata* (PHILIPPI) has not so far been known from Korytnica. In the Miocene of Poland it also occurs at Łychów (KRACH, 1962*b*) Skoczów (KRACH, 1974) and Żegocina (FRIEDBERG, 1914).

### Genus LAIOCOCHLIS DUNKER & METZGER, 1874

#### *Laiocochlis inopinata* COSSMANN & PEYROT, 1922

(Pl. XX, Fig. 7)

1922. *Laeocochlis?* *inopinata* nov. sp.; M. COSSMANN & A. PEYROT, p. 303, Pl. 7, Fig. 37.

1966. *Laiocochlis granosa inopinata* COSSMANN & PEYROT; L. STRAUZ, p. 170, Pl. 8, Figs 33-36.

1966. *Laeocochlis inopinata* COSSM. & PEYR.; J. KÓKAY, p. 47, Pl. 5, Fig. 2.

**Material.** — One incomplete specimen (three and a half later whorls).

**Dimensions.** — Height, 6.0 mm, width, 2.7 mm.

**Description.** — Shell sinistral, medium-sized, not very thick-walled, shaped like a slender turret (?). The fragment preserved is cylindrical. Protoconch and the early teleoconchal whorls not preserved. Later whorls convex, the last of them slightly flattened at the base. Ornamentation formed by four spiral whorls. The upper ones are granulated (the uppermost is the thinnest) and the lower one quite smooth. Granules (twenty per whorl) are formed at the intersections of spiral and not very prominent axial ribs. Two smooth spiral cords also run on the base, the innermost one scarcely visible. Aperture slightly damaged, quadrilateral in outline, anteriorly somewhat extended and terminating in a fairly long, bent siphonal canal.

**Remarks.** — The identification of this specimen is rather difficult. The present writer believes it to be conspecific with a shell from Peyrere, Aquitaine, which served COSSMANN & PEYROT (1922) as a basis for erecting the species *Laiocochlis?* *inopinata* COSSMANN & PEYROT. The specimen from Aquitaine is also preserved in the form of three later whorls. Its whorls are maybe only slightly less convex and its ornamentation less prominent. Specimens from Varpalota, Hungary, described by STRAUZ (1966) as *L. granosa inopinata*, although slightly different in ornamentation, seem to be also conspecific. They differ in the presence of one more granulated spiral rib occurring on the whorls (especially in more strongly developed specimen) between the two upper ribs. It is probably developed as a secondary rib. The specimen from Korytnica displays, as a matter of fact, a very slight trace of the formation of such a secondary rib, but it takes place considerably later, with more strongly developed whorls, than in the Hungarian specimens. As compared with *L. granosa* WOOD, *L. inopinata* has more cylindrical and less convex

whorls and, therefore, it would be more proper to consider them as separate species and not subspecies, as STRAUSZ (1966) believes them to be.

*L. inopinata* COSSMANN & PEYROT has not so far been known from the Miocene of Poland.

## Family TRIPHORIDAE JOUSSEAUME, 1884

### Genus TRIPHORA BLAINVILLE, 1828

#### *Triphora perversa* (LINNAEUS, 1758)

(Pl. XX, Figs 3-5)

1856. *Cerithium perversum* LINN.; M. HÖRNES, pp. 414-415, Pl. 42, Fig. 20.  
 1895. *Monophorus perversus* L. var. *adversa* (MTG.); F. SACCO, pp. 63-64, Pl. 3, Fig. 62.  
 1901. *Triforis perversa* (L.); O. BOETTGER, p. 123, no. 388.  
 1907. *Trifora perversa* (L.); O. BOETTGER, p. 143, no. 495.  
 1914. *Triforis perversa* L.; W. FRIEDBERG, pp. 316-317, Pl. 19, Figs 2-3.  
 1922. *Triphora adversa* (MONTAGU), mut. *miocaenica* nov. mut.; M. COSSMANN & A. PEYROT, pp. 307-309, Pl. 7, Figs 61-62.  
 1937. *Triphora (Triphora) perversa* (LIN.); R. SIEBER, pp. 508-509, Pl. 25, Figs C3-4.  
 1949. *Triphora (Triphora) perversa* LINNÉ; M. GLIBERT, p. 157, Pl. 10, Fig. 13.  
 1950b. *Trifora adversa* MONT. mut., *miocaenica* COSSM. & PEYR.; W. KRACH, p. 306, Pl. 1, Fig. 4.  
 1954. *Trifora perversa* L.; L. STRAUSZ, p. 19, Pl. 2, Fig. 23.  
 1966. *Triphora perversa* LINNÉ; L. STRAUSZ, pp. 171-172, Pl. 8, Figs 39-44.

**Material.** — Two hundred specimens.

**Dimensions.** — The largest complete specimen is 6.6 mm high and 1.9 mm wide. Another specimen (Pl. XX, Fig. 4), preserved in the form of eight later whorls, is 8.0 mm high and 2.4 mm wide.

**Description.** — Shell sinistral, small or medium-sized, not very thin-walled, shaped like a very slender, somewhat fusiform, turret. Protoconch consisting of about five (?) whorls, the first of which is convex and smooth and further ones provided with very many extremely spiral ribs. At the end of the fifth whorl, both spiral ribs meet to form one and in this place the ornamentation suddenly changes. Teleoconch reaching about 15 nearly quite flat whorls (11 in the largest specimen preserved complete). The last whorl rounded at the base, but the base of whorls in not fully grown specimens is strongly flattened. Shell ornamentation prominent. Two spiral ribs provided with roundish granules are formed on the early teleoconchal whorls. The lower of them, at first slightly thicker, is situated in the extension of the united protoconchal ribs and the upper one is formed just below the suture. Beginning with the third to sixth whorl, the third rib, situated somewhat nearer the upper one, appears between the two ribs. At first it is very thin and then gradually thickens but remains thinner than the two mentioned above. One (the fourth), granulated rib and below it (on the base), two smooth cords, also run at the bottom of the last whorl. On the base of not fully grown shells, the fourth rib is smooth and below it there occur no cords or at most one only. The roundish granules are arranged in axial, somewhat oblique rows, whose number varies within limits of 15 to 18 on the early and 25 to 28 on the later whorls. Aperture roundish, in younger specimens quadrilateral, posteriorly slightly contracted, anteriorly extended and forming a short, bent siphonal canal. Lips not very thin, the outer one adhering to columella.

**Remarks.** — The assignment of the specimens described to *Triphora perversa* (LINNAEUS) does not arouse any doubt. The differences in comparison with specimens from other localities, expressed in a varying place of the appearance of the middle rib, in its various thickness and, finally, in a more or less fusiform shape of shell, do not exceed the range of variability. Some of the specimens, found at Korytnica (Pl. XX, Fig. 5) are very similar to *T. aequalirata* (BOETTGER) described from Kostej (BOETTGER, 1901; ZILCH, 1934). They differ only in the presence of two (instead of three as in *T. aequalirata*) smooth cords at the base of the last whorl, but their shells are not smaller. A certain doubt may here arise as to whether such a minor difference is a sufficient justification for considering them as separate species.

*T. perversa* (LINNAEUS) was mentioned from Korytnica by FRIEDBERG (1938). In the Miocene of Poland it also occurs at Małoszów (KRACH, 1947), Trzydnik (KRACH, 1950*b*), Benczyn (KRACH, 1950*a*), Skoczów (KRACH, 1974), Żegocina (FRIEDBERG, 1914) and Bogucice (LISZKA, 1933; FRIEDBERG, 1938).

### ***Triphora dux* BOETTGER, 1907**

(Pl. XX, Fig. 2)

1907. *Trifora dux* n. sp.; O. BOETTGER, p. 144, no. 498.

1934. *Triforis dux* BOETTGER; A. ZILCH, p. 266, Pl. 9, Fig. 60.

**Material.** — A specimen without early whorls.

**Dimensions.** — Height, 3.5 mm, width, 1.6 mm.

**Description.** — Shell sinistral, small, fairly thick-walled, shaped like a slightly fusiform turret. Protoconch and the early teleoconchal whorls not preserved. The specimen consisting of five nearly quite flat teleoconchal whorls, the last of them narrower than the two preceding ones and rounded at the base. Ornamentation formed by two spiral ribs, with the third rib appearing between them on the last but one whorl. The third rib, at first very thin, then gradually thickens, while the other two become thinner and, consequently, the last whorl is ornamented by three almost identical spiral ribs. They are provided with roundish tubercles arranged nearly one above another. The tubercles are fairly large, numbering 14 or 15 per whorl, except for the last whorl where they are smaller and more numerous (20). Three more smooth ribs, the lower the less strongly developed, also run at the base of shell below the three ribs mentioned above. Aperture slightly damaged, posteriorly somewhat contracted, anteriorly extended to form a short, open and bent siphonal canal.

**Remarks.** — The specimen, found in the Korytnica clay, although incomplete is undoubtedly conspecific with those of *Triphora dux* BOETTGER, described from Kostej, Rumania. Its size, shape and ornamentation are exactly the same as in the specimen recognized by ZILCH (1934) as a lectotype of the species.

*T. dux* BOETTGER has not so far been known from the Miocene of Poland. Outside of Korytnica, it occurs at Kostej only.

### ***Triphora* cf. *regina* (BOETTGER, 1901)**

(Pl. XX, Fig. 1)

1901. *Triforis regina* n. sp.; O. BOETTGER, pp. 123-124, no. 390.

1907. *Trifora regina* BTGR.; O. BOETTGER, p. 143, no. 496.

1934. *Triforis regina* BOETTGER; A. ZILCH, p. 226, Pl. 9, Fig. 58.

1960. *Triphora (Triphora) perversa* var. *regina*; E. KOJUMDGIEVA, p. 110, Pl. 31, Fig. 18.

1966. *Triphora regina* BOETTGER; L. STRAUZ, p. 172, Pl. 8, Figs 45-46.

1970. *Tryphora perversa regina* BOETTGER; G. RADO & R. MUTIU, p. 148, Pl. 5, Fig. 17.

**Material.** — An incomplete specimen.

**Dimensions.** — Height, 4.3 mm, width, 1.6 mm.

**Description.** — Shell sinistral, small, not very thick-walled, shaped like a slender turret. The specimen consists of about seven whorls. It is preserved incomplete, lacking both protoconch, early teleoconchal whorls and later whorls (or the last whorl). Whorls are nearly quite flat, ornamented by two prominent spiral ribs, with one more, third, very thin, nearly threadlike between them on the last of the preserved whorls. Cardinal ribs are provided with relatively large, slightly spiny tubercles (14 or 15 per whorl), arranged not above each other but alternately. Base strongly flattened, with a smooth rib situated below the granulated ribs. Aperture destroyed.

**Remarks.** — The specimen, found at Korytnica, probably belongs to *Triphora regina* (BOETTGER), which is indicated by its characteristic sculpture. It is very similar to a corresponding part of shell from Kostej, considered by ZILCH (1934) as a lectotype of this species. On account of its incompleteness and not the best state of preservation, the present writer only tentatively assigns it to *T. regina*.

*T. regina* (BOETTGER) has not so far been known from the Miocene of Poland.

### ***Triphora eugeniae* (BOETTGER, 1901)**

(Pl. XX, Fig. 6)

1901. *Triforis eugeniae* n. sp.; O. BOETTGER, p. 125, no. 393.

1907. *Trifora eugeniae* BTGR.; O. BOETTGER, p. 144, no. 500.

1914. *Triforis Berwerthi* AUING. (in coll.); W. FRIEDBERG, pp. 317-318, Pl. 19, Figs 4-5.

1934. *Triforis eugeniae* BOETTGER; A. ZILCH, p. 226, Pl. 9, Fig. 62.

1937. *Triphora aequilirata* BOETTGER; R. SIEBER, p. 509, Pl. 25, Figs C5 and D5.

1966. *Triphora eugeniae* BOETTGER; L. STRAUZ, p. 172, Pl. 8, Figs 37-38.

**Material.** — Eighteen specimens.

**Dimensions.** — The largest specimen is 6.0 mm high and 1.8 mm wide. In other, fragmentary specimens, the width reaches 2.0 mm.

**Description.** — Shell sinistral, small, not very thick-walled, shaped like a slender turret. Protoconch not preserved as a whole in any of the specimens, except for its two whorls, provided with two smooth spiral ribs occurring in one of them. No elements of axial sculpture preserved. Teleoconch reaching about eleven nearly quite flat whorls. The whorl is provided on periphery with a fairly distinct carina. Shell base slightly flattened. Ornamentation formed by three spiral, granulated ribs. Two lower ones of them run in the extension of smooth protoconchal ribs and at first are slightly thicker than the third of them which appears at the top of whorl just below suture. On later whorls, all the three ribs are nearly identical. Granules are arranged above each other and form axial rows, which may be even treated as axial ribs. Three more ribs, the first of them slightly crenated, the rest smooth (the lower one, situated on the siphonal canal, is slightly thicker), run at the base of shell under the three granulated ribs. Aperture



oval, distinctly rhomboid in outline, posteriorly slightly contracted, anteriorly extended to form a short, strongly bent siphonal canal. Both lips fairly thin, the inner of them very slightly thickened posteriorly.

**Remarks.** — The conspecificity of the specimens described with *Triphora eugeniae* (BOETTGER) is unquestionable. The specimen from Korytnica do not display any differences as compared with the lectotype of this species, first described from Kosteĵ, Rumania (BOETTGER, 1901). In the present writer's opinion, these specimens are also conspecific with *T. berwerthi* (FRIEDBERG). Describing specimens from Zborów, Podolia, FRIEDBERG (1914) applied to them the name, which was used by AUINGER for assigning analogous specimens from Lapugy, housed in the Viennese collections. Since this name was first published (FRIEDBERG, 1914) after BOETTGER's (1901) work, it should be considered as a younger synonym of *T. eugeniae*. The present writer also assigns to the species under study the specimens from Forchtenau, Vienna Basin, described by SIEBER (1937) as *T. aequilirata* BOETTGER, which, as a matter of fact, were united by SIEBER with *T. berwerthi* (FRIEDBERG).

*T. eugeniae* (BOETTGER) has not so far been known from the Miocene of Poland. FRIEDBERG's specimens came from Podolia.

### Superfamily SCALACEA

#### Family SCALIDAE BRODERIP, 1839

##### Genus SCALA KLEIN, 1753

##### Subgenus CLATHRUS OKEN, 1815

##### *Scala* (*Clathrus*) *spinosa* BONELLI, 1826

(Pl. XX, Figs 17-18)

1856. *Scalaria clathratula* TURK.; M. HÖRNES, pp. 475-476, Pl. 46, Fig. 8.  
 1890. *Hirtoscala frondicula* WOOD var. *spinosa* BON.; F. SACCO, pp. 26-27, Pl. 1, Fig. 38.  
 1912. *Spiniscala spinosa* (BONELLI); M. COSSMANN, p. 169, Pl. 5, Figs 2 and 20.  
 1938. *Scala spinosa* BONELLI; W. FRIEDBERG, p. 83, Text-fig. 20.  
 1966. *Scala* (*Clathrus*) *frondicula spinosa* BONELLI; L. STRAUZ, p. 175, Pl. 1, Figs 34-35, Pl. 13, Fig. 17.

**Material.** — Three hundred specimens.

**Dimensions.** — The largest specimen is 15 mm high and 5 mm wide.

**Description.** — Shell medium-sized, relatively thin-walled, shaped like a slender turret with an apical angle of about 28°. Protoconch conical, consisting of about four slightly convex and smooth whorls. Teleoconch reaching eleven convex whorls, separated by deep sutures. Whorls provided with listlike axial ribs slightly oblique to shell axis. A small, but very distinct spiny process is developed in the upper part of each rib just below suture. These processes, the same as the ribs themselves, are slightly curved posteriorly. Some of the ribs are considerably thicker and do not look like lists. These are varices, which are irregularly distributed over the shell so as sometimes even three ribs in succession have the character of varices. The number of ribs fluctuates within limits of 11 to 13 on the early and 10 to 12 on the later whorls. Shell surface between ribs is in principle smooth, except for small, very thin, shallow and widely-spaced grooves sometimes visible when viewed in magnification. Aperture oval, oblique, with a slightly marked shallow depression for the inhalant siphon.

**Remarks.** — The specimens described are exactly conformable with this species's descriptions and illustrations (see COSSMANN, 1912, Pl. 5, Figs 2 and 20). As compared with the specimens from Kosteĵ, Rumania, they have more closely-spaced ribs, while 12 ribs per whorl is a rarity among those from Kosteĵ (BOETTGER, 1901). The conspecificity of the specimens, described by HÖRNES (1856) from Steinabrunn under the name *Scalaria clathratula* TURTON with those from Korytnica is not absolutely certain, since the illustration given in HÖRNES's monograph is not quite legible. According to SACCO (1890) and BOETTGER (1901), their similarity to the species under study is out of the question. On the other hand, STRAUZ (1966) includes them in the synonymy of *Scala (C.) spinosa* BONELLI.

*S. (C.) spinosa* BONELLI has already been described from Korytnica by FRIEDBERG (1938). Outside of Korytnica, it has not so far been known from any Miocene locality in Poland.

### **Scala (Clathrus) kostejana** (BOETTGER, 1901)

(Pl. XX, Figs 15-16)

1901. *Scalaria (Hirtoscala) kostejana* n. sp.; O. BOETTGER, p. 85, no. 268.

1912. *Hyaloscala kostejensis* BOETTGER; M. COSSMANN, pp. 170-171, Pl. 5, Fig. 3.

1934. *Scala (Hyaloscala) kostejana* (BOETTGER); A. ZILCH, p. 229, Pl. 10, Fig. 76.

1960. *Scala (Hyaloscala) kostejana* (BOETTGER.); T. BALDI, p. 62, Pl. 1, Fig. 9.

**Material.** — Three specimens.

**Dimensions.** — The largest specimen, preserved without apical whorls and with a damaged aperture, is 9 mm high and 3.1 mm wide.

**Description.** — Shell relatively thin-walled, turretlike and with an apical angle of about 20°. Protoconch not preserved. Teleoconch reaching about nine or ten convex whorls, separated by deep sutures. Whorls provided with many listlike axial ribs. Very small spiny processes, which are lacking in ribs on later whorls, are developed in the upper part of ribs running in early whorls. The number of ribs per whorl amounts to 14, or, sometimes but very rarely, 15. Varices are very rare and occur on later whorls only. Intercostal spaces in principle smooth, except for very delicate, closely-spaced spiral grooves seen through the microscope. Aperture roundish, slightly oblique.

**Remarks.** — The assignment of the specimens here described to *Scala kostejana* (BOETTGER) is not quite certain. The holotype of this species (see COSSMANN, 1912, Pl. 5, Fig. 3; ZILCH, 1934, Pl. 10, Fig. 76) is a young specimen, which, as already noticed by DE BOURY (in COSSMANN, 1912) is rather poorly preserved. The specimens from Korytnica do not display a characteristic (according to BOETTGER, 1901) bend in the middle of whorls, which, however, is also indiscernible in the illustrations of the holotype. The specimens of *S. (C.) kostejana* from Korytnica differ from those of *S. (C.) spinosa* BONELLI in a larger number of ribs per whorl and in the lack of the spiny process on ribs (except for the early whorls).

*S. (C.) kostejana* (BOETTGER) has not so far been known from the Miocene of Poland.

### **Scala (Clathrus) detracta** (DE BOURY in COSSMANN, 1912)

(Pl. XX, Fig. 14)

1901. *Scalaria (Hirtoscala) muricata* (RISSO); O. BOETTGER, p. 85, no. 267.

1912. *Clathrus detractus* DE BOURY nom. mut.; M. COSSMANN, p. 172, Pl. 5, Fig. 4.

1934. *Scala (Clathrus) detracta* DE BOURY; A. ZILCH, p. 231, Pl. 10, Fig. 81.

**Material.** — Five specimens.

**Dimensions.** — The largest complete specimen (Pl. XX, Fig. 14) is 4.2 mm high and 2.3 mm wide.

**Description.** — Shell small, relatively thin-walled, shaped like a not very slender turret with an apical angle of about 30°. Protoconch conical, consisting of about three slightly convex and smooth whorls. Teleoconch reaching about four and a half strongly convex whorls, limited by deep sutures. Distinctly oblique, wide and thin, listlike axial ribs run on whorls. Each rib has in its upper part, just below suture, a strong spiny process. The number of ribs fluctuates between ten on the early and seven or eight on the later whorls. Shell surface between ribs lustrous and quite smooth, even without visible growth lines. Aperture roundish, slightly extended anteriorly.

**Remarks.** — The specimens described seem to be in a complete conformity with the holotype of the species, which comes from Kosteĵ (comp. ZILCH, 1934). Ribs, which are somewhat more closely-spaced on the early whorls represent the only observable difference. In addition, the holotype has about one whorl more. Specimens from Szob, Hungary, assigned to this species by CSEPREGHY-MEZNERICS (1956), are considerably more slender and their ribs have much smaller spiny processes. As observed by STRAUZ (1966), they probably belong to another species.

*Scala (Clathrus) detracta* (DE BOURY) has not so far been known from the Miocene of Poland. Outside of Korytnica, it occurs only in the region of Kosteĵ and Lapugy, Rumania.

### ***Scala (Clathrus) parilis* (DE BOURY in COSSMANN, 1912)**

(Pl. XX, Fig. 13)

1901. *Scalaria (Clathrus) communis* LMK. var. *dertonensis* SACCO; O. BOETTGER, p. 84, no. 265.

1912. *Clathrus parilis* DE BOURY nom. mut.; M. COSSMANN, p. 172, Pl. 5, Fig. 5.

**Material.** — Thirty specimens.

**Dimensions.** — The largest specimen (Pl. XX, Fig. 13) with an incomplete protoconch is 4.2 mm high and 2 mm wide.

**Description.** — Shell small, relatively thick-walled, turretlike, with an apical angle of about 30°. Protoconch conical, consisting of four smooth and very slightly convex whorls. Teleoconch reaching five whorls, separated by deep sutures and provided with prominent, listlike axial ribs, which are devoid of any traces of the spiny process and arranged on whorls somewhat obliquely to shell axis. All ribs of whorls adjoining each other are in mutual contact which gives the impression that they continue throughout all whorls. This also causes that the number of ribs per whorl is uniform in a given specimen. It amounts to eight or nine in particular specimens. Shell surface between ribs quite smooth. Aperture roundish, only slightly extended anteriorly.

**Remarks.** — This species was found at Kosteĵ by BOETTGER (1901, 1906), who identified it as *Scalaria (Clathrus) communis* Lmk. var. *dertonensis* SACCO. Acknowledging the correctness of assigning it to this variety, DE BOURY (in COSSMANN, 1912) gave, however, the reasons why a different name should be given it, that is, because the name *dertonensis* SACCO had already

been applied to another species of the genus *Scala*. As compared with the specimens from Kosteĵ, those from Korytnica differ in the number of ribs only. BOETTGER (1901, 1906) found nine or ten ribs per whorl, but he had at his disposal six specimens only. The difference discussed above is probably a symptom of specific variability. In addition, as follows from the illustration (COSSMANN, 1912, Pl. 5, Fig. 5), the specimens from Kosteĵ are somewhat larger (by about one whorl).

This species has not so far been known from the Miocene of Poland. Outside of Korytnica, it only occurs in the Vienna-type Miocene deposits of Kosteĵ, Rumania.

### *Scala (Clathrus) oligocostata* sp. n.

(Pl. XX, Fig. 12)

*Holotype*: Pl. XX, Fig. 12 (Z.PAL.U.W., No BkK-G 342).

*Type horizon*: Lower Tortonian (= Lower Badenian).

*Type locality*: Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.

*Derivation of the name*: Lat. *oligocostata*, after a small number of ribs.

**Diagnosis.** — Shell small, ornamented by five or six prominent, listlike, axial ribs.

**Material.** — Two specimens.

**Dimensions.** — The larger specimen, established as a holotype, is 3.5 mm high and 1.6 mm wide.

**Description.** — Shell small, relatively thick-walled, turret-like, with an apical angle of about 30°. Protoconch preserved incomplete, its last whorl being smooth and convex. Teleoconch reaching about four and a half convex whorls. Prominent axial ribs, looking like wide but not very thin lists and without any trace of a spiny process, run on whorls somewhat obliquely to shell axis and distinctly curved posteriorly. The ribs of adjoining whorls contact each other, giving the impression as if they continued throughout all whorls. The number of ribs per whorl is constant on all whorls and amounts to five in the first and to six in the second specimen. Shell surface between ribs quite smooth. Aperture roundish, slightly extended anteriorly.

**Remarks.** — *Scala (Clathrus) oligocostata* sp. n. differs from *C. (C.) parilis* (DE BOURY) in somewhat larger whorls and less closely-spaced but thicker axial ribs. On the other hand, it differs from similar species *Faveoscala recidiva* DE BOURY (in COSSMANN & PEYROT, 1922) from the Miocene of Aquitaine in smaller dimensions, less slender shape and stronger ribs. *F. recidiva* is known only as a single specimen, in which the early whorls are not preserved and, therefore, its close comparison with the Korytnica specimens is rather difficult.

### Subgenus *CIRSOTREMA* MÖRCH, 1852

### *Scala (Cirsotrema) pumicea* (BROCCHI, 1814)

(Pl. XXI, Figs 9-10)

1856. *Scalaria pumicea* BROCC.; M. HÖRNES, pp. 477-478, Pl. 46, Fig. 10.

1890. *Cirsotrema rusticum* (DEFR.), et var.; F. SACCO, pp. 53-54, Pl. 2, Figs 35-39.

1890. *Cirsostrema pumiceum* (BR.), et var.; F. SACCO, pp. 54-56, Pl. 2, Figs 40-43.

1901. *Scalaria (Cirsotrema) pumicea* BROCC. var. *dertonensis* SACCO; O. BOETTGER, p. 85, no. 269.  
 1912. *Cirsotrema pumiceum* (BRONN); M. COSSMANN, p. 50, Pl. 2, Figs 38-39.  
 1922. *Cirsotrema sallomacense* DE BOURY; M. COSSMANN & A. PEYROT, pp. 148-149, Pl. 4, Figs 101-104.  
 1938. *Cirsotrema pumiceum* BROCC. var. *dertonensis* SACCO; W. FRIEDBERG, p. 84, Text-Fig. 21.  
 1966. *Scala (Cirsotrema) pumicea* BROCCHI; L. STRAUZ, p. 177, Pl. 1, Figs 43-46, Pl. 13, Fig. 15.

**Material.** — A hundred specimens.

**Dimensions.** — The largest specimen (Pl. XXI, Fig. 9) is 24 mm high and 9.8 mm wide.

**Description.** — Shell medium-sized, fairly robust, shaped like a steplike turret with an apical angle of about 40° to 44°. Protoconch not preserved complete in any of the specimens. Its last whorl, quite smooth, lustrous and sharply separated from the rest of shell, is visible in one specimen only. Teleoconch reaching about eight to nine whorls. Shell surface provided with very characteristic axial ribs. On the early whorls, ribs are very thin and delicate, taking on later whorls (usually, beginning with the fourth teleoconchal whorl) the form of lists composed of many (even more than 40) very thin, strongly wavy lamellae. Spiny processes, whose presence gives the shell its characteristically steplike outline, are developed in upper parts of ribs. Some of the ribs, more strongly developed, form varices. The number of ribs is variable and fluctuates within limits of 16 to 22, averaging 18. Shell surface between ribs covered with closely-spaced spiral cords. A strong, spiral swelling, formed by identically bent costal lamellae occurs at the base of the last whorl. Aperture relatively small, roundish, with inner lip usually provided with a varix.

**Remarks.** — The specimens from Korytnica, described above, are assigned by the present writer to *Scala (Cirsotrema) pumicea* (BROCCHI). They are in a complete conformity with the specimen from both Northern Italy (COSSMANN, 1912, Pl. 2, Figs 38-39) and Vienna Basin (HÖRNES, 1856, Pl. 46, Fig. 10). Several species and subspecies (see synonymy), which are strongly resemblant of *S. (C.) pumicea* (BROCCHI) were described from many Miocene localities in Europe. They differ very slightly both from *S. (C.) pumicea* and each other in a varying degree of their slenderness, more or less steplike outline of shell and unequal spacing of ribs. The present writer believes that these differences are only symptoms of specific variability and do not seem to give sufficient basis for distinguishing separate species. For this reason, he considers these taxons as synonyms of *S. (C.) pumicea* (BROCCHI).

The specimen under study has never before been known from Korytnica. From the Miocene of Poland, it was mentioned, on the other hand, from Niechobrz (GOLĄB, 1932; FRIEDBERG, 1938) and Benczyn (KRACH, 1950a).

## Genus **ACRILLA** H. ADAMS, 1860

### Subgenus **ACRILLA (ACRILLA)**

#### **Acrilla (Acrilla) subreticulata** (d'ORBIGNY, 1852)

(Pl. XXI, Figs 5-7)

1856. *Scalaria amoena* PHIL.; M. HÖRNES, p. 479, Pl. 46, Fig. 11.  
 1875. *Scalaria amoena* PHIL.; R. HOERNES, p. 362, Pl. 46, Figs 8-9.  
 1901. *Scalaria (Acrilla) amoena* PHIL.; var. *subcancellata* d'ORB.; O. BOETTGER, p. 86, no. 271.  
 1912. *Acrilla mio-Bromni* SACCO; M. COSSMANN, p. 185, Pl. 3, Figs 10-11.

1922. *Acrilla* cf. *mio-Bronni* SACCO; M. COSSMANN & A. PEYROT, pp. 154-156, Pl. 4, Fig. 109.

1952. *Scala (Acrilla) amoena* f. *subreticulata* d'ORBIGNY; M. GLIBERT, pp. 44, Pl. 7, Fig. 1.

1969. *Scala (Acrilla) amonea subreticulata* d'ORB.; I. CSEPREGHY-MEZNERICS, p. 74, Pl. 1, Fig. 30.

**Material.** — Thirty specimens.

**Dimensions.** — The largest specimen, preserved in the form of three later whorls (Pl. XXI, Fig. 6) is 40 mm high (if complete, it would be about 70 mm high) and 20 mm wide.

**Description.** — Shell large, relatively thin-walled, brittle, shaped like a slender turret with an apical angle of about 25°. Protoconch conical, preserved in one specimen only (Pl. XXI, Fig. 1), consisting of three slightly convex, smooth whorls, distinctly separated from the rest of shell. Teleoconch reaching about 17 strongly convex whorls, separated from each other by deep sutures. Ornamentation formed by axial and spiral ribs intersecting each other. The former are closely-spaced, thin and, in particular on early whorls, listlike. Some of them (only on later whorls) are thicker and make up varices. The number of axial ribs is variable and fluctuates between 20 on the first teleoconchal whorl and to 48 on later whorls. The spiral ribs are slightly thicker and more closely-spaced than the axial ones. At first, there appear five of them, all identical in thickness and then, they are followed by many secondary ribs so that about twelve spiral ribs varying in thickness usually run on later whorls, with many spiral cords, also unequal in thickness, occurring between them. The strongest spiral rib runs on the base of the last whorl and below it the shell is slightly flattened. Aperture roundish, with a relatively prominent outer lip, incomplete in all specimens.

**Remarks.** — The specimens from Korytnica seem to be in a complete conformity with those described from the Miocene of Aquitaine (COSSMANN & PEYROT, 1922) and Belgium (GLIBERT, 1952). *Acrilla phoenix* DE BOURY and *Acrilla mio-bronni* SACCO are so closely resembling both each other and *Acrilla amoena subreticulata* d'ORBIGNY that distinguishing so many separate species is not substantiated. The differences in the shape and density of the distribution of ribs, presented by the investigators are, in the present writer's opinion, only the symptom of specific variability.

*A. (A.) subreticulata* has not so far been known from the Miocene of Poland.

### ***Acrilla (Acrilla) orientalis* (FRIEDBERG, 1928)**

(Pl. XXI, Figs 1-3)

1928a. *Scala orientalis* FRIEDB.; W. FRIEDBERG, p. 606, Pl. 38, Figs 23-24.

**Material.** — Sixty specimens.

**Dimensions.** — The largest specimen, preserved in the form of three later whorls (Pl. XXI, Fig. 2) is 5.5 mm high and 3.5 mm wide. The complete specimens, shown in Pl. XXI, Fig. 1 is 4.7 mm high and 2.0 mm wide.

**Description.** — Shell medium-sized, relatively thin-walled, brittle, turretlike, with an apical angle of about 26 to 28°. Protoconch conical, smooth and lustrous, consisting of three slightly convex whorls. Teleoconch reaching about seven to eight strongly convex whorls. Shell surface ornamented by many, thin axial ribs. Their number amounts to 18 to 20 on early and 26 to 30 on later whorls. Specimens having more closely-spaced ribs, e.g., those having 36 ribs on the sixth whorl, are rare. Varices lacking. Shell surface between ribs is covered with delicate

spiral cords, one of which, running at the base of the last whorl, is much more strongly developed. Below it, the whorl is slightly flattened. Aperture roundish, slightly extended anteriorly.

**Remarks.** — The specimens here assigned are marked by a fairly high degree of variability, expressed by a variable slenderness, spacing of ribs and unequal development of ribs, which may be threadlike or narrowly listlike. Despite these differences, they are completely conformable with those described by FRIEDBERG (1928a). *A. (A.) herthae* (BOETTGER) is a similar species, but it differs from *A. (A.) orientalis* (FRIEDBERG) in a considerably smaller number of ribs (14 of them on the last whorl). As follows from the illustrations, *Scala* cf. *orientalis* FRIEDBERG, described by ATANACKOVIĆ (1969), does not belong to this species.

*A. (A.) orientalis* (FRIEDBERG) has not so far been known from the Miocene of Poland. The species was described by FRIEDBERG from Volhynia.

### ***Acrilla (Acrilla) laticostata* sp. n.**

(Pl. XXI, Fig. 8)

*Holotype*: Pl. XXI, Fig. 8 (Z.PAL.U.W., No BkK-G 351)

*Type horizon*: Lower Tortonian (= Lower Badenian).

*Type locality*: Korytnica, 24 km SSW of Kielce, southern slopes of the Holy Cross Mts.

*Derivation of the name*: Lat. *laticostata*, after its axial ribs which look thin but wide list.

**Diagnosis.** — Shell slightly steplike in outline, with whorls provided with many, wide, listlike axial ribs and closely-spaced spiral cords.

**Material.** — Thirty specimens.

**Dimensions.** — The largest specimen, with an incomplete protoconch (established as a holotype), is 5 mm high and 2.6 mm wide.

**Description.** — Shell small, fairly thin-walled, brittle, shaped like a not very slender and slightly steplike turret, with an apical angle of about 33 to 35°. Protoconch conical, consisting of about four quite smooth and slightly convex whorls, sharply separated from the rest of shell. Teleoconch reaching about six convex and relatively low whorls. Whorls are provided with prominent, closely-spaced and slightly oblique axial ribs looking like thin, wide lists. A distinct, spiny process, slightly bent posteriorly (when partly broken-off, it gives the impression of being bent anteriorly) is developed in the upper part of each rib. The number of ribs variable, increasing from 14 to 16 on the first teleoconchal whorl to 24 to 33 on later whorls. Varices lacking. Shell surface between ribs covered with delicate and closely-spaced spiral cords, which are also visible on the other side of axial ribs. A slight carina, below which the whorl is somewhat flattened and ribs, running here, longitudinally bent and curved posteriorly, is marked at the base of the last whorl. Aperture roundish, somewhat oblique and with a distinctly marked notch for the inhalant siphon.

**Remarks.** — *Acrilla (Acrilla) laticostata* sp. n. differs from *A. (A.) orientalis* in a steplike outline of shell, wide axial ribs provided with spiny processes and closely-spaced spiral cords. On the other hand, it departs from the seemingly similar species *A. (A.) kimakowiczi* (BOETTGER) (see COSSMANN, 1912, Pl. 5, Fig. 6; ZILCH, 1934, Pl. 10, Fig. 79) in smaller dimensions, considerably less slender shape, steplike outline of shell and much wider ribs, provided with spiny processes, on early whorls.

Subgenus **ACRILLOSCALA** SACCO, 1890**Acrilla (Acrilloscala) terebralis** (MICHELIN, 1831)

(Pl. XX, Figs 19-20)

1912. *Acrilloscala Degrangei* DE BOURY; M. COSSMANN, pp. 187-188, Pl. 3, Figs 17-19.1922. *Acrilloscala terebralis* MICHELIN; M. COSSMANN & A. PEYROT, pp. 162-163, Pl. 4, Figs 114-115.1949. *Scala (Acrilloscala) terebralis* MICHELIN; M. GLIBERT, p. 168, Pl. 11, Fig. 1.**Material.** — A hundred and forty specimens.**Dimensions.** — The largest complete specimen (Pl. XX, Fig. 19) is 12.5 mm high and 3.0 mm wide. Another specimen (Pl. XX, Fig. 20), preserved in the form of four and a half later whorls, is 10 mm high and 3.8 mm wide.**Description.** — Shell medium-sized, thin-walled, brittle, shaped like a very slender turret, with an apical angle of about 15°. Protoconch conical, consisting of about four slightly convex, smooth and lustrous whorls and very distinctly separated from the rest of shell. Teleoconch reaching about 14 moderately convex whorls, separated from each other by shallow sutures. Shell surface ornamented by many thin axial ribs. The number of ribs varying in particular specimens from 22 on early to 14 on later whorls of more densely ribbed shells to 18 and 11 respectively in other specimens. Shell surface between ribs densely and very delicately grooved spirally. A prominent spiral cord, below which the shell is slightly flattened, runs at the base of the last whorl. Some ribs are stronger on later whorls and form wide, flat varices. Aperture oval, slightly extended anteriorly. Outer lip provided with a wide varix.**Remarks.** — The specimens from Korytnica seem to be in a complete conformity with those described from the Miocene of Aquitaine (COSSMANN & PEYROT, 1922), although they are perhaps somewhat more slender than the latter. *A. (A.) terebralis* (MICHELIN) differs from the Pliocene species *Acrilla geniculata* (BROCCHI) in less numerous and slightly thicker ribs and in not reaching such large dimensions (comp. SACCO, 1891; COSSMANN, 1912; ROSSI RONCHETTI, 1952). Specimens from Kostej, described by BOETTGER (1901) as *Scalaria (Fuscoscala) turtonis* TURT. var. and afterwards illustrated and identified as *Acrilla subuloprisca* SACCO by DE BOURY (in COSSMANN, 1912), as well as those from the Tortonian of Bulgaria, described by KOJUMDIEVA (1960) as *Scala (Fuscoscala) tenuicostata* MICHAUD are forms very closely related to the Korytnica specimens, but distinctly differing from them in a less slender shape of shell. The present writer does not believe them to be conspecific with *A. (A.) terebralis*.*A. (A.) terebralis* (MICHELIN) has not so far been known from the Miocene of Poland.Genus **OPALIA** H. & A. ADAMS, 1853Subgenus **PLICISCALA** DE BOURY, 1887**Opalia (Pliciscala) brandenburgi** (BOETTGER, 1906)

(Pl. XXI, Figs 11-12)

1906. *Scala (Acrilla) brandenburgi* n. sp.; O. BOETTGER, pp. 94-95, no. 343.1912. *Punctiscala? Brandenburgi* (BOETTGER); M. COSSMANN, pp. 190-191, Pl. 6, Fig. 1.1934. *Opalia (Punctiscala?) brandenburgi* (BOETTGER); A. ZILCH, p. 228, Pl. 10, Fig. 68.



**Material.** — Two specimens.

**Dimensions.** — The complete specimen (Pl. XXI, Fig. 12) is 12.5 mm high and 4 mm wide. The other, preserved without early whorls (Pl. XXI, Fig. 11) and aperture, is 16 mm high and 5 mm wide (when complete it was probably about 21 mm high).

**Description.** — Shell medium-sized, relatively thick-walled, shaped like a slender turret, with an apical angle of about 22°. Protoconch conical, smooth, consisting of four slightly convex whorls, very distinctly separated from the rest of shell. Teleoconch reaching about 12 whorls (in the complete specimen it consists of nine and a half whorls). Whorls convex, ornamented by many axial ribs, running slightly obliquely to shell axis. On the first two teleoconchal whorls, these ribs are very delicate and look like thin wrinkles, on further whorls they become stronger, rounded and not listlike. The number of whorls varying from 23 to 26 per whorl in one specimen to 20 to 22 on the other. Some of the ribs, usually two per whorl, are stronger and make up wide varices. In addition, many, distinct, spiral cords, also marked on ribs, run on whorls. Shell surface between spiral cords is also ornamented by rows of very delicate pits (resembling delicate needle punctures), running parallel to the cords. Aperture oval, with outer lip sharp on edge, but provided with a strong varix close behind it.

**Remarks.** — The specimens discussed are in a complete conformity with the holotype of this species (comp. ZILCH, 1934), from which they are, however, larger by a few whorls.

*Opalia (Pliciscala) brandenburgi* (BOETTGER) has not so far been known from the Miocene of Poland. Outside of Korytnica, it was found only at Kostej, from which three specimens were mentioned by BOETTGER (1906).

### ***Opalia (Pliciscala) scacchii* (HÖRNES, 1856)**

(Pl. XXI, Fig. 13)

1856. *Scalaria Scacchii* HÖRN.; M. HÖRNES, pp. 479—480, Pl. 46, Fig. 12.  
 1901. *Pliciscala (Nodiscala) scacchii* (M. Hö.); O. BOETTGER, pp. 86-87, no. 272.  
 1912. *Nodiscala rugatina* DE BOURY; M. COSSMANN, pp. 193-194, Pl. 5, Figs 23 and 25.  
 1934. *Opalia (Nodiscala) rugatina* (DE BOURY); A. ZILCH, pp. 228-229, Pl. 10, Fig. 72.  
 1949. *Opalia (Nodiscala) schacchi* HÖRNES; M. GLIBERT, pp. 163—164, Pl. 10, Fig. 18.  
 1956. *Opalia (Nodiscala) rugatina* (DE BOURY); I. CSEPREGHY-MEZNERICS, pp. 389-390, Pl. 3, Figs 29-32.  
 1966. *Scala (Pliciscala) rugatina* BOURY (in COSSMANN); L. STRAUSZ, p. 179, Pl. 1, Figs 39-40.  
 1967. *Opalia (Nodiscala) schacchi* (HÖRNES); A. W. JANSSEN, pp. 139—140, Pl. 12, Fig. 2.

**Material.** — Six specimens.

**Dimensions.** — The largest specimen, without protoconch, is 7.2 mm high and 2.6 mm wide.

**Description.** — Shell small, relatively thick-walled, shaped like a slender turret, with an apical angle of about 32°. Protoconch conical, consisting of about three slightly convex and smooth whorls. Teleoconch reaching seven and a half whorls, the early ones being completely convex and the later ones having a slight depression in their upper part just below suture. Whorls are provided with many, fairly wide axial ribs, their number varying from 16 on the early to 12 on the later whorls. Some, more prominent, ribs form varices. In addition, shell is ornamented by many, closely-spaced, threadlike, spiral cords. Depressions between cords are narrower than cords and each of them contains a row of delicate pits. Aperture oval, both lip prominent, the outer one provided with a robust varix running close behind the apertural edge.

of Poland. Outside of Korymbos, it occurs only at Kozel.

Obolus (*Πισισαλα*) *ρηνονηθηρα* (DE BOUKX) has not so far been known from the Miocene with many varices and with ribs which are bent out deviously of tubercles.

(DE BOUKX, in COZZMANI, 1915), also known from Kozel, has a somewhat less slender shell ribs are slightly less strongly developed. Another, similar species, that is, *Obolus anguliformis* Korymbos represent younger whorls and this is probably the reason why the tubercles on their

**Remarks.** — As compared with the holotype (comb. SIGCH, 1934), the specimens from preserved in other parts of shell.

slightly oblique to shell axis. Outer lip provided with a thick, roller-like varix. No varices closely-spaced spiral cords, separated from each other by rows of delicate ribs. Aberture oval, them bent whorl and the other nine. In addition, whorls are ornamented by many thin and picturesque. The number of ribs unequal, one of the specimens (Pl. XXI, Fig. 4) has eleven of whorls. Their presence gives the impression as if the whorls (in particular the last one) were ribs, each of which has two tuberculate swellings. These tubercles form two spiral rows on

**Description.** — Shell small, slender, not very thin-walled. Whorls ornamented by axial high and 1.4 mm wide.

**Dimensions.** — The larger specimen, preserved in the form of two later whorls, is 5.7 mm

**Material.** — Two incomplete specimens.

1934. *Obolus* (*Μοδισαλα*) *ρηνονηθηρα* (BOETTGER): A. SIGCH, p. 228, Pl. 10, Fig. 10.

1915. *Μοδισαλα ρηνονηθηρα* BOETTGER: M. COZZMANI, p. 192, Pl. 6, Fig. 8.

1901. *Πισισαλα* (*Μοδισαλα*) *ρηνονηθηρα* n. sp.: O. BOETTGER, p. 83, no. 223.

(Pl. XXI, Fig. 4)

### **Obolus (*Πισισαλα*) *ρηνονηθηρα* (BOETTGER, 1901)**

of Poland.

*Obolus* (*Πισισαλα*) *γαααρη* (HOKIES) has not so far been known from the Miocene seems another member.

Pl. I, Fig. 38) as *γααα* (*Πισισαλα*) *γαααρη* HOKIES, is determined incorrectly, and it resembles with those from Korymbos. A specimen from Larisa, presented by ZILKUSZ (1900, only those from Zor (СЗЕРВЕЧНХ-МЕЗИВЕС, 1920; ZILKUSZ, 1900) are regarded as conspecific ribs) are to be interpreted as an intraspecific variability. Of the Hungarian specimens, СГІВЕРТ (1949) and ІВІССЕН (1901), and some unimportant differences (smaller number of striae presented by HOKIES. The Korymbos specimens do not differ from those given by *γααα* *μαααα* DE BOUKX; this mistake probably resulted from analysis of the inadequate illustration (in COZZMANI, 1915), the specimens from Kozel do not represent a new species, called *Μοδισα* (comb. SIGCH, 1934, Pl. 10, Fig. 15). In contrast to the opinion expressed once by DE BOUKX be and doubt. The only difference is in a greater number of varices in the Kozel specimens *Κορυμβος*, described by BOETTGER (1901) as *Πισισαλα* (*Μοδισαλα*) *γαααρη* (M. HÖ.), seems to

**Remarks.** — Conspecificity of the discussed Korymbos specimens with those from Kozel,



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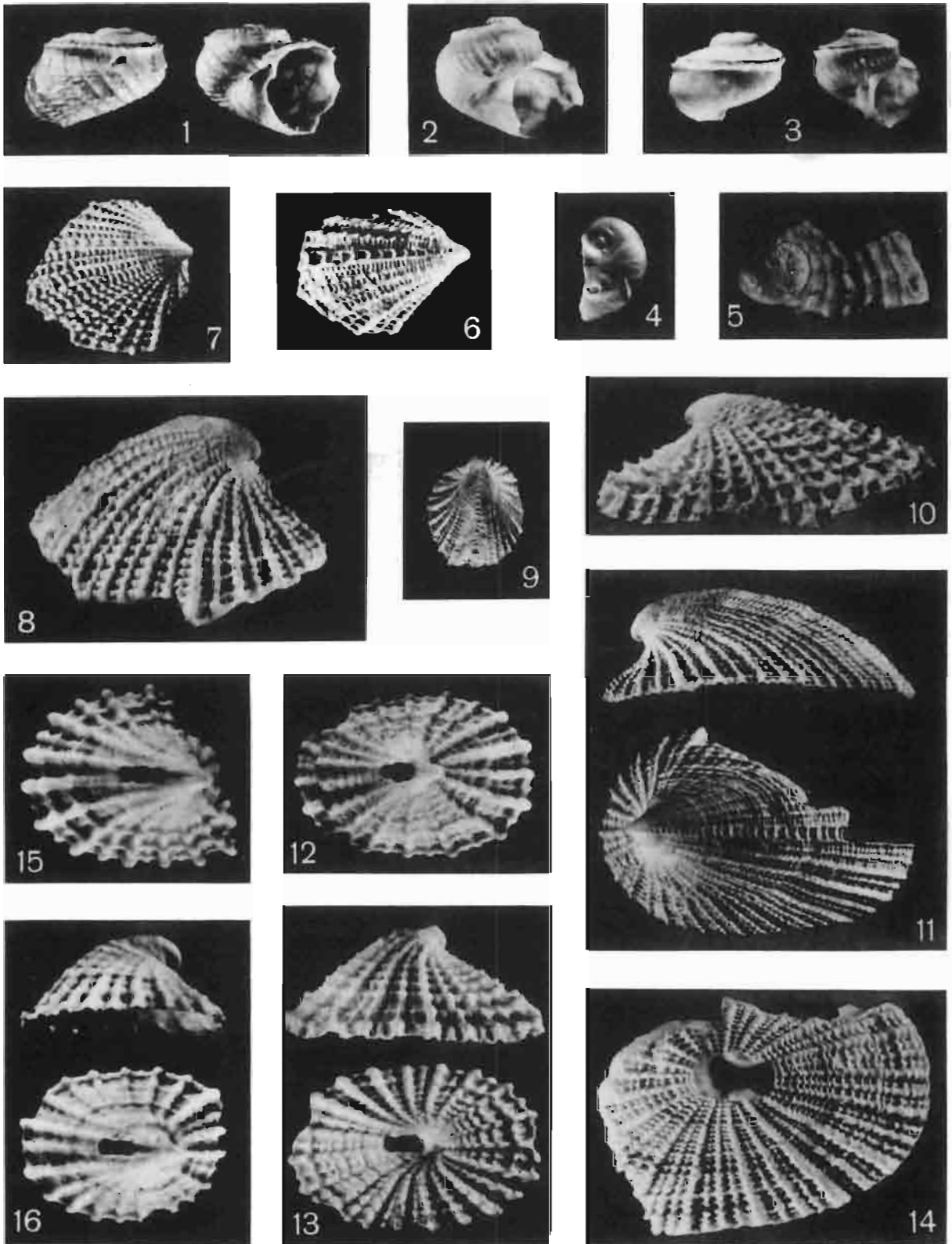
All photographs taken by B. Drozd

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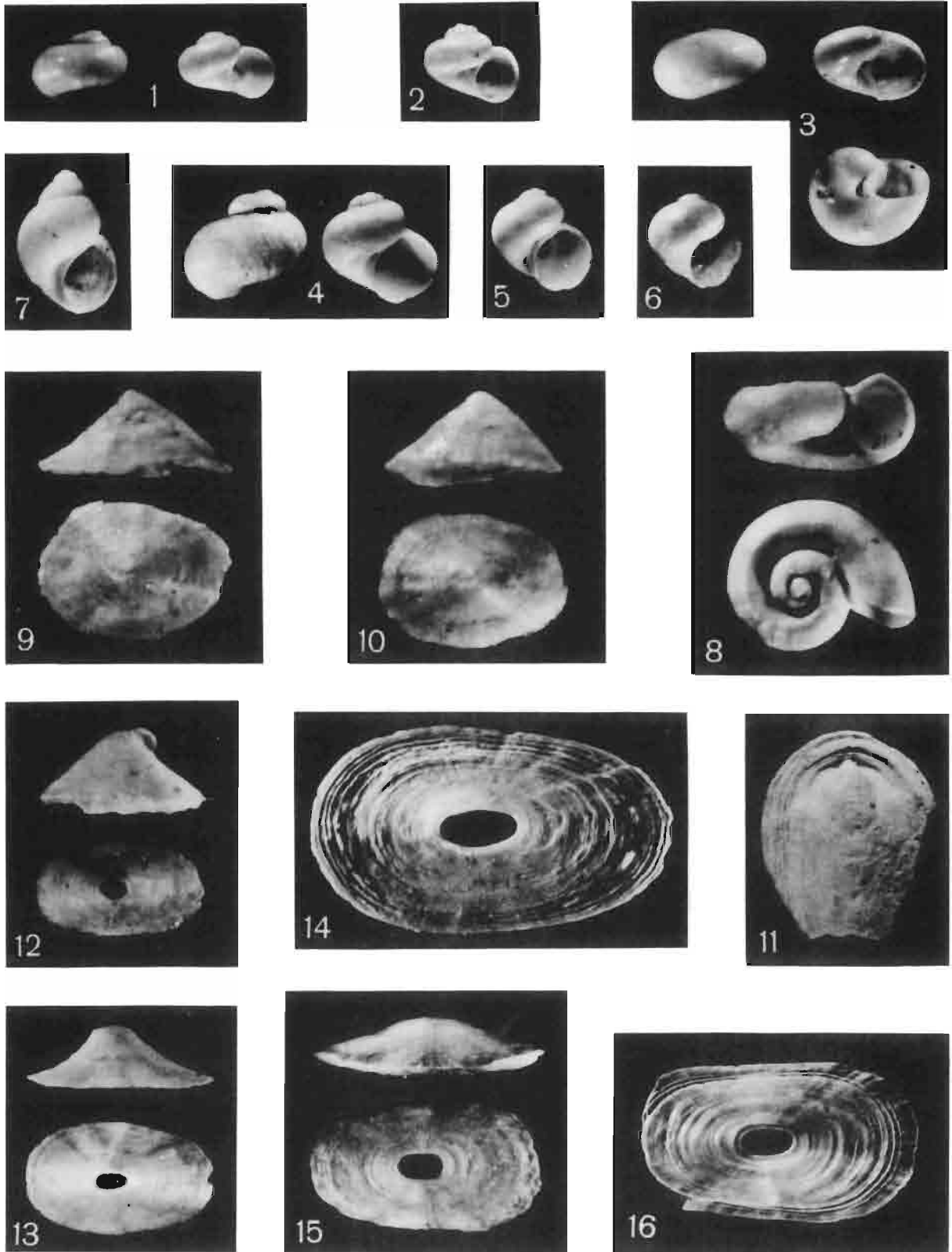
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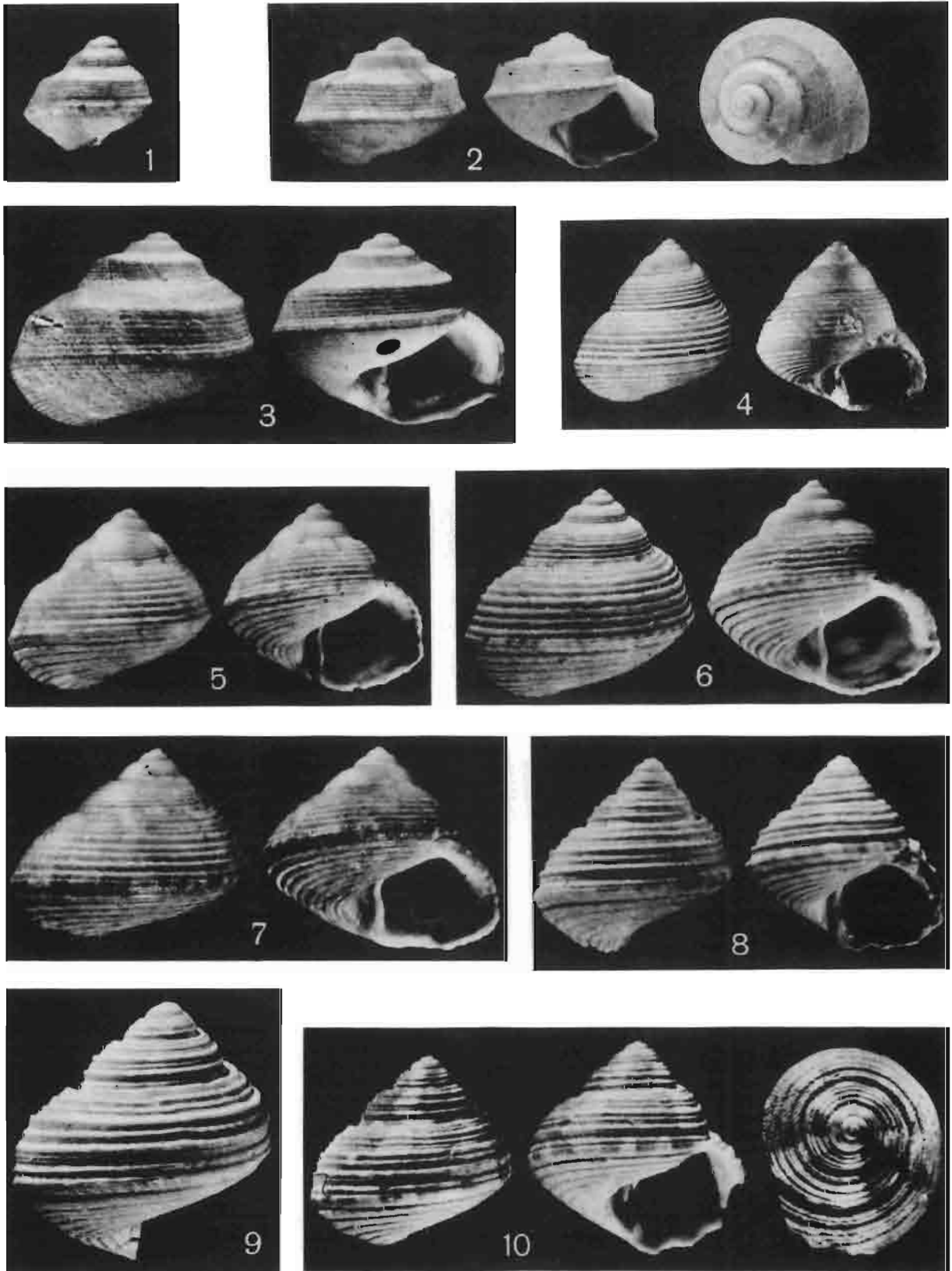
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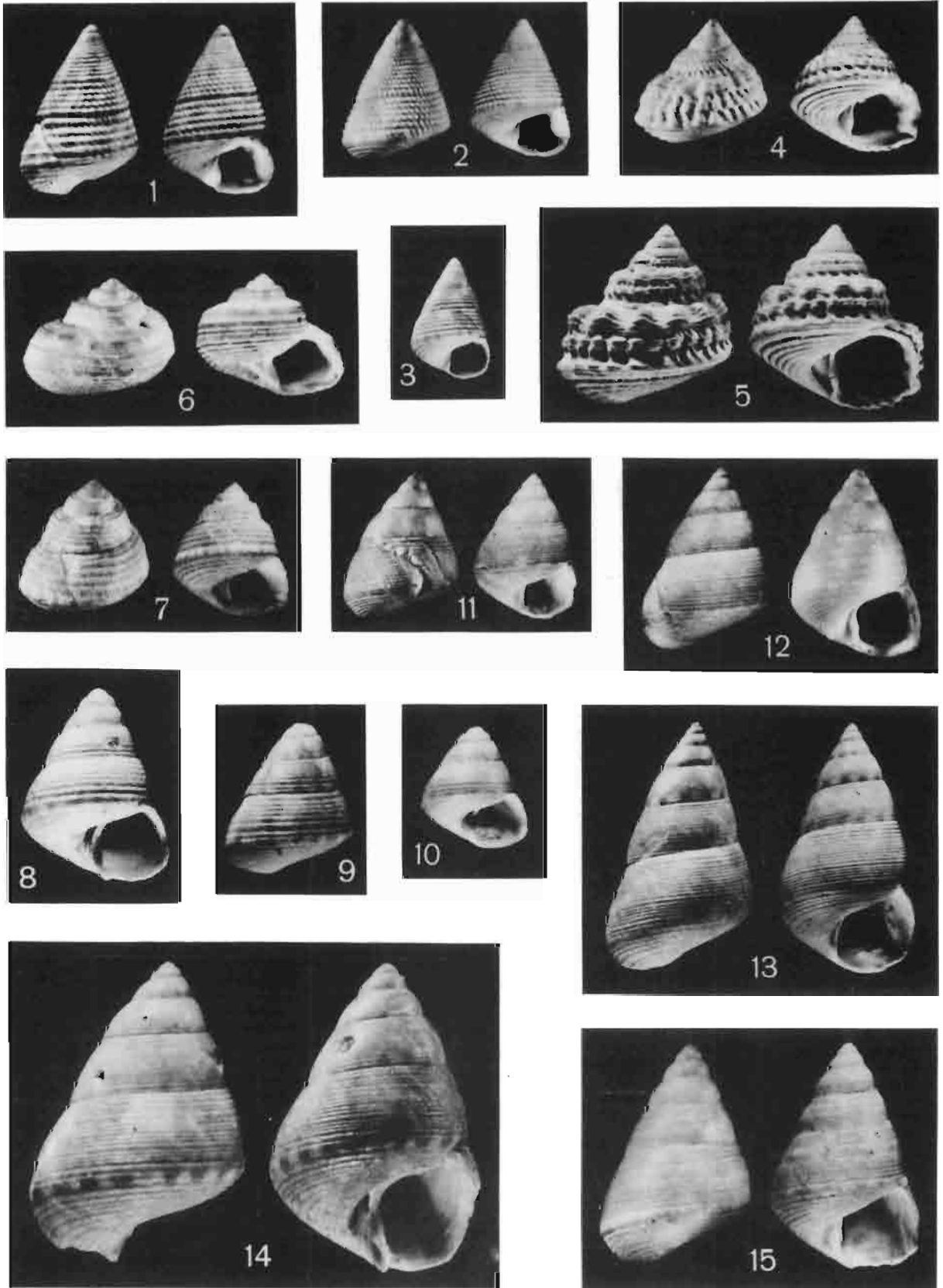
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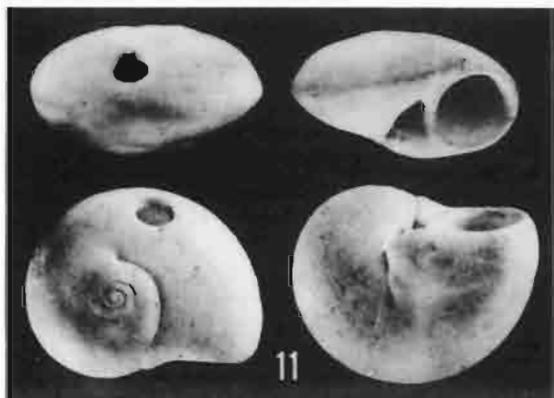
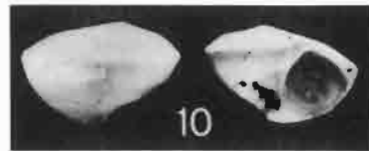
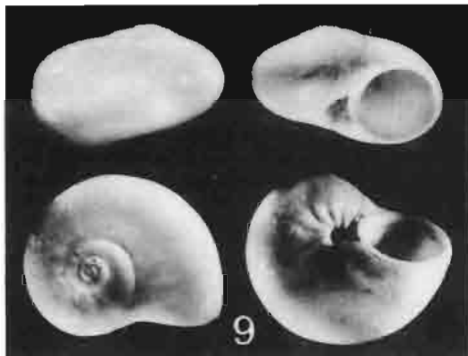
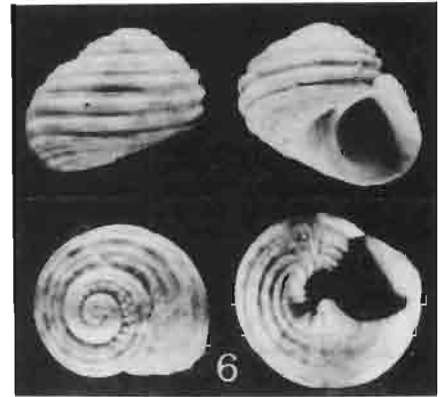
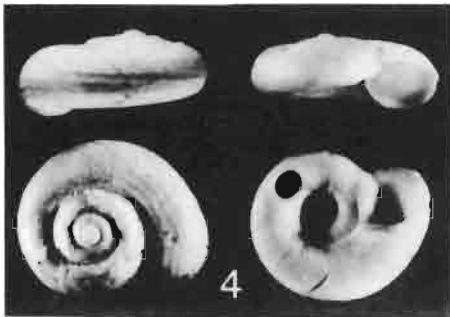
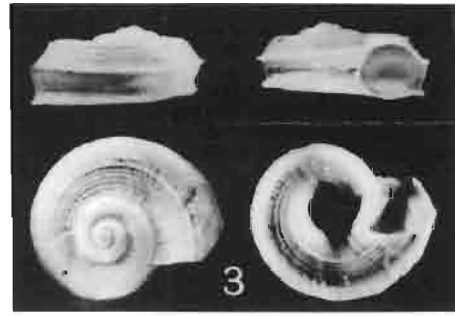
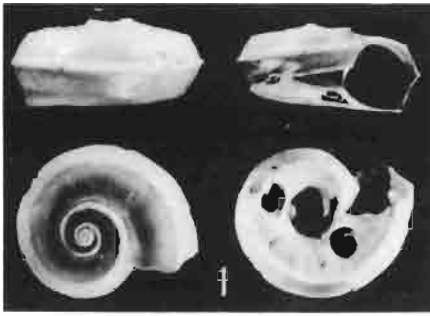
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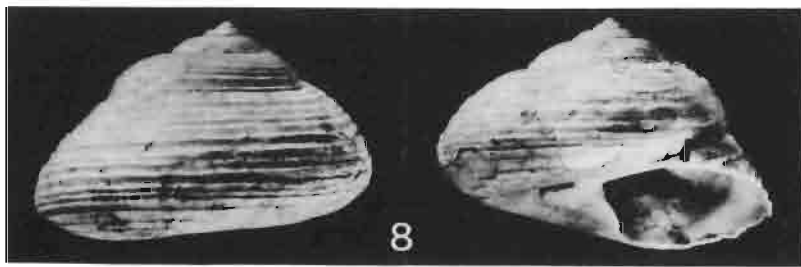
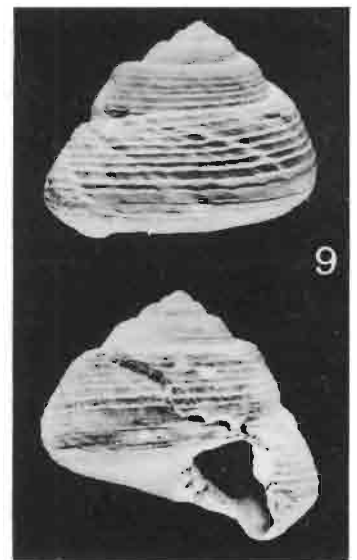
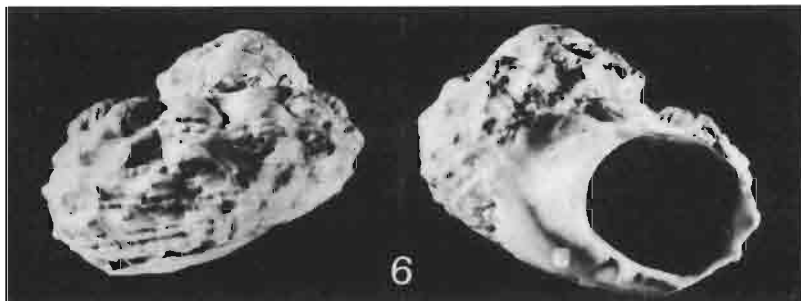
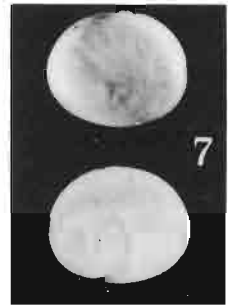
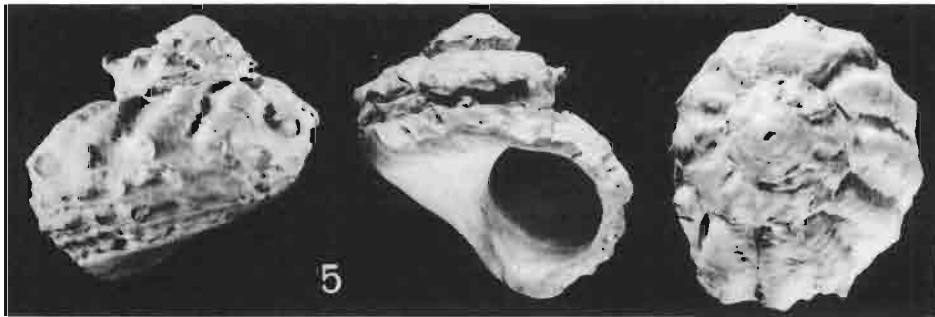
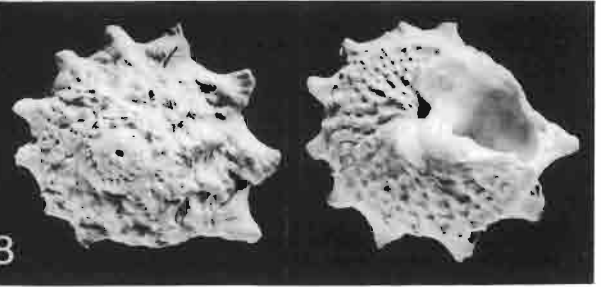
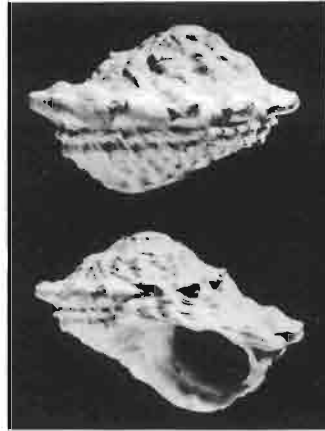
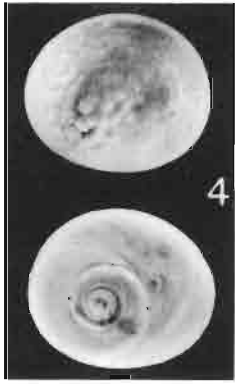
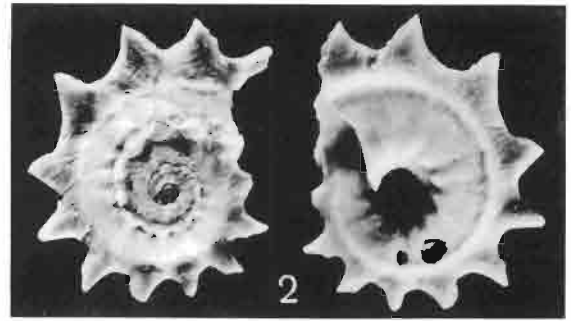
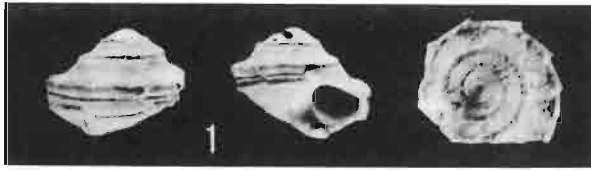
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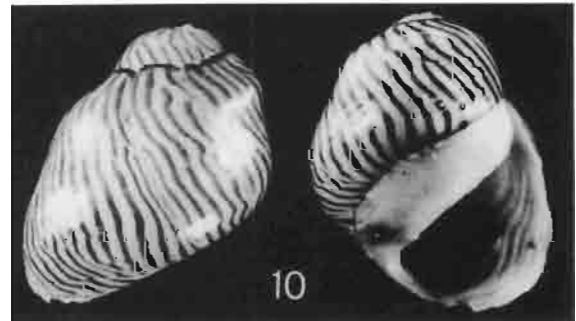
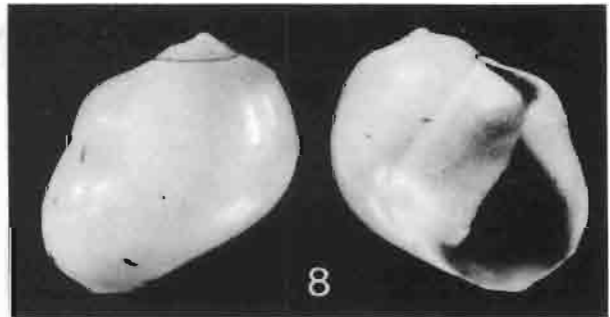
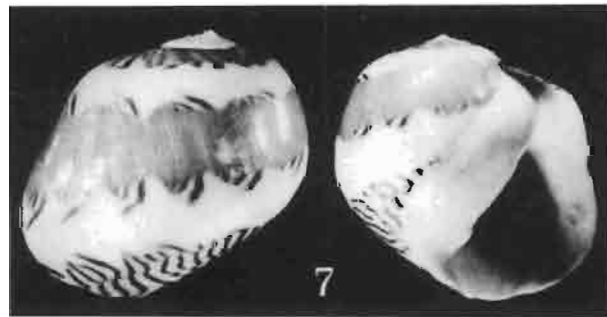
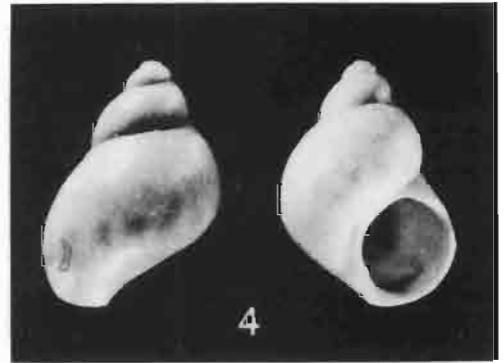
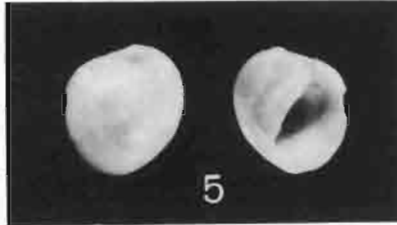
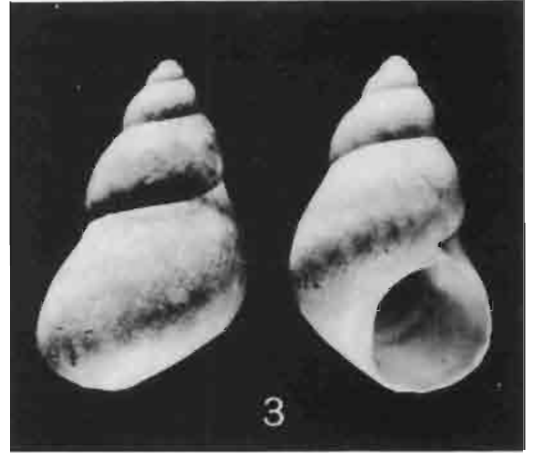
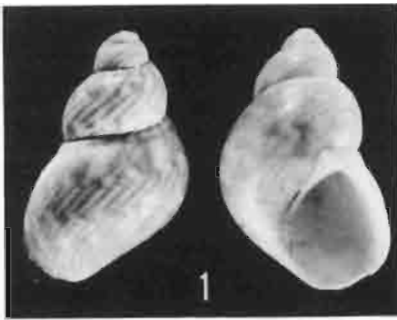
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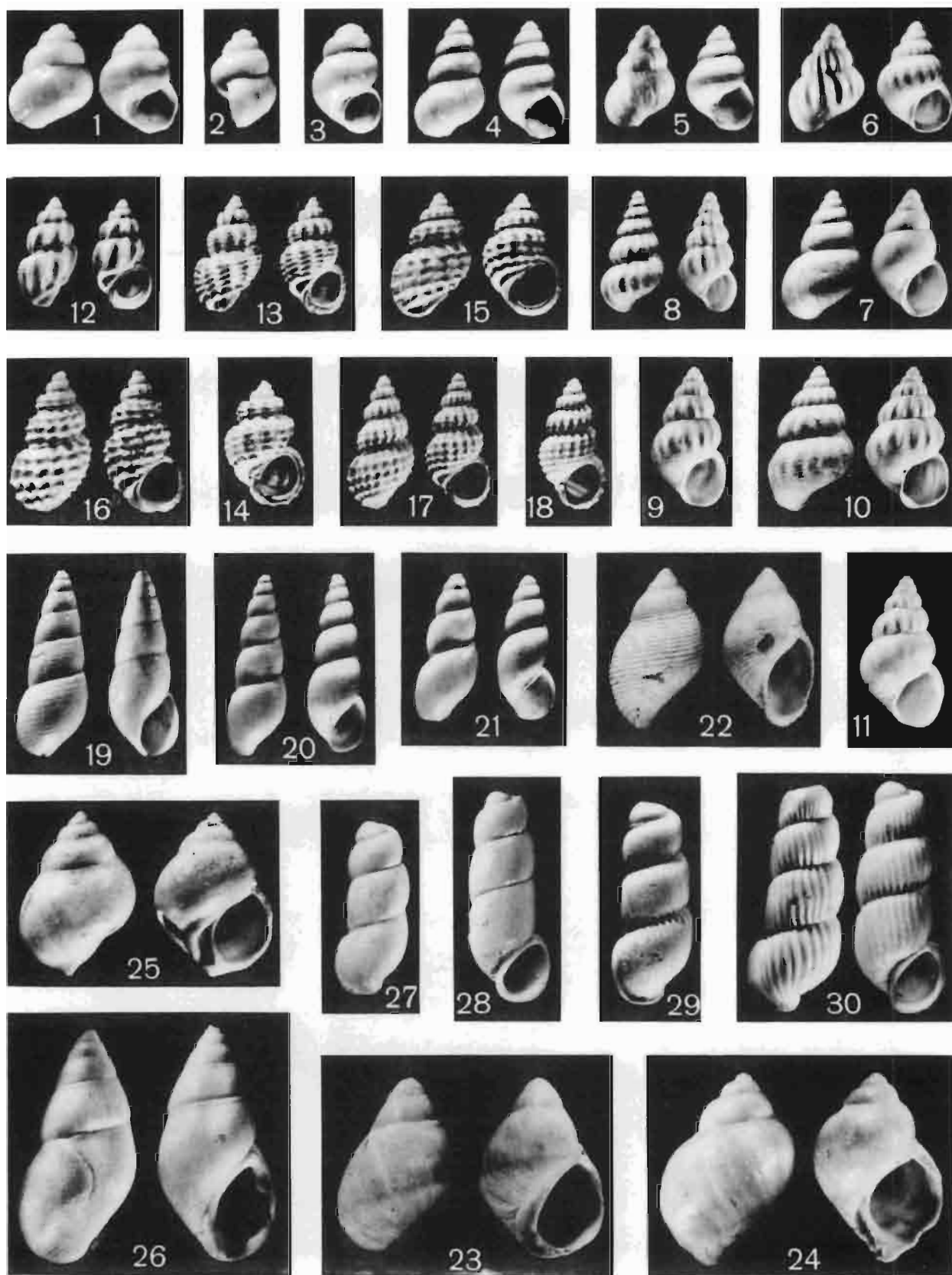
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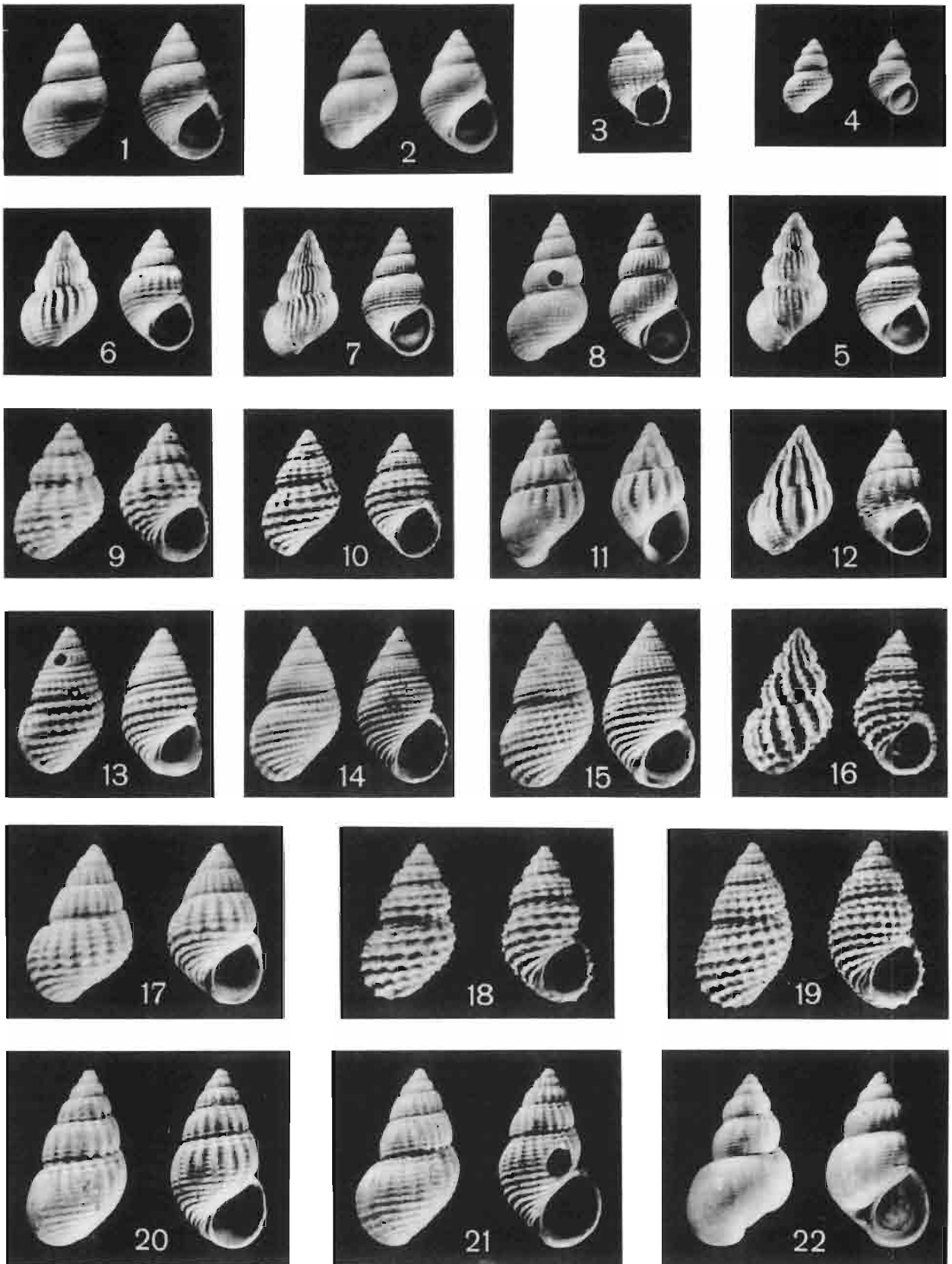
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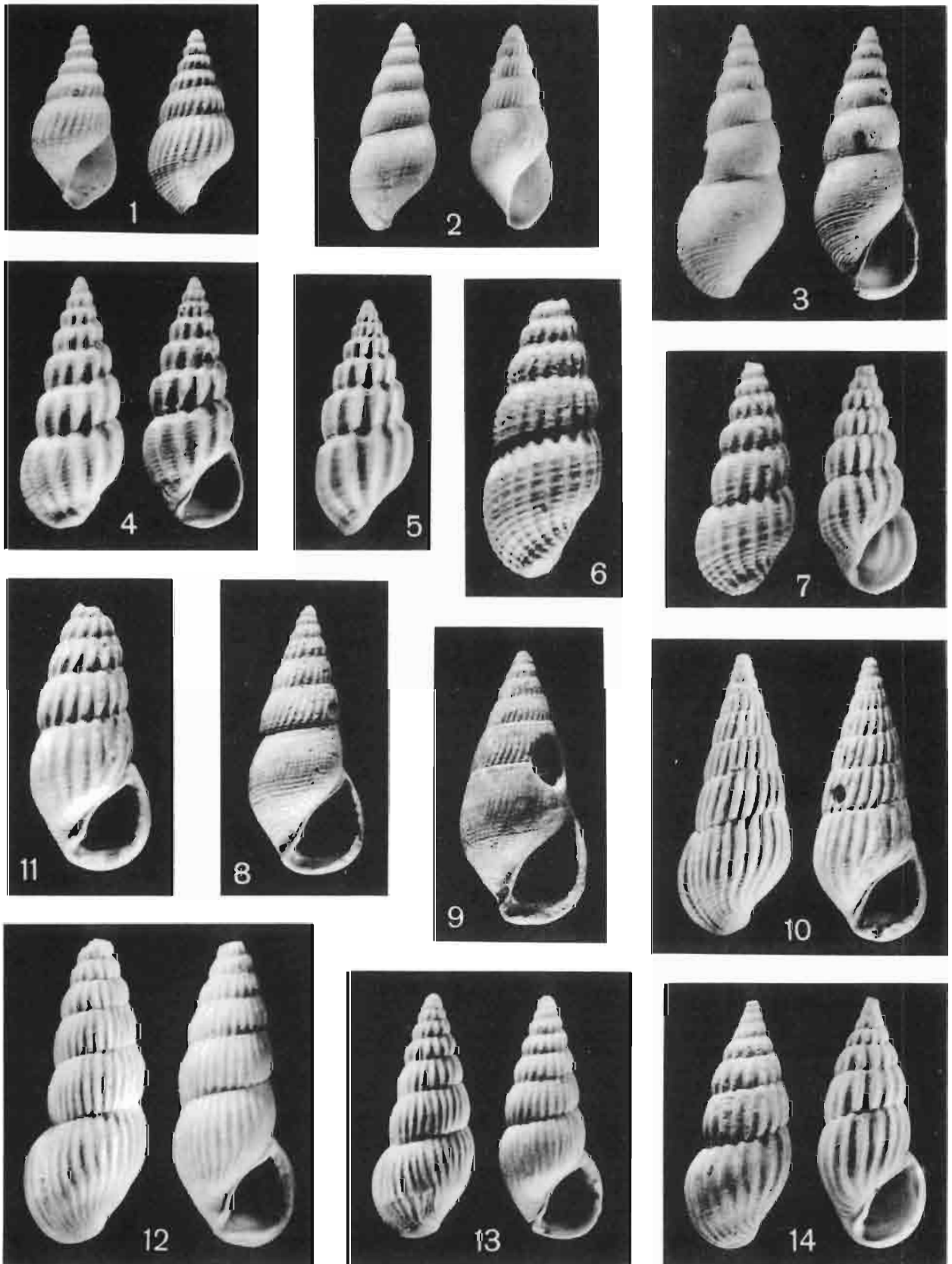
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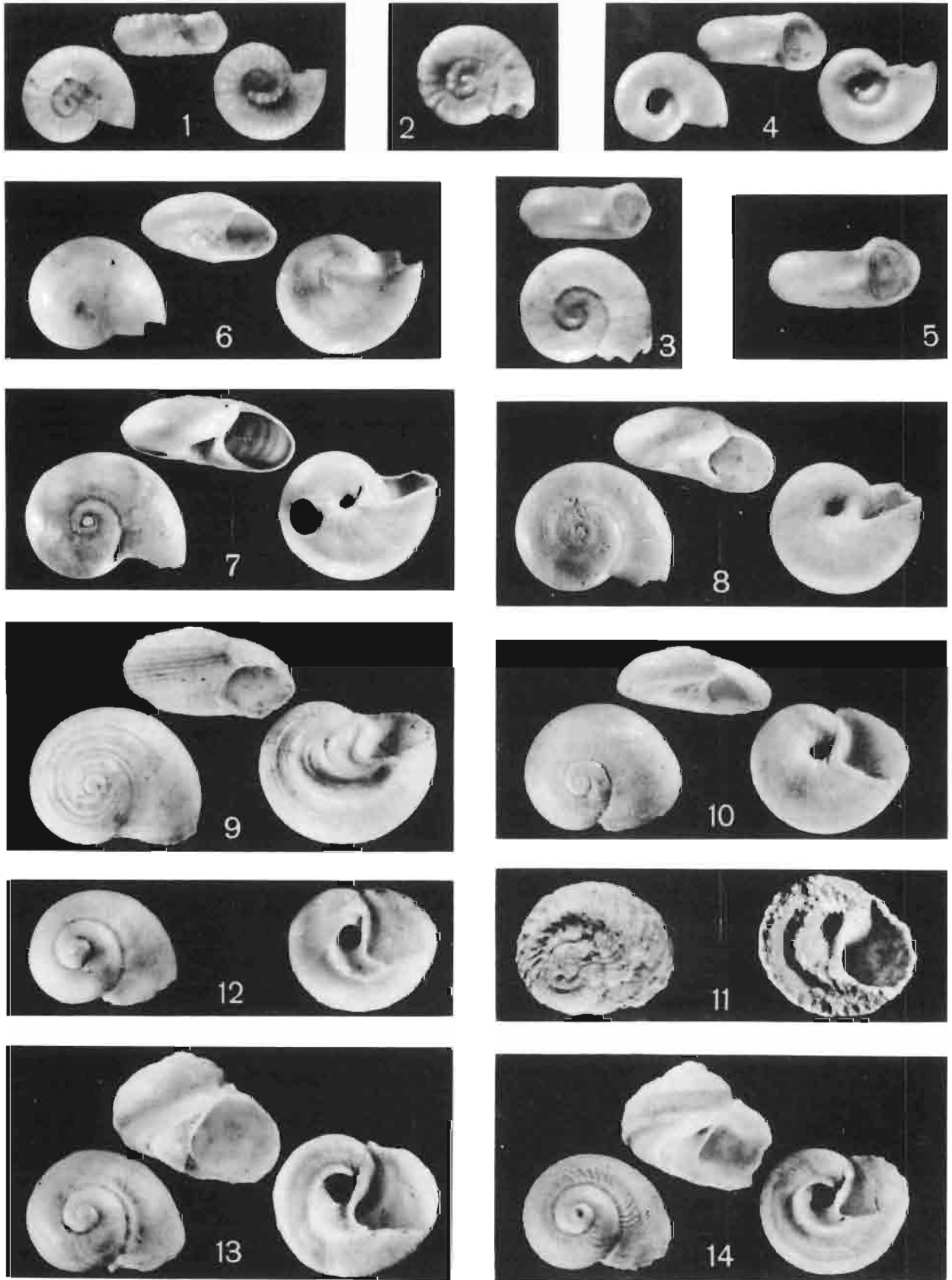
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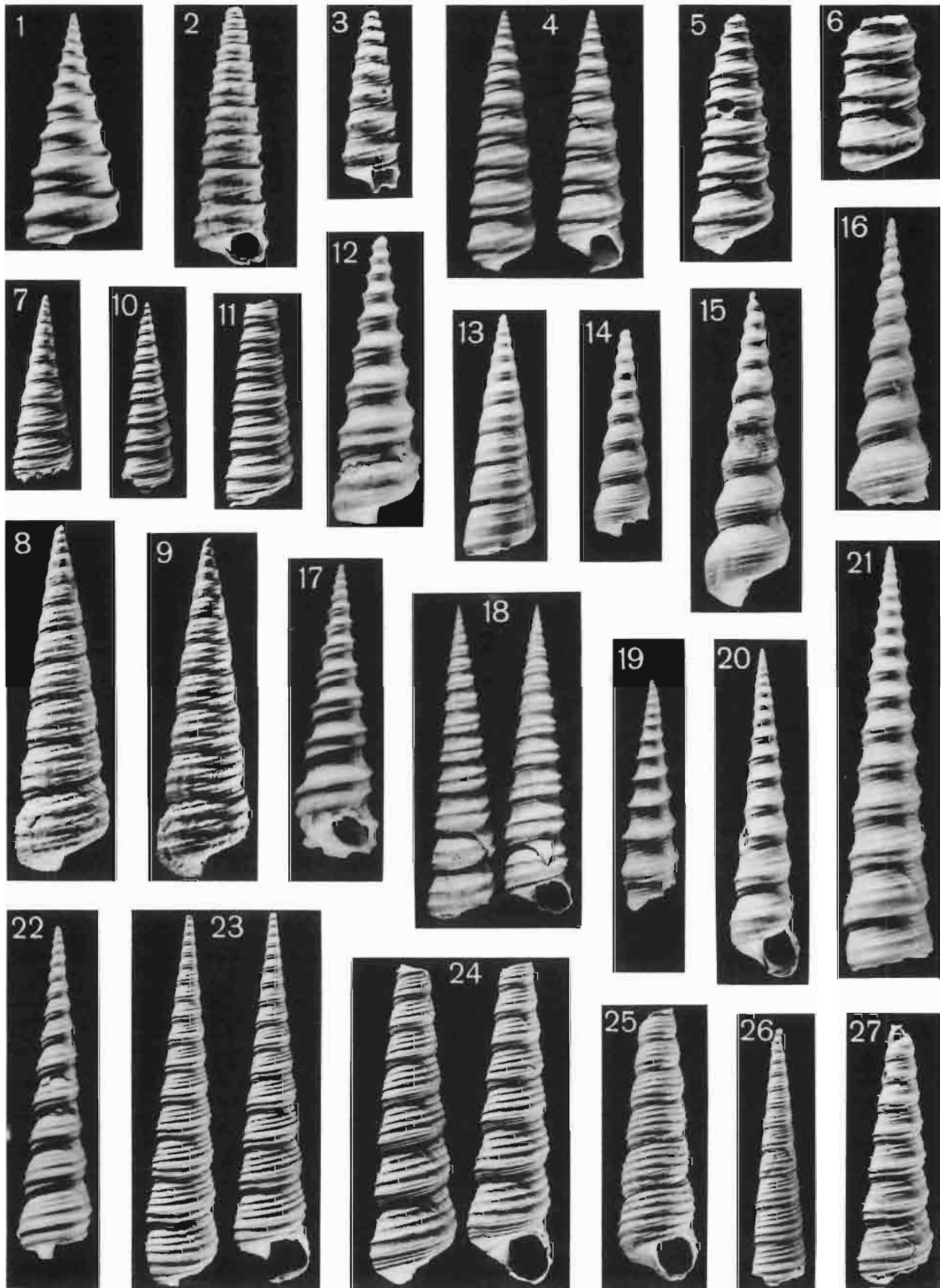
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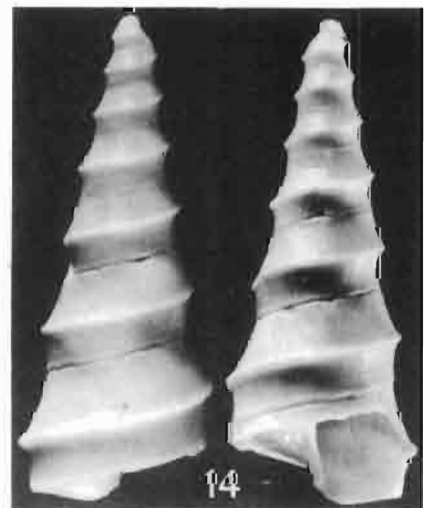
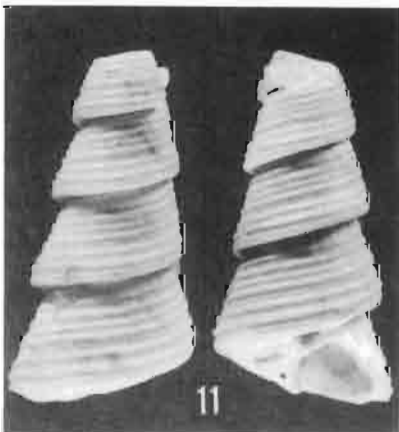
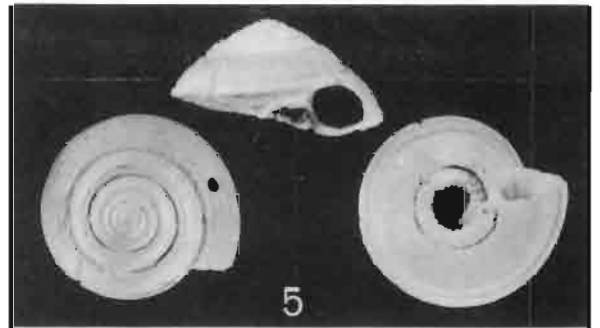
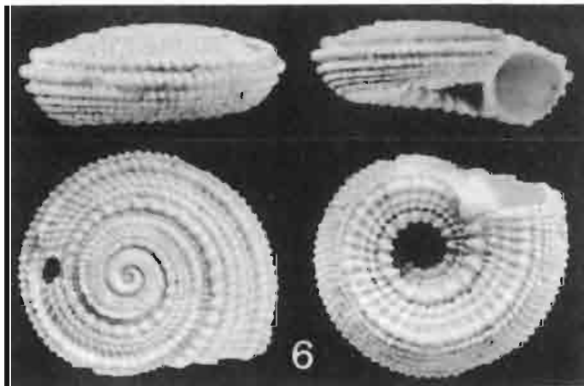
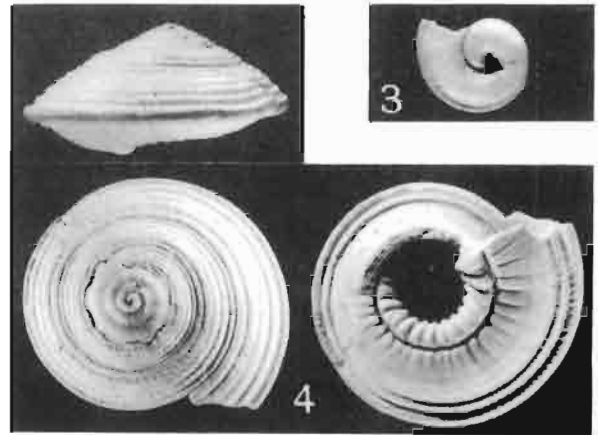
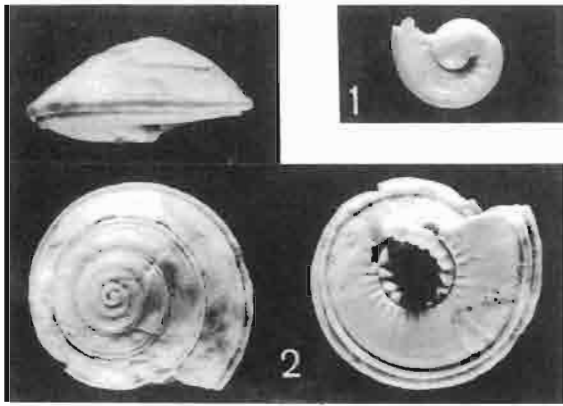
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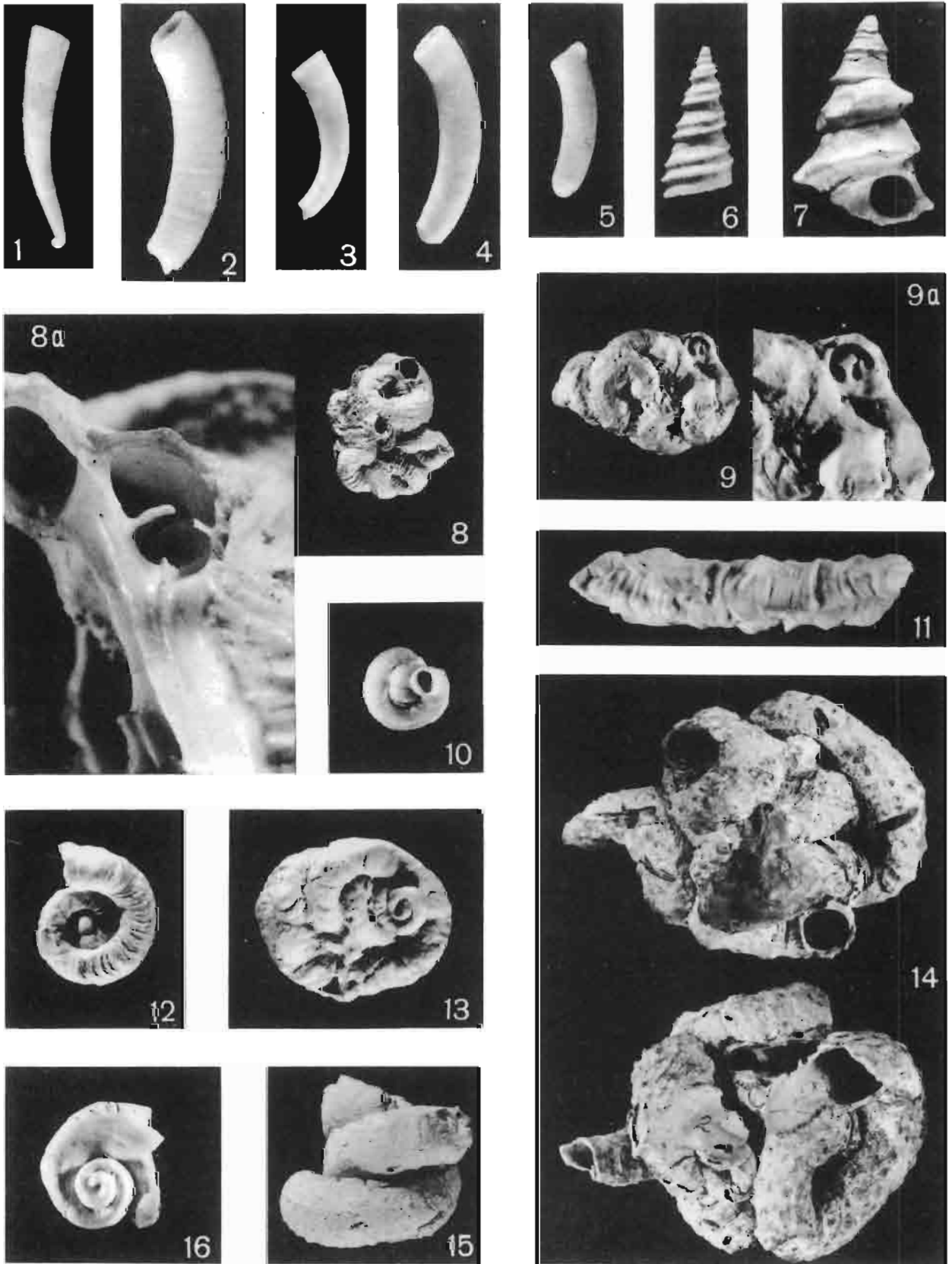
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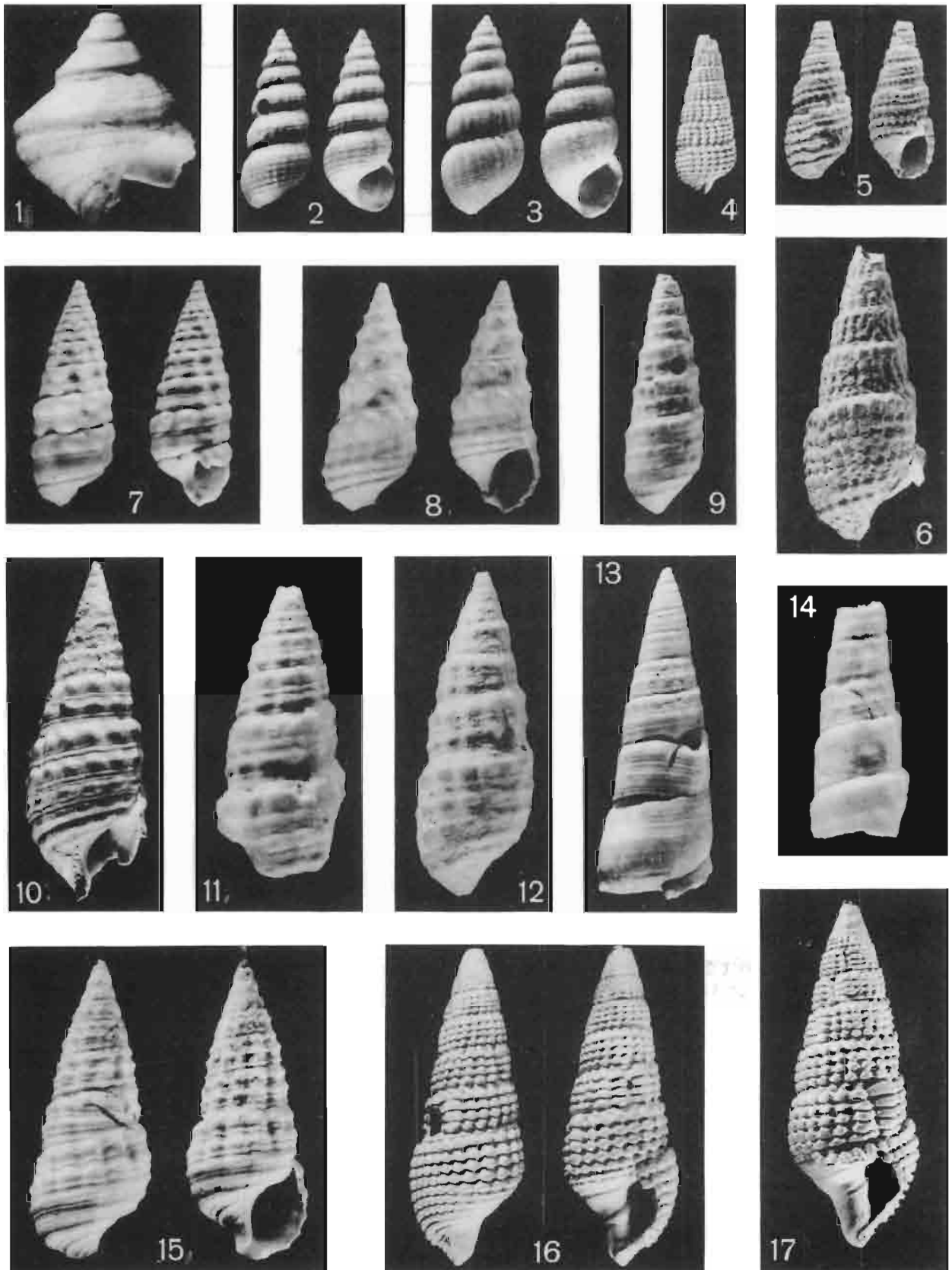
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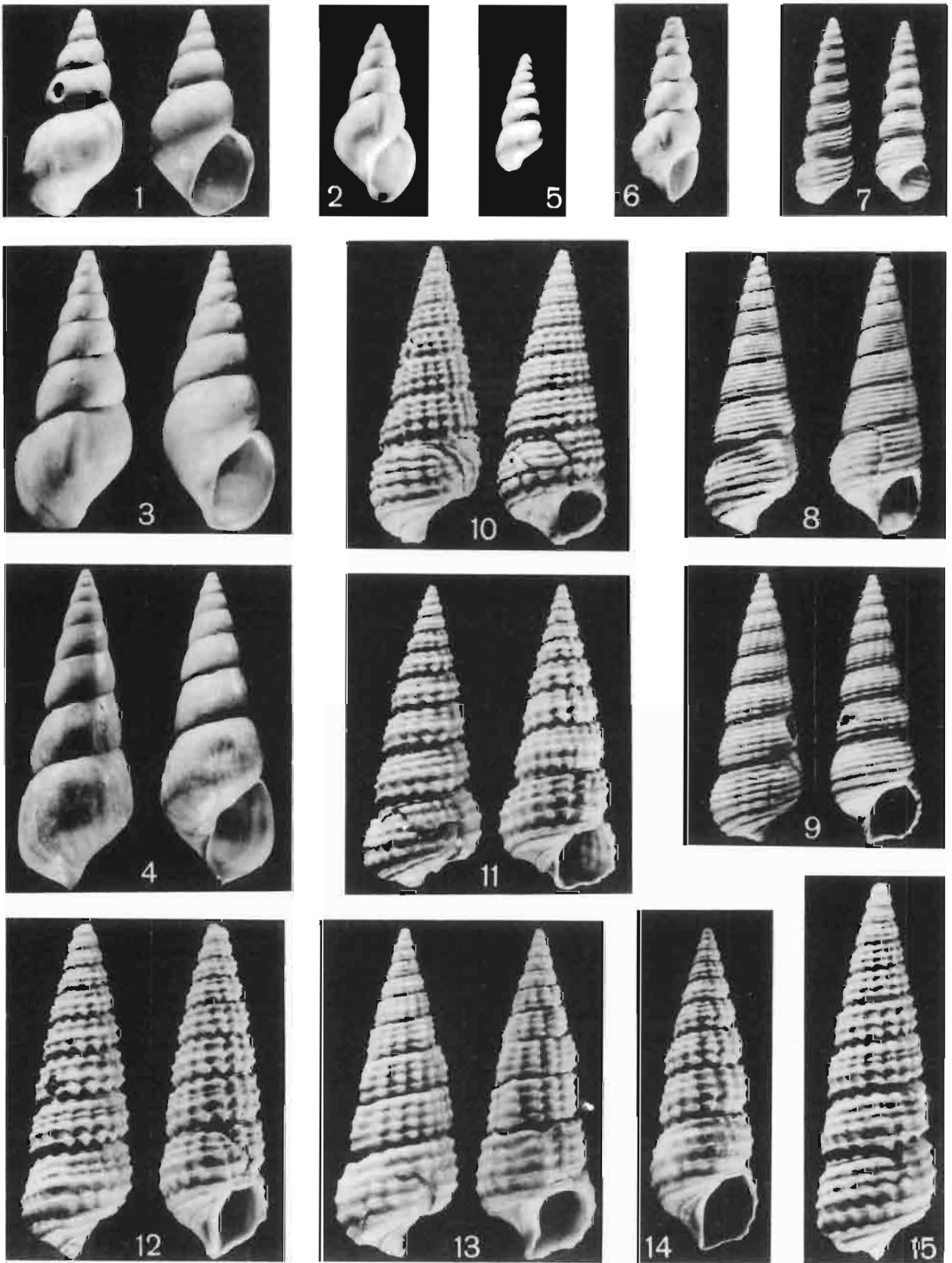
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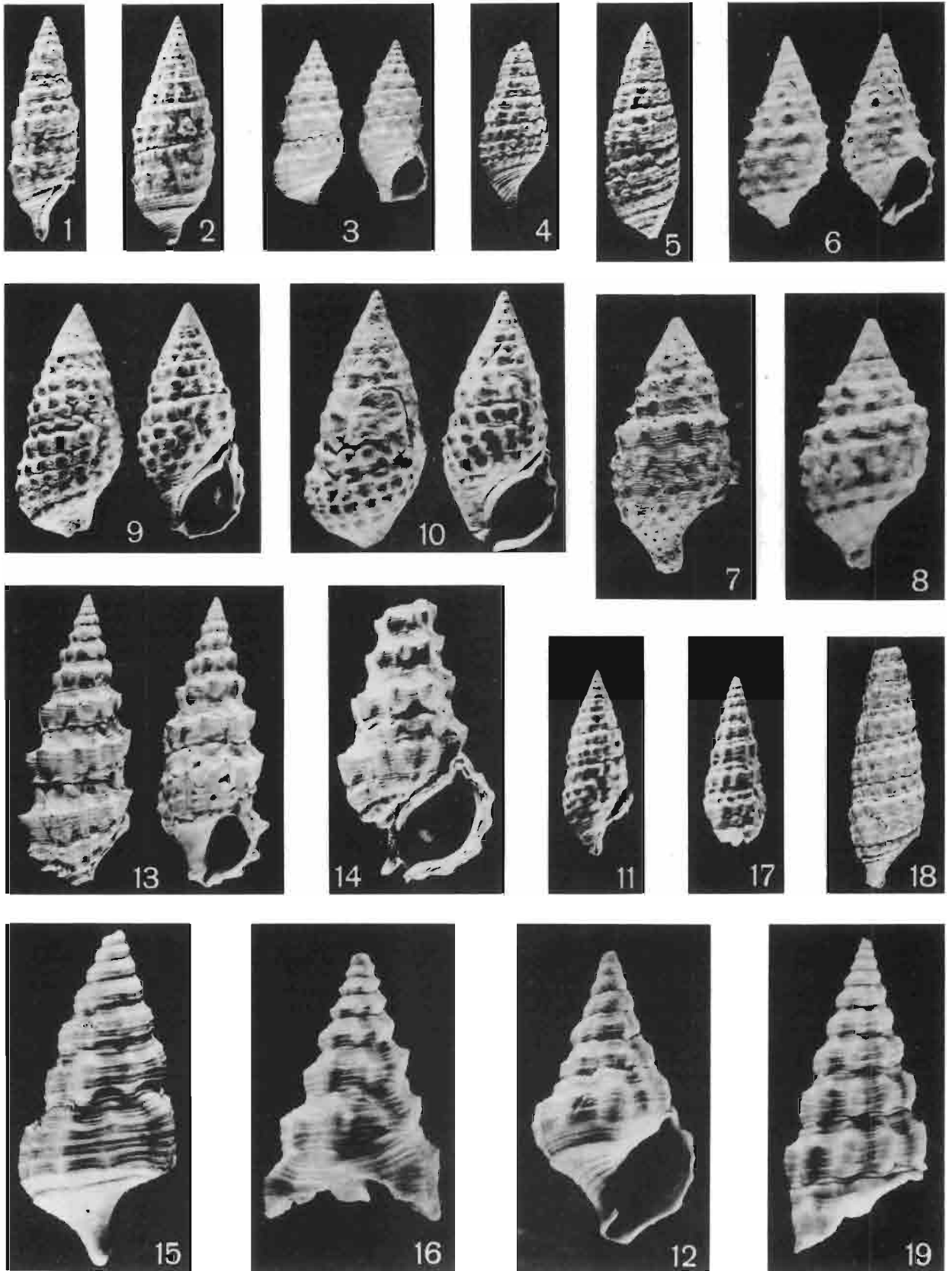
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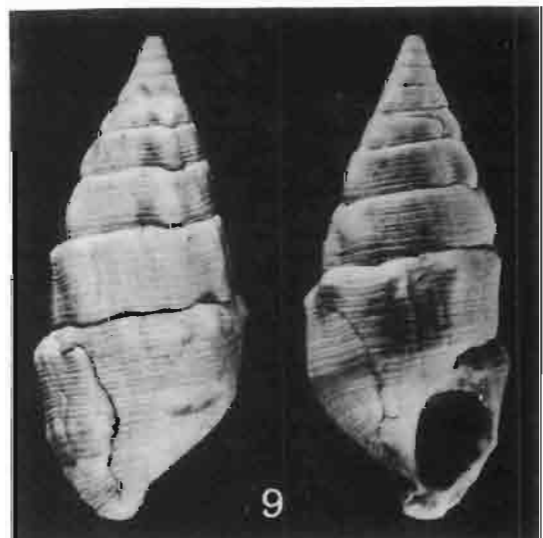
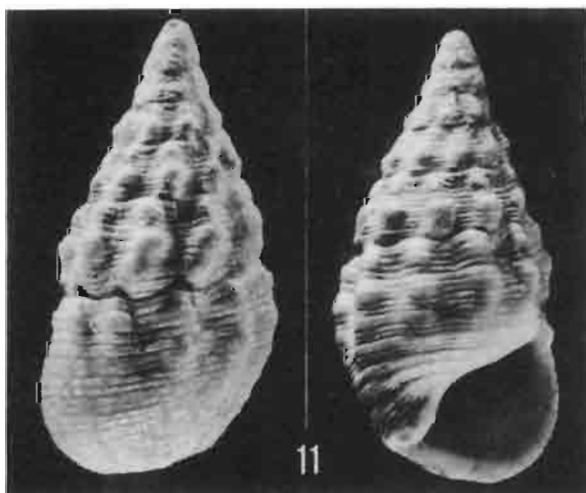
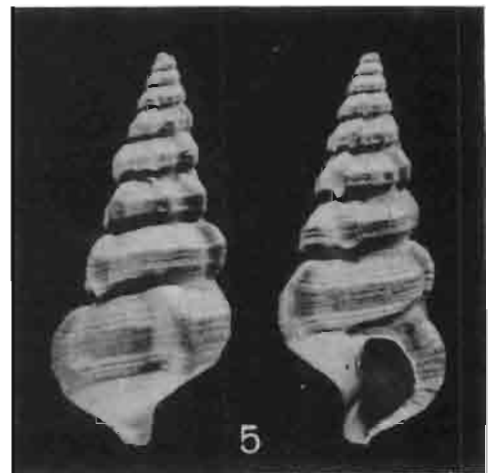
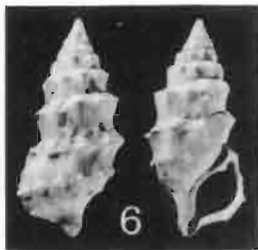
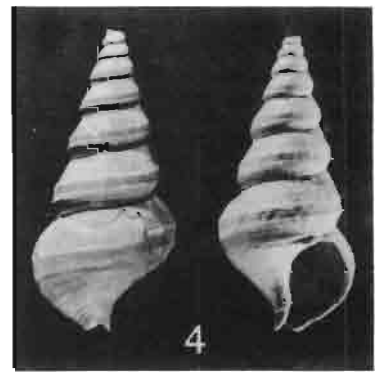
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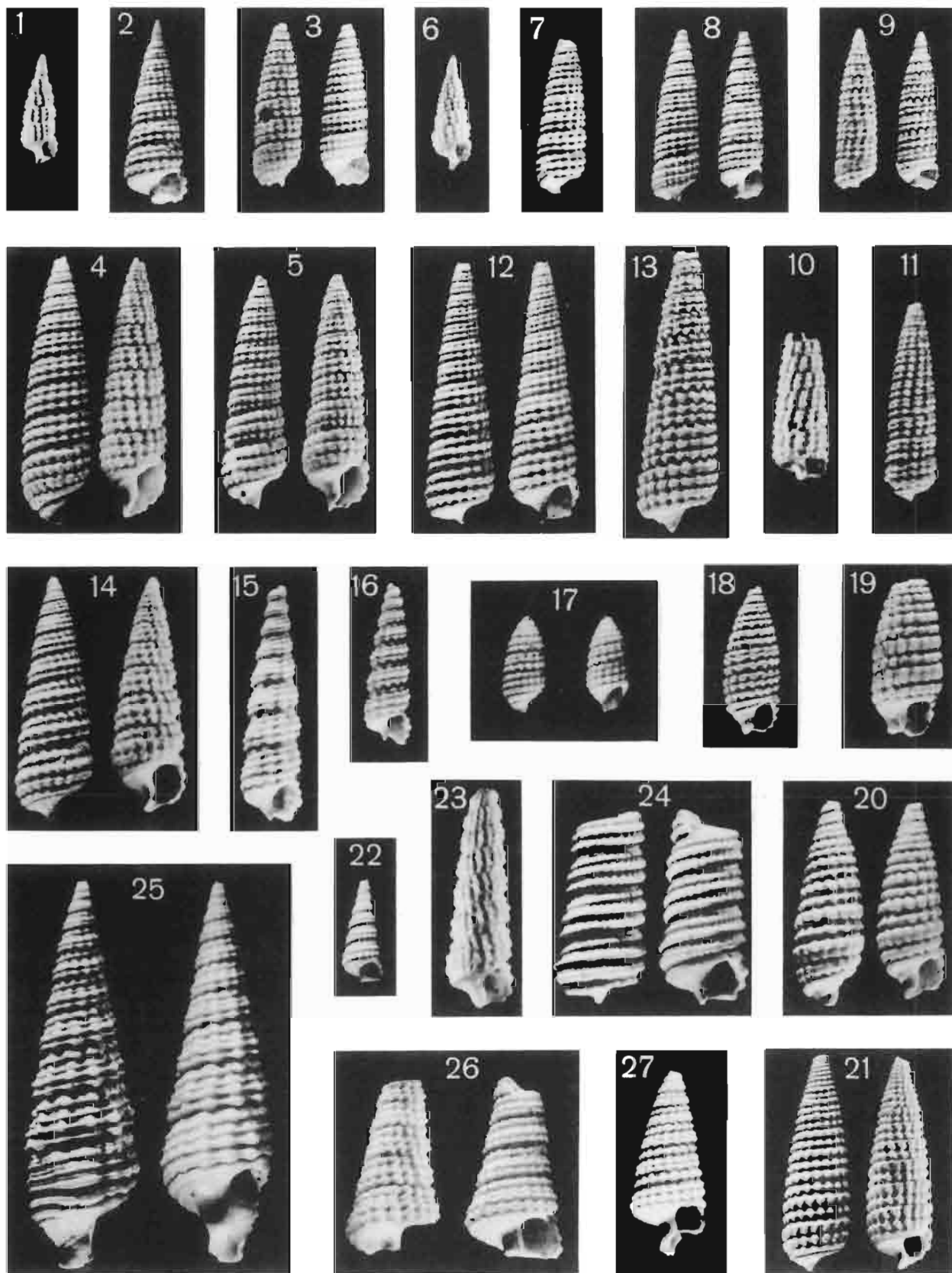
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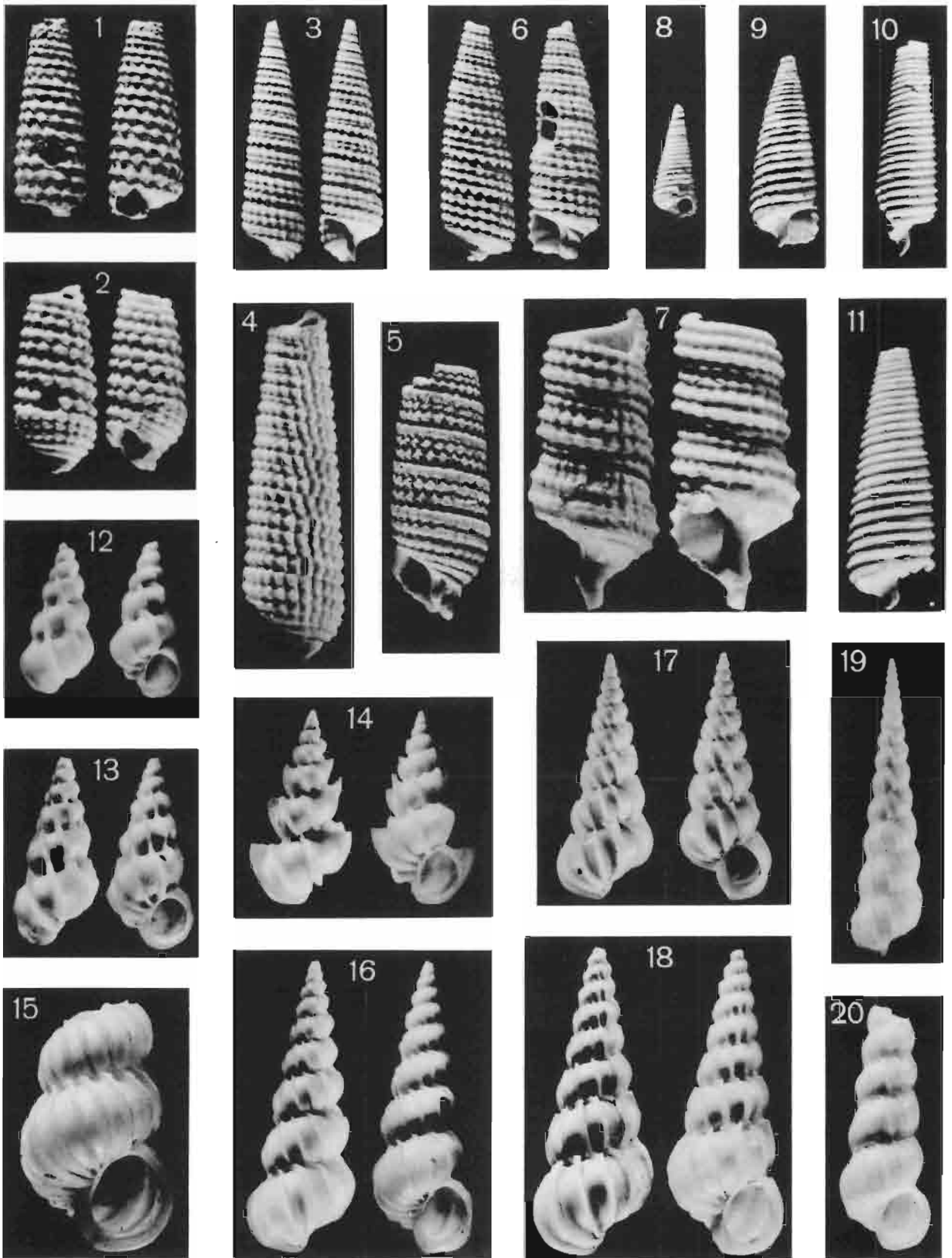
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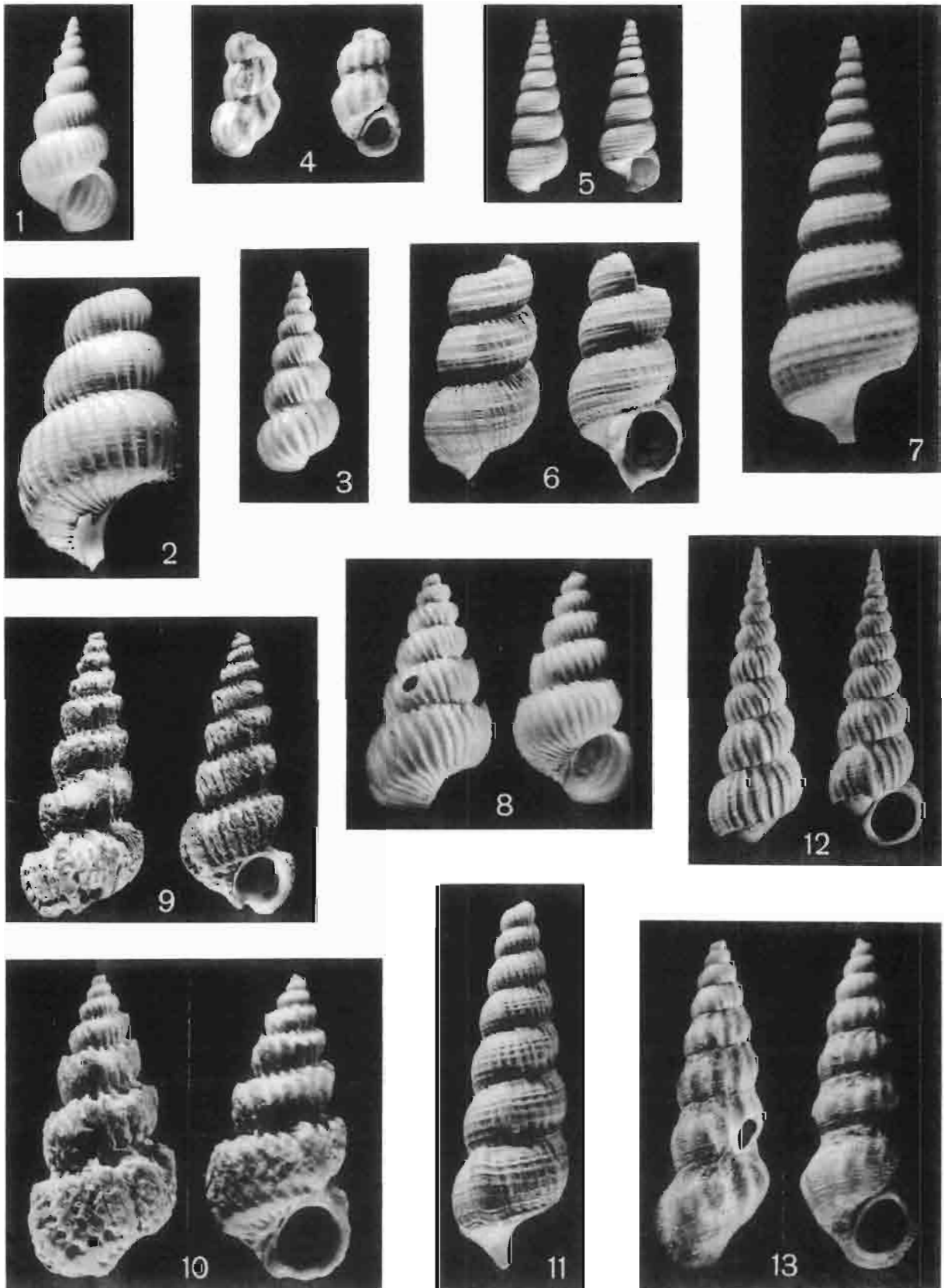
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