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Mid-Cretaceous Events

Project 58

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MID-CRETACEOUS MICROBIOSTRATIGRAPHY AND FORAMINIFERS OF THE NE MARGINS OF THE ŚWIĘTOKRZYSKIE (HOLY CROSS) MTS., POLAND

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Mid-Cretaceous foraminifers of the northeastern Mesozoic margin of the Holy Cross Mts. have been described. Planktic foraminifer standard zones — the *Rotalipora appeninnica*, *Rotalipora brotzeni*, *Rotalipora cushmani*, *Praeglobotruncana helvetica* — have been distinguished in the profile of Ożarów. A local benthic zonation, with the *Lingulogavelinella frankei*, *Gavelinella schloenbachi*, *Lingulogavelinella spinosa/Lingulogavelinella formosa*, *Gavelinella baltica* and *Lingulogavelinella globosa* zones, has been established in this profile. Due to the strong stratigraphic condensation and mixed fauna, no boundaries between the zones mentionned could be determined in the Rachów anticline.

Key words: Foraminiferida, Albian, Cenomanian, Turonian, stratigraphy, Poland.

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INTRODUCTION

The Mid-Cretaceous stratigraphy of the northeastern margins of the Holy Cross Mts., based on the foraminifers, is established in the present paper. The material for studies came from outcrops at Ożarów, Annopol and Jakubowice (fig. 1). These outcrops are situated in an area which since the mid-19th century has been the object of geologists' interest. Samsonowicz's works (1924, 1925), in which the Albian deposits were first distinguished in this area and the foundations of the Cenomanian and Turonian stratigraphy were presented, were of crucial importance to the knowledge of the geology of this area. Samsonowicz's discovery (1924) of a phosphorite deposit at Rachów (now: Annopol) was followed by several works on petrography and deposits (review of literature: Uberna 1967) and on stratigraphy (for example, Pożaryski 1948, Cieśliński 1959, 1960, 1965; Marcinowski 1980). Micropaleontological studies were started in the 1950's. Several species of benthic foraminifers from the Cenomanian

and Turonian of Jakubowice were described by Pożaryska (1954, 1957), while the planktic foraminifers, assigned then to the genus *Globotruncana*, were described from this area by Pożaryski and Witwicka (1956). The foraminiferal plankton from the Cenomanian of Jakubowice was described by Peryt (1980).

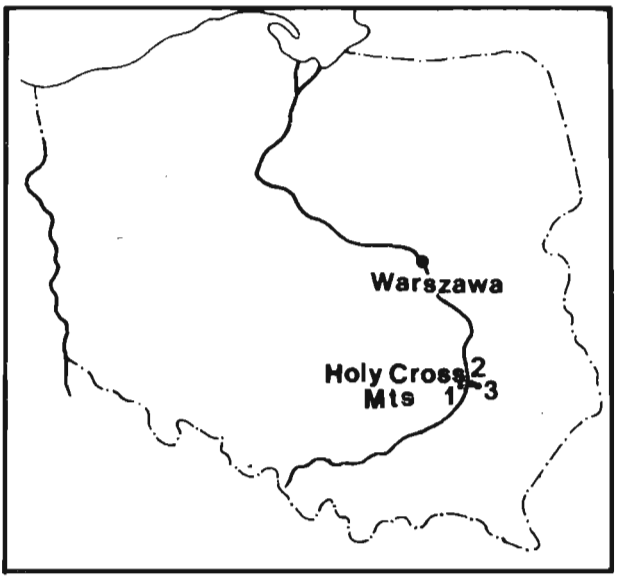

Fig. 1. A sketch map showing the distribution of outcrops from which foraminifera were examined. 1 — Ożarów, 2 — Jakubowice, 3 — Annopol.

ACKNOWLEDGEMENTS

My thanks are due to Professor K. Pożaryska for making available the samples from Jakubowice and to Dr R. Marcinowski for allowing me to describe his samples from the Ożarów outcrop and two samples from Annopol, as well as for a critical review of my manuscript and numerous discussions. The figures were drawn by Mrs. D. Sławik and photographs prepared by Mrs. G. Podbielska (Institute of Paleobiology, Polish Academy of Sciences). The SEM microphotographs were taken at the Nencki Institute of Experimental Biology.

The micropaleontological collection here described is housed at the Institute of Paleobiology, Polish Academy of Sciences, Warsaw (ZPAL).

THE MID-CRETACEOUS MACROFOSSIL STRATIGRAPHY OF THE AREA

The Albian and Cenomanian stratigraphy of the area under study worked out by Samsonowicz (1924, 1925) was later modernized by Cieśliński (1959, 1960, 1965) who divided the Albian into the Lower (continental) and Middle and Upper (marine) and, on the basis of lithological changes,

distinguished in the Albian, eight lithological members — A_1 to A_8. The phosphorite deposit, assigned previously (Samsonowicz 1925; Pożaryski 1947) to the Middle and Upper Albian and Lower Cenomanian, was assigned by Cieśliński (1959) as a whole to the Middle and Upper Albian and included in members — A_5 to A_8, and the boundary between the Albian and Cenomanian was marked out by this author above the upper layer of the phosphorites. The Cenomanian was divided into the Lower and Upper ones. The *Schloenbachia varians* Zone was distinguished by Cieśliński (1965) in the Lower and the *Holaster subglobosus* & *Schloenbachia lymense* Zone in the Upper Cenomanian. This author (Cieśliński 1976) has recently expressed the opinion that a sedimentary gap, caused by an upheaval of this area, occurred in the Annopol anticline in the Lower Cenomanian and the lower part of the Middle Cenomanian (according to the recently suggested tripartite division of the Cenomanian, Cieśliński 1976), as well as that no Upper Cenomanian occurred at all in this area. This view was questioned by Marcinowski (1980), who applied to the Cenomanian of this area a tripartite division with eight ammonite zones proposed by Hancock, Juignet and Kennedy (Kennedy and Juignet 1975; Juignet and Kennedy 1975; Kennedy and Hancock 1976). Marcinowski (1980) proved that the deposits contained between the upper sandy phosphorite and hardground in the Annopol anticline (cf. figs. 2 and 3) represent the Lower and Middle Cenomanian, without the uppermost ammonite zone, but, due to a strong stratigraphic condensation and mixed fauna, it is impossible to mark out the interzonal boundary. The stratigraphic gap, including the *Acanthoceras jukesbrownei* Zone, occurs in the hardground (Marcinowski 1980), which is overlain by the entire Upper Cenomanian although it does not exceed 50 m in thickness. The boundary between the Cenomanian and Turonian is documented by the first appearance of the *Inoceramus labiatus* Zone. The Turonian stratigraphy of the northeastern margins of the Holy Cross Mts. was elaborated in detail by Pożaryski (1938, 1948). He divided the Turonian into two parts. In the Lower Turonian, he separated the *Inoceramus labiatus* and *Inoceramus lamarcki* Zones and, in the Upper Turonian — the *Scaphites geinitzi* and *Inoceramus schloenbachi* Zones. The *Inoceramus costellatus*/ /*Inoceramus inconstans* Zone was introduced by Błaszkiewicz and Cieśliński (1973) instead of the *Scaphites geinitzi* Zone. The uppermost Turonian zone, that is, the *Inoceramus schloenbachi* has recently been assigned by Marcinowski and Radwański (1982) to the Coniacian.

LITHOLOGY AND DISTRIBUTION OF THE FORAMINIFERS

The Mid-Cretaceous outcrops here discussed belong to the northeastern Mesozoic margins of the Holy Cross Mts. The Mid-Cretaceous deposits form an anticline in the environs of Annopol on the right-hand

bank of the Vistula. The Jakubowice and Annopol outcrops are situated in the area of the anticline and that of Ożarów in the monoclinal part of the Mesozoic margin of the Holy Cross Mts.

Annopol and Jakubowice (the Annopol anticline)

Albian

The Albian deposists in the Annopol anticline, about 6 m in thickness, are sands intercalated by sandstones and, in the uppermost part, with 40 cm thick bed of phosphorites, divided by a thin layer of sand into two parts, the so-called lower and upper sandy phosphorites.

The foraminifers were found by the present writer only in the phosphorites. According to Cieśliński (1959, 1976), the phosphorites belong to members A_5—A_8 and, according to the ammonite zonation, to the zones ranging from the *Hoplites dentatus* to the *Stoliczkaia dispar* Zone. These deposits were formed under the conditions of considerable slowdown in the rate of sedimentation and, consequently, there occurred the phenomenon of stratigraphic condensation expressed by the concurrence of the Middle and Upper Albian (Cieśliński 1976).

A fairly rich foraminiferal fauna is contained in these deposits (figs. 2 and 3). There occur both planktic and benthic foraminifers, both calcareous and arenaceous. In the assemblage of planktic foraminifers, predominant species are *Hedbergella planispira*, *H. delrioensis*, *H. simplex*, *Guembelitria cenomana*, *Globigerinelloides bentonensis* and *Heterohelix moremani*. Next to them, although much less frequent, there occur *Rotalipora appenninica*, *Rotalipora brotzeni*, *R. gandolfii*. The stratigraphic condensation, expressed in, among other elements, a mixed fauna varying in age, is also confirmed by an analysis of the stratigraphic ranges of these species in considerably thick Albian profiles and by a comparison of these ranges with those of ammonites occurring in the phosphorites of the Annopol anticline. *Rotalipora appenninica* is known only from the *Stoliczkaia dispar* Zone (cf. Robaszynski and Caron 1979). In the material under study, it occurs as early as in the lower sandy phosphorites, together with *Hoplites dentatus*. The co-occurrence of these species is possible only if we have to do with mixed deposits varying in age. *Rotalipora brotzeni* and *R. gandolfii*, known from the uppermost Albian (upper part of the *Stoliczkaia dispar* Zone) (Robaszynski and Caron 1979), also co-occur in the anticline of Annopol with *Hoplites dentatus*.

Of benthic foraminifers, the most numerously represented in this assemblage is the family Anomalinidae and the genera *Lingulogavelinella* and *Gavelinella*. The genus *Arenobulimina* with its species *A. chapmani* and *A. advena*, as well as the genus *Ataxophragmium* predominate among the arenaceous foraminifers.

Cenomanian

The Albian phosphorites are overlain, with a sedimentary continuity, by the Cenomanian sandy-glauconitic marls with phosphoritic concretions. At a level of about 180 cm over the Albian phosphorites, concretions of

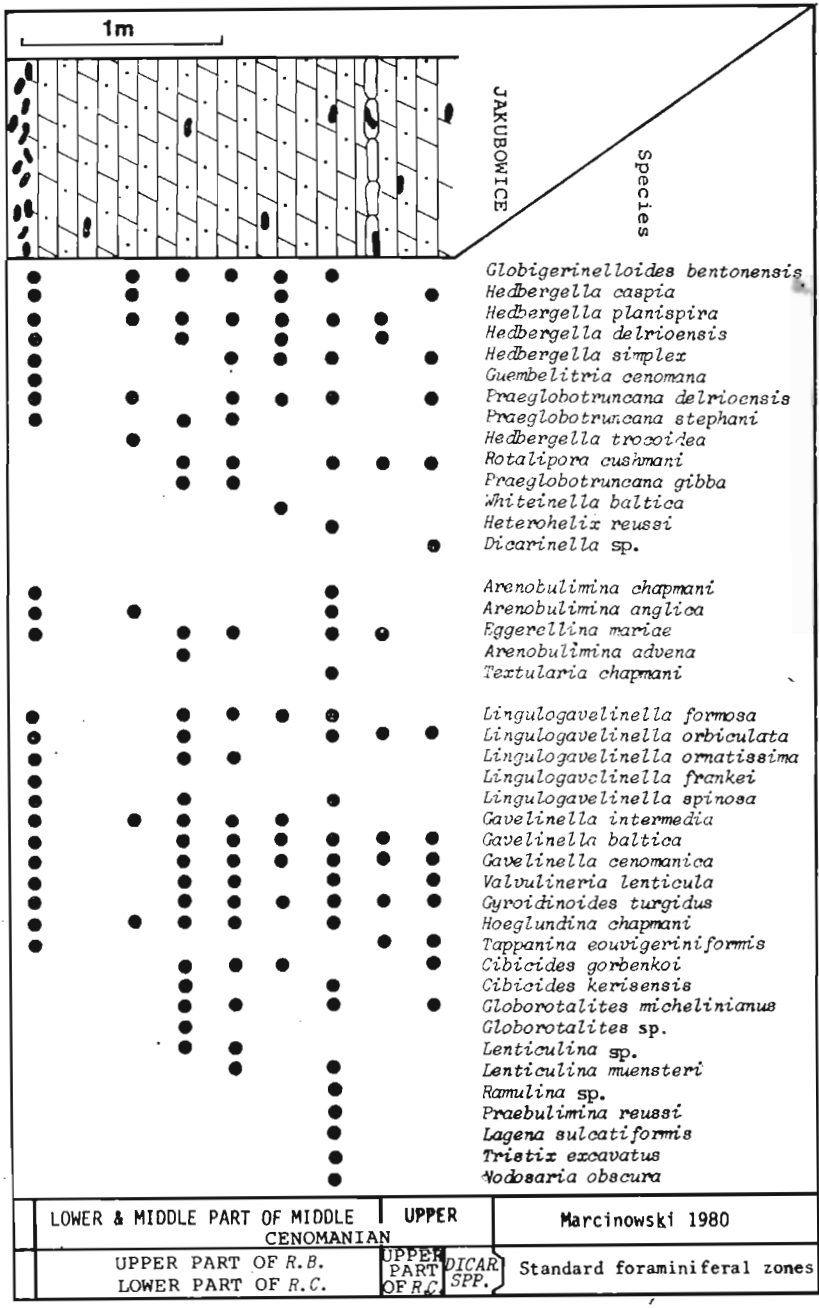

Fig. 2. Columnar section Jakubowice, with distribution of species and zonation. See fig. 4 for explanation.

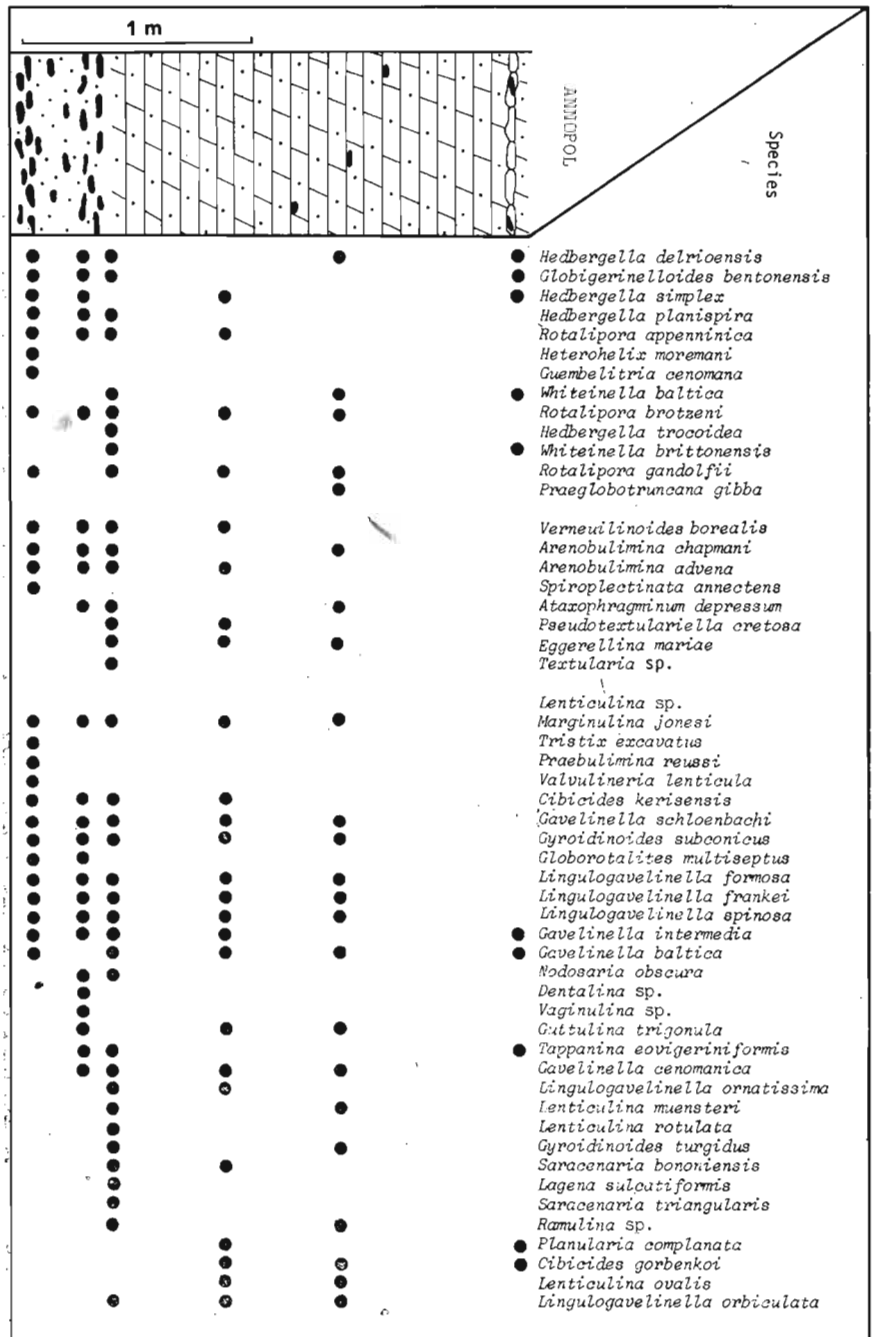

Fig. 3. Columnar section Annopol, with distribution of species and zonation. See fig. 4 for explanation.

nodular shape are formed by Cenomanian sandy-phosphoritic marls. This is a hardground (cf. figs 2 and 3). Marls overlying the deposit of phosphorite and overlain by hardground are assigned by Marcinowski (1980) to the Lower and, in part, Middle Cenomanian. In his opinion (Marcinowski 1980), the uppermost zone of the Middle Cenomanian, that is, the *Acanthoceras jukesbrownei* Zone is most likely to be lacking here and this absence is connected with the development of hardground. Hardground is also overlain by a 50 cm thick bed of sandy-glauconitic marls representing the whole Upper Cenomanian (Marcinowski 1980).

The Cenomanian is also marked by the occurrence of a rich foraminiferal assemblage. An almost entire assemblage of planktic foraminifers, occurring in the Middle and Upper Albian phosphorites, also occurs in the Lower and Middle Cenomanian marls, except for *Guembelitria cenomana* which disappears in the uppermost Albian. There appear such species as *Praeglobotruncana gibba*, *Rotalipora cushmani*, *Whiteinella baltica*, *W. brittonensis* and *Heterohelix reussi*. All of them are known beginning from the Middle Cenomanian (cf. Robaszynski and Caron 1979), but, due to the stratigraphic condensation and mixing of the Lower and Middle Cenomanian fauna (Marcinowski 1980), their appearance in the profile should be considered accidental. This also concerns the distribution of benthic foraminifers in this profile. All species of benthic foraminifers, found in the Albian, also occur in the Lower and Middle Cenomanian (figs 2 and 3), together with new representatives of the family Anomalinidae, that is, *Cibicides gorbenkoi*, *C. kerisensis*, *Lingulogavelinella orbiculata* and *L. ornatissima*. Increase is also observed in the assemblage of arenaceous foraminifers. In the Upper Cenomanian, i.e. in deposits from above the hardground, the assemblage is not as rich as that from the condensed layer. The greatest changes are observed in the assemblage of planktic foraminifers in which, first of all, except for *Rotalipora cushmani*, no other species of *Rotalipora* occurs. The first representative of the genus *Dicarinella* appears here, whereas the benthic foraminifers are mostly represented by particular species of the genera *Lingulogavelinella*, *Gavelinella* and *Arenobulimina* (cf. figs 2 and 3).

Ożarów

Albian

The deposits of this stage, 9 m in thickness, somewhat discordantly overlie the Kimmeridgian limestones (fig. 4). In the lowermost part, these are green, coarse-grained sands, with fragments of limestones and rare phosphoritic concretions. They are overlain by a series of glauconitic sands about 2.5 m in thickness, with single phosphoritic concretions. Considerable accumulations of phosphorites form three distinct horizons in some places. The sands turn into poorly cemented sandstones more

than 3.5 m in thickness; in the lower part, they are slightly silicified. They are overlain by a series of glauconitic sandstones, 2.5 m in thickness with rare phosphoritic concretions and with traces of the *Chondrites* observed in the floor. No macrofauna was found in this part of the profile

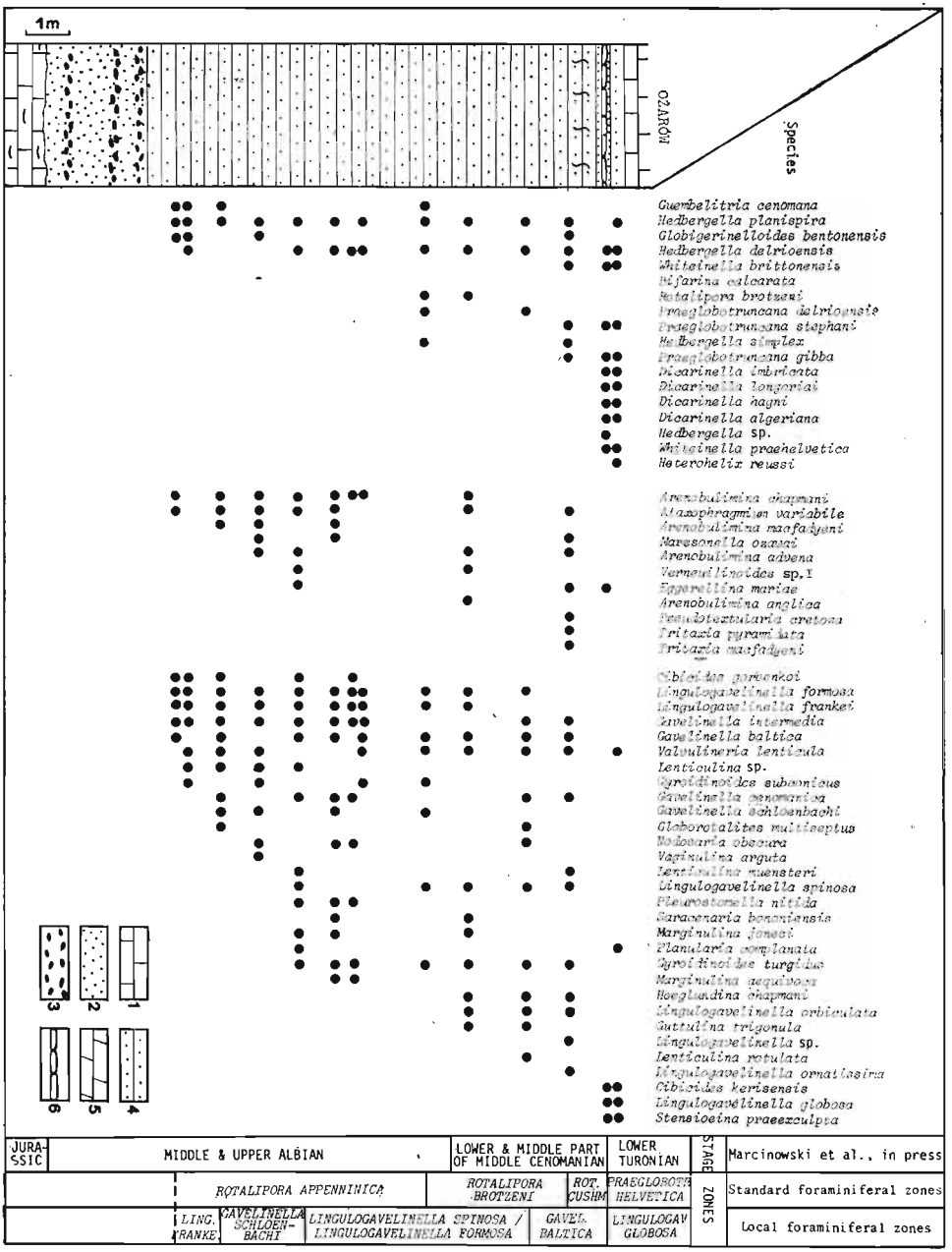

Fig. 4. Columnar section Ożarów, with distribution of species and zonation (columnar section Ożarów after Marcinowski, Naidin, Tröger, in press); 2 — sands, 3 — phosphorites, 4 — sandstones, 5 — marls, 6 — hardground.

(Marcinowski, Naidin and Tröger, in press). A poor foraminiferal assemblage occurs here only over the second phosphoritic horizon (fig. 4). Planktic foraminifers are represented mostly by *Hedbergella planispira*, *H. delrioensis*, *Guembelitria cenomana* and *Globigerinelloides bentonesis*. The genera *Lingulogavelinella* (*L. formosa* and *L. frankei*) and *Gavelinella* predominate among the calcareous benthic foraminifers and *Arenobulimina* — among the arenaceous ones. Except for *Bifarina calcarata*, all species found in the Albian also occur in the Cenomanian.

Cenomanian

The Albian deposits are overlain, with a sedimentary continuity, by the Cenomanian glauconitic sandstones almost 4 m in thickness. A macrofauna, on the basis of which a boundary between the Albian and Cenomanian was marked out at a level of 9 m above the Kimmeridgian limestones (Marcinowski, Naidin and Tröger, in press), was found in these sandstones. The Cenomanian sandstone 4 m in thickness is overlain by a thin layer of a strongly compact marly-phosphoritic nodular sandstone. This is a hardground. The stratigraphic gap, connected with the formation of this hardground, includes an interval from the uppermost part of the Middle Cenomanian, that is, the *Acanthoceras jukesbrownei* Zone, through the Upper Cenomanian, to the lower part of the *Inoceramus labiatus* Zone of the Lower Turonian (cf. Marcinowski, Naidin and Tröger, in press). Thus, only the Lower Cenomanian and the lower and middle part of the Middle Cenomanian occur in this profile.

The foraminiferal fauna in the Cenomanian sandstones of Ożarów is poor and cosmopolitan. This is particularly true in regard to the planktic foraminifers. Of index forms, only *Rotalipora brotzeni*, appearing as early as the uppermost Albian and occurring in the lowermost Cenomanian, is observed in this locality. *Praeglobotruncana gibba* (cf. fig. 4) occurs for the first time at a level of about 3 m over the Albian-Cenomanian boundary, whereas *Lingulogavelinella formosa* and *L. frankei* of the assemblage of benthic foraminifers disappear in the upper part of the profile. *Lingulogavelinella orbiculata*, *L. ornatissima* and *Hoeglundina chapmani* are species which appear for the first time in the Cenomanian.

Lower Turonian

Directly overlying hardground, there occurs a 50 cm thick layer of a poorly cemented marly sandstone, with glauconite and rare phosphorites. It is overlain by a 60 cm thick layer of a white sandy limestone, with an admixture of glauconite. These deposits belong to the upper part of the *Inoceramus labiatus* Zone of the Lower Turonian (Marcinowski, Naidin and Tröger, in press).

The foraminiferal assemblage occurring above the hardground differs

radically from that from under the hardground. It is dominated by planktic foraminifers. In addition to species of the genus *Hedbergella*, already known from the Albian an Cenomanian and those of the genus *Praeglobotruncana* from the Cenomanian, here appears for the first time the genus *Dicarinella*, represented by the species: *imbricata, hagni, longoriai* and *algeriana*. *Whiteinella praehelvetica* also occurs here for the first time. The assemblage of benthic foraminifers in the deposits overlying hardground is represented by six species only as compared with eighteen occurring under it. Twelve species found in the Cenomanian deposits do not occur in the Lower Turonian, but *Lingulogavelinella globosa* appears here for the first time (fig. 4).

FORAMINIFERAL ZONATIONS

An assemblage of foraminifers composed of about 80 species was found by the present writer in the material under study. This assemblage enabled to distinguish several zones on the basis of both planktic and benthic foraminifers.

The writer (Peryt 1983) had slightly modified the planktic zonal scheme proposed previously by Robaszynski and Caron (1979). The modification consists in separating the *Whiteinella archaeocretacea* and *Praeglobotruncana helvetica* zones in the rank of subzones of the *Dicarinella* spp. Zone, proposed by the present writer and which includes an interval from the last occurrence of *Rotalipora cushmani* to the first occurrence of *Marginotruncana coronata*. Several species of the genus *Dicarinella* abundantly occur in the area under study as early as in the uppermost Cenomanian, as well as the Lower and Middle Turonian, whereas *Whiteinella archaeocretacea* and *Praeglobotruncana helvetica* are here very rare.

In contrast to the zonation based on planktic foraminifers applicable to extensive regional correlations, the zonation based on benthic foraminifers the occurrence of which is frequently limited facially is most frequently applicable only locally. Due to the occurrence of numerous species of the genera *Gavelinella* and *Lingulogavelinella* in the Middle Albian--Lower Turonian deposits of the Ożarów profile, the benthic zonal scheme was elaborated on the basis of their appearing and disappearing in this profile.

PLANKTIC ZONAL SCHEME

The Annopol anticline

Rotalipora appenninica — *Rotalipora brotzeni* — *Rotalipora cushmani* zones:

In the area of the Annopol anticline, the deposits ranging from the Middle Albian to the middle part of the Middle Cenomanian are strongly condensed stratigraphically (Samsonowicz 1925; Pożaryski 1947; Cieśliński 1959, 1976; Marcinowski 1980). Among other factors, this led to the mixing of fauna. In this connection, on the basis of the occurrence of *Rotalipora appenninica, R. brotzeni* and *R. cushmani* in the profile under study, I find that zones for which these species are index fossils are present in these deposits, but I can not determine boundaries between them. On the other hand, absence of *Rotalipora reicheli*, the species on the basis of which the *R. reicheli* Range Zone (including the uppermost Lower and the lowermost Middle Cenomanian) was separated by Robaszynski and Caron (1979), may be indicative either of the lack of appropriate ecologic conditions for this species, or of a stratigraphic gap which included this zone. Since, on the basis of macrofauna, the Albian-Cenomanian boundary is unequivocally traced above the upper sandy phosporite, the mixing of fauna has been proved only within particular stages, for example, the mixing of the ammonite fauna in the Cenomanian (Marcinowski 1980). The mixing of fauna varying in age in the lower sandy phosporite (Samsonowicz 1925 and Cieśliński 1959), is confirmed by the foraminifers; *Rotalipora appenninica, R. brotzeni* and *R. gandolfii* occur in these deposits together with *Hoplites dentatus* (Cieśliński, 1959). The three species of foraminifers mentioned above are known only from the *Stoliczkaia dispar* Zone of the uppermost Albian. Their co-occurrence with the Middle Albian species of ammonite may be explained only by the mixing of heterochronous faunas. All this taken into account, we can find here that the mixed foraminiferal fauna of the *Rotalipora appenninica* Zone and of the lower part of the *Rotalipora brotzeni* Zone occurs in the Upper Albian, whereas the mixed fauna of the upper part of the *Rotalipora brotzeni* and lower part of the *Rotalipora cushmani* occurs in the Lower Cenomanian to the middle part of the Middle Cenomanian. The *Rotalipora cushmanni* Zone is considered by most authors as a range Zone, being an equivalent of the upper part of the *Acanthoceras rothomagense* Zone, of the *A. jukesbrownei* and *Calycoceras naviculare* Zones and the lower part of the *Metoicoceras* gr. *geslinianum* Zone (Robaszynski and Caron 1979). Since the stratigraphic gap in the Annopol anticline, connected with the hardground, occurs in the *Acanthoceras jukesbrownei* Zone (Marcinowski 1980), only the lowermost (overlain by the hardground) and uppermost (overlying it) parts of the *Rotalipora cushmani* is present in this locality. The last occurrence of *Rotalipora cushmani*, recorded at a level of about 20 cm above the hardground, confirms the presence of the *Rotalipora cushmani* Zone in the Upper Cenomanian. The Upper Cenomanian deposits in which *Rotalipora cushmani* occurs no more belong to the *Dicarinella* spp. Zone (Peryt1983).

Ożarów

The Mid-Cretaceous deposits of the Ożarów profile, are also condensed stratigraphically, although not so strongly as in the Annopol anticline. On the other hand, no mixing of heterochronous faunas is observed in this locality (Marcinowski, Naidin, Tröger, in press) and, consequently, there is a possibility of determining boundares between the zones.

Rotalipora appenninica Interval-zone:

Remarks. — An interval between the first occurrence of the index species and the first occurrence of *Rotalipora brotzeni* has been assigned by Robaszynski and Caron (1979) to the *Rotalipora appenninica* Zone. It means that the *Rotalipora appenninica* Zone is an equivalent of the *Stoliczkaia dispar* Zone, without its uppermost part. Althought *Rotalipora appenninica* does not occur in the Mid-Cretaceous deposits of Ożarów, the first occurrence of *Rotalipora brotzeni* determines in this profile the boundary between the two zones. *Rotalipora brotzeni* appears here somewhat below the Albian-Cenomanian boundary determined on the basis of macrofauna (Marcinowski, Naidin, Tröger, in press). On the other hand, the uppermost Albian is here indicated by the occurrence of such species as *Hedbergella planispira*, *H. delrioensis*, *Bifarina calcarata*, *Guembelitria cenomana* and *Globigerinelloides bentonensis*, but without *Rotalipora brotzeni*. Noteworthy is the fact that *Globigerinelloides bentonensis* and *Bifarina calcarata*, similarly as *Rotalipora appenninica*, are known from the *Stoliczkaia dispar* Zone. However, the lack of an index species for the zone precludes the possibility of determining its lowermost boundary.

Rotalipora brotzeni Interval-zone:

Remarks. — This zone includes an interval from the first occurrence of *Rotalipora brotzeni* to the first occurrence of *Rotalipora cushmani*. Since *Rotalipora reicheli* [1] and its upper boundary corresponds to the first occurrence of *Rotalipora cushmani*. *Bifarina calcarata* and *Guembelitria cenomana* do not occur any more in this zone, while *Preaglobotruncana delrioensis* and *Hedbergella simplex* appear here for the first time and the remaining species are the same as in the former zone. Glauconitic sandstones 3.2 m in thickness were assigned to this zone. The boundary between the *Rotalipora appenninica* and *Rotalipora brotzeni* Zones runs at a level of 8.4 m above the Jurassic limestones.

Rotalipora cushmani Range-zone:

Remarks. — It includes the almost entire Middle aud Upper Ceno-

[1] An index species of the zone corresponding to the upper part of the *Mantelliceras dixoni* Zone and the lower part of the *Acanthoceras rothomagense* Zone, does not occur in the Cenomanian of the northeastern margins of the Holy Cross Mts., the *Rotalipora brotzeni* Zone is prolonged by the *Rotalipora reicheli* Range Zone.

manian. Since the stratigraphic gap (including an interval between the *Acanthoceras jukesbrownei* Zone and the lower part of the *Inoceramus labiatus* Zone) is connected with the hardground, only the lower part of the *Rotalipora cushmani* Zone is present in the profile of Ożarów (Marcinowski, Naidin, Tröger, in press).

Rotalipora cushmani Zone was indirectly identified on the basis of assemblage of species. The lower boundary of this zone is determined by the first occurrence of *Praeglobotruncana gibba* which is known for its simultaneous appearance with *Rotalipora cushmani* (cf. Robaszynski and Caron 1979). *Praeglobotruncana stephani* also appears for the first time in this zone. The remaining species are the same as in the former zone — *Rotalipora brotzeni.*

Glauconitic sandstones, about 1 m in thickness, directly overlain by the hardground, have been assigned to the *Rotalipora cushmani* Zone.

Dicarinella spp. Partial-range-zone (*Praeglobotruncana helvetica* Subzone):

Remarks. — This zone includes an interval between the last occurrence of *Rotalipora cushmani* and the first occurrence of *Marginotruncana coronata* with numerous dicarinellas (Peryt 1983).

The following foraminiferal assemblage has been found in the deposits overlying the hardground: *Hedbergella planispira, H. delrioensis, Whiteinella brittonensis, Praeglobotruncana stephani, P. gibba, Dicarinella imbricata, D. longoriai, D. hagni, D. algeriana, Whiteinella praehelvetica* and *Heterohelix reussi.* The lack of what is known as "large globigerinas" and the presence of *Whiteinella praehelvetica* in this assemblage allow me to assign these deposits to the upper part of the *Dicarinella* spp. Zone, that is, the *Praeglobotruncana helvetica* Subzone.

The presence of the *Praeglobotruncana helvetica* Subzone directly over the hardground confirms the opinion of Marcinowski, Naidin and Tröger (in press) on the range of the stratigraphic gap including the lowermost Turonian.

Due to the lack of samples, no upper boundary of this zone could be determined.

BENTHIC ZONAL SCHEME

Ożarów

Lingulogavelinella frankei Partial-range-zone:

Definition. — Interval with a zonal marker to the first appearance of *Gavelinella schloenbachi.* Due to the lack of material, no lower boundary of this zone could be determined precisely.

Remarks. — In this zone, in addition to the index species, there occur *Lingulogavelinella formosa, Gavelinella intermedia, G. baltica, G. ceno-*

manica, Valvulineria lenticula, Arenobulimina chapmani, Ataxophragmium variabile, Cibicides gorbenkoi and *Lenticulina* sp. (fig. 4). In the profile of Ożarów, the boundary between the *Lingulogavelinella frankei* and *Gavelinella schloenbachi* Zones is situated at about 3.8 m over the Jurassic limestone, which corresponds to the lower part of the *Rotalipora appenninica* Zone stated in this locality.

Age. — Upper Albian

Gavelinella schloenbachi Interval-zone:

Definition. — Interval ranging from the appearance of zonal marker to the first appearance of *Lingulogavelinella spinosa.*

Remarks. — In this zone, the assemblage of benthic foraminifers is increased by the following new species: *Arenobulimina macfadyeni, A. advena, Marssonella ozawai, Globorotalites multiseptus*, some species of the family Lagenidae and the index species *Gavelinella schloenbachi* (fig. 4). This zone is represented by about 2 m thick deposits. The boundary between the *Gavelinella schloenbachi* and *Lingulogavelinella spinosa/L. formosa* Zone runs at a level of about 5.8 over the Jurassic limestone. This zone corresponds to the middle part of the *Rotalipora appenninica* Zone stated in this locality (fig. 4).

Age. — Upper Albian.

Lingulogavelinella spinosa/L. formosa Conccurrent-range-zone:

Definition. — Interval in which *Lingulogavelinella spinosa* and *L. formosa* co-occur.

Remarks. — In this zone, considerable changes occur in the composition of its foraminiferal assemblage. There appear new species, mostly of the family Lagenidae, as well as some species of arenaceous foraminifers such as *Arenobulimina anglica* and *Eggerelina mariae.* On the other hand, such species as *Arenobulimina frankei, A. macfadyeni, Cibicides gorbenkoi, Gavelinella schloenbachi, Globorotalites multiseptus*, etc. occur in this zone for the last time (fig. 4). This zone ranges between 5.8 m and 18 m above the Jurassic limestone. It corresponds to the upper part of the *Rotalipora appenninica* Zone and lower part of the *Rotalipora brotzeni* Zone (fig. 4).

Age. — Upper Albian — Lower Cenomanian.

Gavelinella baltica Partial-range-zone:

Definition. — Interval with a zonal marker from the disappearance of *Lingulogavelinella formosa* to the appearance of *Lingulogavelinella globosa.*

Remarks. — In addition to a difference resulting from the definition, this zone differs from the former one in the presence of such species as *Pseudotextulariella cretosa*, *Tritaxia pyramidata*, *T. macfadyeni* and *Lingulogavelinella ornatissima*, while *Arenobulimina anglica* disappears on the boundary of zones. This zone occupies an about 1.8 m thick section of the profile (directly overlain by the hardground) and corresponds to the upper part of the *Rotalipora brotzeni* Zone and to the *Rotalipora cushmani* Zone.

Age. — Lower and Middle Cenomanian.

Lingulogavelinella globosa Interval-zone:

Definition. — Interval ranging from the appearance of *Lingulogavelinella globosa* to the first appearance of *Globorotalites hangensis* (Magniez-Jannin, 1980).

Remarks. — In this zone, the benthic foraminifers are decidedly predominated by the planktic ones. Of the benthic foraminifers there occur only *Valvulineria lenticula*, *Eggerellina mariae*, *Planularia complanata*, *Cibicides kerisensis*, *Lingulogavelinella globosa* (fig. 4). This zone includes at least 1 m thick layer of deposit overlaying the hardground. Due to the lack of material, no upper boundary could be determined. This zone is an equivalent of the upper part of the *Dicarinella* spp. Zone, a subzone of the *Praeglobotruncana helvetica* Zone, stated in this locality.

Age. — Lower Turonian.

The Annopol anticline

All species of foraminifers on the basis of which the local benthic zonation was established in the Mid-Cretaceous profile of Ożarów occur in the Albian and Cenomanian of the Annopol anticline, confirming the presence of these zones also in this locality. However, due to a strong stratigraphic condensation and mixing of fauna, the zones have not been separated.

FINAL REMARKS

1. The analysis od the foraminiferal assemblage (in particular the presence of such species as *Rotalipora appenninica*, *R brotzeni* and *R. gandolfii occurring* in the Middle und Upper Albian and Lower Cenomanian) is indicative of the presence of both the uppermost Albian and Lower Cenomanian in the Annopol anticline. This would contradict Cieśliński's (1976) statement concerning a sedimentary gap in that area in the Lower Cenomanian and in the lower part of the Middle Cenomanian. *Rotalipora cushmani*, occurring in the Cenomanian sandy

marls overlain by the hardground, documents the Middle Cenomanian. Since the lack of the uppermost Middle Cenomanian, that is, the *Acanthoceras jukesbrownei* Zone, was proved by Marcinowski (1980), this is probably the lower part of the Middle Cenomanian.

2. The co-occurrence of foraminifers, characteristic of various foraminiferal zones, in the Middle-Upper Albian and Cenomanian of the Annopol anticline is indicative of the stratigraphic condensation and mixing of fauna and confirms earlier opinions (Samsonowicz 1925; Cieśliński 1959; Marcinowski 1980).

3. The occurrence of such species as *Praeglobotruncana gibba, Dicarinella hagni, D. imbricata, D. algeriana, D. longoriai, Whiteinella praehelvetica* directly over the hardground at Ożarów, with a simultaneous lack of what is known as "large globigerinas", is indicative of the presence, directly over the hardground, of the *Praeglobotruncana helvetica* Subzone. Thus, it dates the upper range of the stratigraphic gap, connected with the hardground, as, more or less, the middle part of the *Inoceramus labiatus* Zone. The lower range of this gap is settled by *Inoceramus ultimus*, directly overlying the hardground, as the middle part of the Middle Cenomanian (Marcinowski, Naidin, Tröger, in press). The stratigraphic gap, connected with the formation of hardground in the profile of Ożarów, includes, therefore, an interval stretching from the uppermost Middle Cenomanian to the lowermost Lower Turonian.

SYSTEMATICS

Loeblich's and Tappan's (1964) systematics has been adopted in the present paper with modifications proposed by Malapris (1965), Pessagno (1967), Gawor-Biedowa (1969), Porthault (1974) and Longoria and Gamper (1975). Stratigraphic ranges were given as well as occurrence but only in the studied profiles.

Order **Foraminiferida** Eichwald, 1830
Suborder **Textulariina** Delage et Hérouard, 1896
Superfamily **Lituolacea** de Blainville, 1825
Family **Textulariidae** Ehrenberg, 1838
Subfamily **Textulariinae** Ehrenberg, 1838
Genus *Textularia* Defrance *in* de Blainville, 1824
Textularia chapmani Lalicker, 1935
(pl. 22: 11)

1935. *Textularia chapmani* Lalicker: 13, pl. 2: 8*a*—*c*, 9 (*fide* Ellis and Messina).
1972. *Textularia chapmani* Lalicker; Gawor-Biedowa: 19, pl. 1: 2*a*—*b*.
1975. *Textularia chapmani* Lalicker; Magniez-Jannin: 54, pl. 3: 1—9.
Material. — Twelve specimens.

Dimensions (in mm):

	ZPAL F.XXIX/21
length	0.4
width	0.25

Distribution. — Jakubowice, Annopol — Lower to mid- Middle Cenomanian condensed sequence.

Textularia sp.
(pl. 21: 1)

Material. — Nine specimens.
Dimensions (in mm):

	ZPAL F.XXIX/1
length	0.66
width	0.4

Remarks. — Specimens are most similar to *Textularia foeda* Reuss from which they differ in a smaller number and shape of chambers in test and a general outline of test. The chambers of *Textularia* sp. are subcircular in contrast to low and horizontally elongated ones in *T. foeda* Reuss. Its tests are also more cuneate in outline than those of *T. foeda*.

Distribution. — Annopol — Lower to mid- Middle Cenomanian condensed sequence.

Family **Trochammnidae** Schwager, 1877
Subfamily **Globotextulariinae** Cushman, 1927
Genus *Eggerellina* Marie, 1941
Eggerellina mariae Ten Dam, 1950
(pl. 21: 10)

1950. *Eggerellina mariae* Ten Dam: 15, pl. 1: 17 (*fide* Ellis and Messina).

Material. — Over twenty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/10
length	0.3
width	0.3

Remarks. — Test very small, subcircular and trochospiral, with very low whorls; 3 chambers per whorl, sutures slightly depressed. Polish specimens correspond well to those described by Ten Dam (1950) as "type ovoide".

Distribution. — Ożarów, Annopol, Jakubowice — Cenomanian.

Subfamily **Trochammninae** Schwager, 1877
Genus *Trochammina* Parker et Jones, 1859
Trochammina cf. *watteri* Stelck et Wall, 1955
(pl. 22: 5, 14, 15)

Material. — Over ten specimens.
Dimensions (in mm):

	ZPAL F.XXIX/24	ZPAL F.XXIX/25
diameter	0.39	0.40

Remarks. — Specimens differing from the holotype in a more convex spiral side, less lobulate margin of test and almost invisible sutures. As compared with *Trochammina globigeriniformis* Cushman, *T. cf. wetteri* Stelck et Wall (1955) has a more coarsely grained test.

Distribution. — Annopol — Lower to mid-Middle Cenomanian condensed sequence.

Subfamily **Verneuilininae** Cushman, 1911

Genus *Spiroplectinata* Cushman, 1927

Spiroplectinata annectens (Parker et Jones, 1863)

(pl. 22: 6, 10)

1863. *Textularia annectens* Parker et Jones: 92, pl. 1: 1 (*fide* Ellis and Messina).
1972. *Spiroplectinata annectens* (Parker et Jones); Gawor-Biedowa: 23, pl. 1: 8.
1975. *Spiroplectinata annectens* (Parker et Jones); Magniez-Jannin: 69, pl. 5: 23.

Material. — Seven specimens.

Dimensions (in mm):

	ZPAL F.XXIX/16	ZPAL F.XXIX/20
length	0.41	0.43
width	0.2	0.21

Remarks. — This species is marked by a wide range of variability, mostly in the size of particular serial stages and shape of chambers. The specimens under study correspond to what is known as "small forms" separated by Magniez-Jannin (1975).

Distribution. — Annopol — Middle to Upper Albian condensed sequence, Ożarów — Lower Cenomanian.

Genus *Tritaxia* Reuss, 1860

Tritaxia macfadyeni Cushman, 1936

(pl. 21: 3)

1936. *Tritaxia macfadyeni* Cushman: 3, pl. 1: 6*a*, *b* (*fide* Ellis and Messina).
1972. *Tritaxia macfadyeni* Cushman; Gawor-Biedowa: 25, pl. 2: 2*a*, *b*.

Material. — A few specimens.

Dimensions (in mm):

	ZPAL F.XXIX/3
length	0.44
width	0.2

Distribution. — Ożarów — Middle Cenomanian.

Tritaxia pyramidata Reuss, 1862

(pl. 22: 4)

1862. *Tritaxia pyramidata* Reuss: 32, pl. 1: 9*a*—*c* (*fide* Ellis and Messina).
1975. *Tritaxia pyramidata* Reuss; Magniez-Jannin: 71, pl. 5: 25—38.

Material. — A few specimens.

Dimensions (in mm):

	ZPAL F.XXIX/14
length	0.81
width	0.4

Distribution. — Ożarów — Middle Cenomanian.

Genus *Verneuilinoides* Loeblich et Tappan, 1949

Verneuilinoides borealis Tappan, 1957

(pl. 22: 1, 2, pl. 21: 4)

1957. *Verneuilinoides borealis* Tappan: 206, pl. 66: 10—18.

Material. — Ten specimens.

Dimensions (in mm):

	ZPAL F.XXIX/11	ZPAL F.XXIX/12
length	0.6	0.6
width	0.29	0.3

Remarks. — This species is marked by a considerable variability, primarily in the size of test, degree of flaring and coarseness of texture. The specimens under study correspond to Tappan's (1957) description and illustrations.

Distribution. — Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence, Ożarów — Upper Albian — Middle Cenomanian.

Verneuilinoides fischeri Tappan, 1957

(pl. 22: 3)

1957. *Verneuilinoides fischeri* Tappan: 207, pl. 66: 23—28.

Material. — A few specimens.

Dimensions (in mm):

	ZPAL F.XXIX/13
width	1.05
length	0.45

Distribution. — Annopol — Lower to mid-Middle Cenomanian condensed sequence.

Verneuilinoides sp.

(pl. 22: 7, 8)

Material. — A few specimens.

Dimensions (in mm):

	ZPAL F.XXIX/17	ZPAL F.XXIX/18
length	0.3	0.33
width	0.24	0.25

Remarks. — Test coarsely grained, triserial, slightly cuneate in outline, with a very slightly convolute axis and almost invisible sutures. It differs from *Verneuilinoides borealis* Tappan in smaller test, more cuneate outline and less convolute axis.

Distribution. — Annopol — Lower to mid-Middle Cenomanian condensed sequence.

Subfamily **Ataxophragminae** Schwager, 1877
Genus *Ataxophragmium* Reuss, 1860
Ataxophragmium variabile (d'Orbigny, 1840)
(pl. 22: 9)

1840. *Bulimina variablis* d'Orbigny: 40, pl. 4: 9—11 (*fide* Ellis and Messina).
1980. *Ataxophragmium variabile* (d'Orbigny); Gawor-Biedowa: 21 pl. 2: 16, 17.

Material. — A few specimens.
Dimensions (in mm):

	ZPAL F.XXIX/19
width	0.57
length	0.4

Remarks. — Individual variability small, mostly in the convexity of chambers, shape of test and arrangement of chambers in the last coil.
Distribution. — Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence, Ożarów — Upper Albian — Middle Cenomanian.

Subfamily **Verneuilininae** Cushman, 1911
Genus *Marssonella* Cusman, 1933
Marssonella ozawai Cushman, 1936
(pl. 21: 2)

1936. *Marssonella ozawai* Cushman: 43, pl. 4: 10*a*—*b* (*fide* Ellis and Messina).
1963. *Marssonella ozawai* Cushman; Barnard: 41, text-fig. 1*a*—*c*.
1977. *Marssonella ozawai* Cushman; Carter and Hart: 12, pl. 2: 1.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/2
width	0.81
length	0.43

Remarks. — Specimens with coarsely agglutinated tests and subparallel sides. Individual variability small, mostly concerns the size of chambers and depression of sutures.
Distribution. — Ożarów — Lower and Middle Cenomanian.

Subfamily **Ammodiscinae** Reuss, 1862
Genus *Ammodiscus* Reuss, 1862
Ammodiscus sp.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/140
diameter	0.4

Remarks. — Test finely agglutinated, planispirally and evolutely coiled. Due to a poor state of preservation, very difficult to identify accurately.
Distribution. — Ożarów — Upper Albian.

Subfamily **Globotextulariinae** Cushman, 1927

Genus *Arenobulimina* Cushman, 1927

Arenobulimina advena (Cushman 1936)

(pl. 21: 5)

1936. *Hagenovella advena* Cushman: 43, pl. 6: 21 (*fide* Ellis and Messina).
1981. *Arenobulimina advena* (Cushman); Hart *et al.*: 174, pl. 7: 1.

Material. — Thirty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/5
width	0.4
length	0.5

Remarks. — Variability small, mostly in the shape and size of test and convexity of chambers.

Distribution. — Annopol — Albian — mid-Middle Cenomanian condensed sequence; Ożarów — Upper Albian — Middle Cenomanian.

Arenobulimina anglica Cushman, 1936

(pl. 24: 1)

1936. *Arenobulimina anglica* Cushman: 27, pl. 4: 8*a*—*b* (*fide* Ellis and Messina).
1981. *Arenobulimina anglica* Cushman; Hart *et al.*: 174, pl. 7: 6.

Material. — Twenty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/40
length	0.4
width	0.33

Distribution. — Annopol, Jakubowice — Lower — mid-Middle Cenomanian condensed sequence; Ożarów — Lower — Middle Cenomanian.

Arenobulimina chapmani Cushman, 1936

(pl. 21: 9)

1936. *Arenobulimina chapmani* Cushman: 26, pl. 4: 7*a*—*b*, (*fide* Ellis and Messina).
1969. *Arenobulimina chapmani* Cushman; Gawor-Biedowa: 81, pl. 5: 1*a*—*b*, pl. 7: 1*a*—*b*, 2; text-figs 3, 4.
1981. *Arenobulimina chapmani* Cushman; Hart *et al.*: 174, pl. 7: 7.

Material. — Twenty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/9
length	0.8
width	0.6

Distribution. — Ożarów — Upper Albian; Annopol — Middle to Upper Albian condensed sequence.

Arenobulimina macfadyeni Cushman, 1936

(pl. 21: 7, pl. 22: 12)

1936. *Arenobulimina macfadyeni* Cushman: 26, pl. 4: 6*a*—*c* (*fide* Ellis and Messina).
1981. *Arenobulimina macfadyeni* Cushman; Hart *et al.*: 174, pl. 7: 8, 9.

Material. — Thirty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/7	ZPAL G.XXIX/22
length	0.33	0.3
width	0.22	0.2

Distribution. — Ożarów — Upper Albian; Annopol — Middle to Upper Albian, condensed sequence.

Family **Pavotinidae** Loeblich et Tappan, 1961
Genus *Pseudotextulariella* Barnard, *in* Barnard and Blow, 1953
Pseudotextulariella cretosa (Cushman, 1932)
(pl. 21: 6)

1932. *Textulariella cretosa* Cushman: 97, pl. 11: 17—19, (*fide* Ellis and Messina).
1963. *Pseudotextulariella cretosa* (Cushman); Barnard: 48, pl. 7: 1—6, 8; text-fig. 6*a*—*d*, 7*a*—*f*, 8*a*—*c*.
1972. *Pseudotextulariella cretosa* (Cushman); Gawor-Biedowa: 34, pl. 3: 4*a*—*b*.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/6
length	0.5
width	0.57

Remarks. — This highly distinctive species is marked by a very small individual variability, expressed almost exclusively in the size of test.
Distribution. — Ożarów — Lower and Middle Cenomanian.

Superfamily **Nodosariacea** Ehrenberg, 1838
Family **Nodosariidae** Ehrenberg, 1838
Subfamily **Nodosariinae**, Ehrenberg, 1838
Genus *Nodosaria* Lamarck, 1812
Nodosaria obscura Reuss, 1845
(pl. 23: 3, 4, 5)

1845. *Nodosaria obscura* Reuss: 26, pl. 13: 7—9 (*fide* Ellis and Messina).
1975. *Nodosaria obscura* Reuss; Magniez-Jannin: 192, pl. 12: 22—34 (here additional synonymy included).

Material. — Over ten specimens.
Dimensions (in mm):

	ZPAL F.XXIX/28	ZPAL F.XXIX/29	ZPAL F.XXIX/30
length	0.3	0.38	0.11
width	0.12	0.10	0.37

Remarks. — *Nodosaria obscura* Reuss is marked by a very high degree of variability in the shape and size of test, shape and degree of increase in the size of chambers, depression of sutures and in ornamentation. The specimens under study are contained within the limits of ontogenic variability given by Magniez-Jannin (1975).
Distribution. — Ożarów — Upper Albian — Lower Cenomanian; Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Genus *Dentalina* Risso, 1826

Dentalina sp.

(pl. 23: 2)

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/27
length	0.4
width	0.09

Remarks. — Test slightly curved, with an asymmetrically situated aperture. Margins of test nonlobate, sutures not marked on the surface, number of chambers indeterminable. In its general outline, the test resembles that of *Dentalina sororia* (Reuss) from which it differs, however, in smaller dimensions, nonlobate margin of test and smaller last two chambers.

Distribution. — Annopol — Middle to Upper Albian condensed sequence.

Dentalina gracilis d'Orbigny, 1840

(pl. 23: 1)

1840. *Dentalina gracilis* d'Orbigny: 14, pl. 1: 5 (*fide* Ellis and Messina).
1946. *Dentalina gracilis* d'Orbigny; Cushman: 65, pl. 23: 3—6.
1957. *Dentalina gracilis* d'Orbigny; Pożaryska: 80, pl. 7: 1, text-fig. 15.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/26
length	0.43
width	0.09

Remarks. — Specimens considerably smaller than those illustrated by Pożaryska (1957).

Distribution. — Ożarów — Upper Albian.

Genus *Lagena* Walker et Jacob *in* Kanmacher, 1879

Lagena sulcatiformis Pożaryska et Urbanek, 1956

(pl. 22: 13)

1956. *Lagena sulcatiformis* Pożaryska et Urbanek; Pożaryska: 113, text-fig. 6.
1957. *Lagena sulcatiformis* Pożaryska et Urbanek; Pożaryska: 55, pl. 1: 8—10, text-fig 5—8.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/23
length	0.27
width	0.2

Remarks. — This species is marked by a very high degree of individual variability, primarily in the shape of test, round to oval, and ornamentation.

Distribution. — Jakubowice, Annopol — Lower — mid-Middle Cenomanian condensed sequence.

Lagena globosa ovalis Reuss, 1870
(pl. 21: 8, pl. 29: 3)

1870. *Lagena globosa* (Montagu) var. *ovalis* Reuss: 466 (*fide* Ellis and Messina).
1857. *Lagena globosa ovalis* Reuss; Pożaryska: 43, pl. 6: 6, 7.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/8	ZPAL F.XXIX/137
length	0.28	0.23
width	0.19	0.17

Distribution. — Annopol — Lower — mid-Middle Cenomanian condensed sequence.

Genus *Lenticulina* Lamarck, 1804

Lenticulina sp.
(pl. 24: 4, 5)

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/42
length	0.3
width	0.23

Remarks. — These specimens, resembling *L. secans* (Reuss) in the presence of keel on the margin of test and round outline of test, differ, however from this species in considerably smaller dimensions and lack of peripheral nodes.
Distribution. — Ożarów — Upper Albian; Annopol — Middle — Upper Albian condensed sequence.

Lenticulina rotulata Lamarck, 1804
(pl. 24: 6, 9)

1804. *Lenticulina rotulata* Lamarck: 188 (*fide* Ellis and Messina).
1975. *Lenticulina rotulata* Lamarck; Jendryka-Fuglewicz: 173, pl. 15; 20: 3—6 (here additional synonymy included).

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/43
length	0.65
width	0.5

Distribution. — Ożarów — Lower Cenomanian.

Lenticulina muensteri (Roemer, 1839)
(pl. 24: 7, 8)

1839. *Robulina Münsteri* Reuss: 48, pl. 20: 29 (*fide* Ellis and Messina).
1975. *Lenticulina muensteri* (Roemer); Jendryka-Fuglewicz: 149, pl. 8: 12—15; pl. 9: 1, 2 (here additional synonymy included).

Material. — Over ten specimens.

Dimensions (in mm):

	ZPAL F.XXIX/44
length	0.55
width	0.46

Remarks. — *Lenticulina muensteri* (Roemer) is a long-lived species marked by considerable individual variability which was the reason why it was divided into many species. As shown by Jendryka-Fuglewicz (1975), *L. muensteri* (Roemer) formed six morphotypes occurring between the Dogger and the Lower Cretaceous inclusively. Specimens which are included in the material under study should be assigned, according to Jendryka-Fuglewicz's classification (1975) to the *tumida* morphotype.

Distribution. — Ożarów — Upper Albian— Lower Cenomanian; Jakubowice, Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Genus *Marginulina* d'Orbigny, 1826
Marginulina aequivoca Reuss, 1862
(pl. 23: 6)

1862. *Marginulina aequivoca* Reuss: 60, pl. 5: 17 (*fide* Ellis and Messina).
1957. *Marginulina aequivoca* Reuss; Pożaryska: 104, pl. 12: 5.
1975. *Lenticulina (Marginulina)* type *aequivoca* Reuss; Magniez-Jannin: 112, pl. 10: 17—21.

Material. — Over ten specimens.
Dimensions (in mm):

	ZPAL F.XXIX/31
length	0.46
width	0.15

Distribution. — Ożarów — Upper Albian.

Marginulina pseudolinearis (Magniez-Jannin, 1975)
(pl. 23: 8)

1975. *Lenticulina (Marginulina) pseudolinearis* Magniez-Jannin: 127, pl. 11: 1, 2. text-fig. 59, 1.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/33
width	0.37
length	0.12

Remarks. — A macrospheric form, fairly conformable to Magniez-Jannin's (1975) description and illustrations, is a predominant form among the specimens here examined. A slight difference is only observed in the number of chambers on test. The material mostly includes five-chamber tests, whereas six to nine-chamber specimens were presented by Magniez-Jannin (1975).

Marginulina sp.
(pl. 23: 7)

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/32
length	0.38
width	0.11

Remarks. — Specimens with a small test, slightly curved in its initial part; sutures indistinct, not marked on the surface. In their shape, the tests resemble those of *Marginulina texanensis* Cushman from which they differ primarily in three to four times smaller dimensions.

Distribution — Ożarów — Upper Albian.

Genus *Planularia* Defrance in de Blainville, 1826
Planularia complanata (Reuss, 1845)
(pl. 23: 11)

1845. *Cristellaria complanata* Reuss: 33, pl. 13: 54*a-b* (*fide* Ellis and Messina).
1975. *Lenticulina* (*Planularia*) *complanata* (Reuss); Magniez-Jannin: 151, pl. 9: 31—36, text-fig. 83*c-d*.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/36
length	0.4
width	0.22

Remarks. — Four subspecies of *Planularia complanata* (Reuss) were separated by Magniez-Jannin (1975). The Polish specimens correspond to the description and illustration of *Lenticulina (Planularia) complanata complanata* (Reuss) given by Magniez-Jannin (1975).

Distribution. — Ożarów — Upper Albian — Lower Turonian.

Genus *Saracenaria* Defrance *in* de Blainville, 1824
Saracenaria bononiensis (Berthelin, 1880)

1880. *Cristellaria bononiensis* Berthelin: 55, pl. 3: 23 (*fide* Ellis and Messina).
1975. *Lenticulina* (*Saracenaria*) *bononiensis* (Berthelin); Magniez-Jannin: 184, pl. 13: 16—21.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/138
length	0.43
width	0.12

Remarks. — This species is marked by a very high degree of variability, primarily in ornamentation and degree of coiling of the initial part of test.

Distribution. — Ożarów — U. Albian — M. Cenomanian; Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Saracenaria triangularis (d'Orbigny, 1840)

1840. *Cristellaria triangularis* d'Orbigny: 27, pl. 2: 21—22 (*fide* Ellis and Messina).
1957. *Saracenaria triangularis* (d'Orbigny); Pożaryska: 119, pl. 10: 8:

Material. — Several specimens.

Dimensions (in mm):

	ZPAL F.XXIX/139
length	0.5
width	0.3

Distribution. — Ożarów — Upper Albian.

Genus *Vaginulina* d'Orbigny, 1826
Vaginulina arguta Reuss, 1860

1860. *Vaginulina arguta* Reuss: 202, pl. 8: 4 (*fide* Ellis and Messina).
1972. *Vaginulina arguta* Reuss; Gawor-Biedowa: 46, pl. 4: 14 (here additional synonymy included).

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/141
length	0.51
width	0.36

Remarks. — This species is marked by a fairly high degree of individual variability, primarily in ornamentation and degree of curving of the dorsal side.
Distribution. — Ożarów — Upper Albian.

Family **Glandulinidae** Reuss, 1860
Subfamily **Glandulininae**, Reuss, 1860
Genus *Tristix* MacFadyen, 1941
Tristix excavatus (Reuss, 1863)
(pl. 29: 5)

1863. *Rhabdogonium excavatum* m. Reuss: 91, pl. 12: 8*a*—*c* (*fide* Ellis and Messina).
1965. *Tristix excavata* (Reuss); Neagu: 24, pl. 5: 14—15.
1975. *Tristix excavata* (Reuss); Magniez-Jannin: 224, pl. 12: 7—11.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/73
length	0.6
width	0.4

Distribution. — Annopol — Middle — Upper Albian condensed sequence.

Superfamily **Buliminacea** Jones, 1875
Family **Bolivinitidae** Cushman, 1927
Genus *Tappanina* Montanaro-Gallitelli, 1955
Tappanina eouvigeriniformis (Keller, 1935)
(pl. 29: 13)

1935. *Bolivinita eouvigeriniformis* Keller: 548, pl. 3: 20—21 (*fide* Ellis and Messina)
1963. *Tappanina eouvegeriniformis* (Keller); Štemprokova-Jirova: 141, pl. 1: 1*a*—*c*.
1980. *Tappanina eouvigeriniformis* (Keller); Gawor-Biedowa: 29, pl. 3: 12.

Material. — Over ten specimens.
Dimensions (in mm):

	ZPAL F.XXIX/78
length	0.22
width	0.13

Remarks. — This minute, highly distinctive species is marked by a small individual variability, expressed in a varying intensity of ornamentation and varying rate of increase in the size of chambers. The Polish specimens display an identical range of variability with those described by Štemprokova-Jirova (1963).

Distribution. — Ożarów — Lower Cenomanian — Lower Turonian; Annopol — Lower — mid-Middle Cenomanian condensed sequence.

Family **Turrilinidae** Cushman, 1917
Genus *Praebulimina* Hofker, 1953
Praebulimina reussi (Morrow, 1934)
(pl. 29: 12)

1934. *Bulimina reussi* Morrow: 195, pl. 29: 12 (*fide* Ellis and Messina).
1946. *Bulimina reussi* Morrow; Cushman: 120, pl. 51: 1—5.
1961. *Bulimina reussi* Morrow; Vasilenko: 174, pl. 38: 2, 7.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/37
width	0.3
length	0.22

Distribution. — Jakubowice, Annopol — Lower — mid-Middle Cenomanian condensed sequence.

Superfamily **Discorbacea** Ehrenberg, 1838
Family **Discorbidae** Ehrenberg, 1838
Subfamily **Bagginae** Cushman, 1927
Genus *Valvulineria* Cushman, 1927
Valvulineria lenticula (Reuss, 1845)
(pl. 29: 8, 9, 10)

1845. *Rotalina lenticula* Reuss: 35, pl. 12: 17a—c (*fide* Ellis and Messina).
1972. *Valvulineria lenticula* (Reuss); Gawor-Biedowa: 59, pl. 6: 6a—c (here additional synonymy included).

Material. — Over twenty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/75
maximum diameter	0.22
minimum diameter	0.18
thickness	0.11

Remarks. — The specimens under study resemble very closely those described by Gawor-Biedowa (1972) and differ considerably, in a much smaller last chamber, from those illustrated and described by Vasilenko.

Distribution. — Annopol, Jakubowice — Middle Albian — mid-Middle Cenomanian, condensed sequence; Ożarów — Lower Cenomanian.

Superfamily **Globigerinacea** Carpenter, Parker et Jones, 1862
Family **Heterohelicidae** Cushman, 1927
Subfamily **Guembelitriinae** Montanaro-Gallitelli, 1957
Genus *Guembelitria* Cushman, 1927
Guembelitria cenomana (Keller, 1935)
(pl. 30: 2, 3)

1935. *Guembelina cenomana* Keller: 547, pl. 2: 13, 14 (*fide* Ellis and Messina).
1980. *Guembelitria cenomana* (Keller); Peryt: 32, pl. 1: 2—6 (with synonymy).

Material. — Over twenty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/80	ZPAL F.XXIX/81
length	0.19	0.18
width	0.10	0.11

Distribution. — Ożarów — Upper Albian; Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Subfamily **Heterohelicinae** Cushman, 1927
Genus *Heterohelix* Ehrenberg, 1843
Heterohelix moremani (Cushman, 1938)
(pl. 35: 12)

part. 1938. *Guembelina moremani* Cushman: 10, pl. 2: 1—2, *non* pl. 2: 3 (*fide* Ellis and Messina).
1980. *Heterohelix moremani* (Cushman); Peryt: 35, pl. 2: 3, 8 (with synonymy).

Material. — Several specimens.

Dimensions (in mm):

	ZPAL F.XXIX/135
length	0.17
width	0.09

Distribution. — Annopol, Jakubowice — Lower — mid-Middle Cenomanian condensed sequence.

Heterohelix reussi (Cushman, 1938)
(pl. 30: 1)

1938. *Guembelina reussi* Cushman: 11, pl. 2: 6—9 (fide Ellis and Messina).
1980. *Heterohelix reussi* (Cushman); Peryt: 39, pl. 3: 10; pl. 7: 13 (with synonymy).
Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/79
length	0.19
width	0.17

Distribution. — Jakubowice — Lower — mid-Middle Cenomanian condensed sequence.

Genus *Bifarina* Parker and Jones, 1872
Bifarina calcarata (Berthelin, 1880)
(pl. 30: 6)

1880. *Bigenerina calcarata* Berthelin: 27, pl. 1: 14—16; pl. 2: 2a—b (*fide* Ellis and Messina).
1975. *Bifarina calcarata* (Berthelin): Magniez-Jannin: 247, pl. 20: 22—24.

Material. — Several specimens.
Dimensions (in mm).

	ZPAL F.XXIX/85
length	0.33
width	0.09

Remarks. — As found by Magniez-Jannin (1975), the variable degree of ornamentation of the tests of *Bifarina calcarata* (Berthelin) depends on ecological conditions. The Polish specimens differ from those, described and illustrated by that author (1975) only in a less distinct ornamentation of test.
Distribution. — Ożarów — Upper Albian.

Family **Planomalinidae** Bolli, Loeblich et Tappan, 1957
Genus *Globigerinelloides* Cushman et Ten Dam, 1948
Globigerinelloides bentonensis (Morrow, 1934)
(pl. 30: 5, 7)

1934. *Anomalina bentonensis* Morrow: 201, pl. 30: 4a—b (*fide* Ellis and Messina).
1980. *Globigerinelloides bentonensis* (Morrow); Peryt: 47, pl. 7: 5a—b, 6, 9 (with synonymy).

Material. — Over twenty specimens.
Dimensions (in mm).

	ZPAL F.XXIX/83	ZPAL F.XXIX/84
length	0.21	0.26
width	0.19	0.23

Distribution. — Ożarów — Upper Albian — Lower Cenomanian; Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Globigerinelloides caseyi (Bolli, Loeblich et Tappan, 1957)

1957. *Planomalina caseyi* Bolli, Loeblich et Tappan: 24, pl. 1: 4, 5.
1980. *Globigerinelloides caseyi* (Bolli, Loeblich et Tappan); Peryt: 48, pl. 7: 3, 4 (with synonymy).
Material. — Several specimens.
Dimensions (in mm).

	ZPAL F.XXIX/143
length	0.23
width	0.18

Distribution. — Jakubowice — Lower mid-Middle Cenomanian condensed sequence.

Superfamily **Hedbergelloidea** Longoria et Gamper, 1975
Family **Hedbergellidae** Longoria et Gamper, 1975
Subfamily **Hedbergellinae** Loeblich et Tappan, 196
Genus *Hedbergella* Brönnimann et Brown, 1958

Hedbergella delrioensis (Carsey, 1926)

(pl. 30: 8, 10)

1926. *Globigerina cretacea* d'Orbigny var. *delrioensis* Carsey: (*fide* Ellis and Messina).
1980. *Hedbergella delrioensis* (Carsey); Peryt: 54, pl. 10: 1a—c (with synonymy).

Material. — Over thirty specimens.
Dimensions (in mm).

	ZPAL F.XXIX/86	ZPAL F.XXIX/88
diameter	0.28	0.20
thickness	0.16	0.12

Distribution. — Ożarów — Upper Albian — Lower Turonian; Jakubowice, Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Hedbergella planispira (Tappan, 1940)

(pl. 30: 9; pl. 31: 4)

1940. *Globigerina planispira* Tappan: 12, pl. 19: 12 (*fide* Ellis and Messina).
1980. *Hedbergella planispira* (Tappan); Peryt: 54, pl. 10: 5, 6 (with synonymy).

Material. — Over twenty specimens.
Dimensions (in mm).

	ZPAL F.XXIX/92	ZPAL F.XXIX/87
diameter	0.12	0.16
thickness	0.06	0.07

Distribution. — Ożarów — Upper Albian — Lower Cenomanian; Jakubowice, Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Hedbergella simplex (Morrow, 1934)

(pl. 31: 7, 9)

1934. *Hastigerinella simplex* Morrow: 198, pl. 30: 6 (*fide* Ellis and Messina).
1979. *Hedbergella simplex* (Morrow): Robaszynski and Çaron: 145, pl. 29: 1—3, pl. 30: 1—2.

Material. — Over twenty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/95
diameter	0.23
thickness	0.08

Distribution. — Ożarów — Upper Albian — Middle Cenomanian; Jakubowice, Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Hedbergella trocoidea (Gandolfi, 1942)
(pl. 35: 10)

1942. *Anomalina lorneiana* d'Orbigny var. *trocoidea* Gandolfi: 98, pl. 13: 2, 5 (*fide* Ellis and Messina).
1961. *Hedbergella trocoidea* (Gandolfi); Loeblich and Tappan: 277, pl. 5: 1, 2.
1977. *Hedbergella trocoidea* (Gandolfi); Koch: 23, pl. 1: 4, 5.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/133
diameter	0.23
thickness	0.09

Distribution. — Annopol — Lower — mid-Middle Cenomanian condensed sequence.

Hedbergella sp.
(pl. 35: 11)

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/134
thickness	0.21
diameter	0.07

Remarks. — In the size and shape of test and the number of chambers in the last coil, these specimens are most similar to *Hedbergella planispira* (Tappan), from which they primarily differ in the structure of the spiral side which is not flat, but concave in its middle.

Distribution. — Annopol — Middle — Upper Albian, condensed sequence.

Genus *Praeglobotruncana* Bermudez, 1952
Praeglobotruncana delrioensis (Plummer, 1931)
(pl. 33: 4, 5, 11)

1931. *Globorotalia delrioensis* Plummer: 199, pl. 13: 2 (*fide* Ellis and Messina).
1979. *Praeglobotruncana delrioensis* (Plummer); Robaszyński and Caron: 29, pl. 43: 1—2.
1980. *Praeglobotruncana delrioensis* (Plummer); Peryt: 57, pl. 13: 4, 5, 6.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/106	ZPAL F.XXIX/107	ZPAL F.XXIX/112
diameter	0.32	0.32	0.30
thickness	0.17	0.16	0.14

Distribution. — Jakubowice, Ożarów — Lower — mid-Middle Cenomanian.

Praeglobotruncana gibba Klaus, 1960
(pl. 32: 1, 2, 4, 5)

1960. *Praeglobotruncana stephani* var. *gibba* Klaus: 304, type-fig. *in*: Reichel 1949, pl. 16: 6; pl. 17: 6.
1979. *Praeglobotruncana gibba* Klaus; Robaszynski and Caron: 33, pl. 44: 1, 2; pl. 45: 1—2.

1980. *Praeglobotruncana hilalensis* Barr; Peryt: 57, pl. 12: 3a—c.

Material. — Over twenty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/98	ZPAL F.XXIX/101
maximum diameter	0.37	0.38
minimum diameter	0.32	0.33
thickness	0.23	0.26

Distribution. — Ożarów — Middle Cenomanian — Lower Turonian; Jakubowice, Annopol — Lower — mid-Middle Cenomanian condensed sequence.

Praeglobotruncana stephani (Gandolfi, 1942)
(pl. 31: 8; pl. 32: 6)

1942. *Globotruncana stephani* Gandolfi: 130, pl. 4, 5; pl. 4: 36, 37, 41—45; pl. 6: 4, 6; pl. 9: 5, 8; pl. 14: 2 (*fide* Ellis and Messina).
1980. *Praeglobotruncana stephani* (Gandolfi); Peryt: 58, pl. 13: 7, 8, 9 (with synonymy).

Material. — Over thirty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/96	ZPAL F.XXIX/102
diameter	0.36	0.45
thickness	0.21	0.23

Distribution. — Ożarów — Lower Cenomanian — Lower Turonian, Jakubowice — Lower — mid-Middle Cenomanian condensed sequence.

Subfamily **Rotaliporinae** Sigal, 1958
Genus *Rotalipora* Brotzen, 1942
Rotalipora appenninica (Renz, 1936)
(pl. 34: 10, 11, 12, 13; pl. 35: 4, 5)

1936. *Globotruncana appenninica* Renz: 20, 135, text-fig. 2; p. 14: text-fig. 7a; p. 71, pl. 6: 2—8; pl. 7: 1; pl. 8: 4 (*fide* Ellis and Messina).
1979. *Rotalipora appenninica* (Renz, 1936); Robaszynski and Caron: 59, pl. 4: 1—3, pl. 5: 1—3.

Material. — Over twenty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/124	ZPAL F.XXIX/131
diameter	0.22	0.4
thickness	0.11	0.19

Distribution. — Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Rotalipora brotzeni (Sigal, 1948)
(pl. 34: 1, 2, 3, 8, 9)

1948. *Thalmanninella brotzeni* Sigal: 102, pl. 1: 5; pl. 2: 6, 7 (*fide* Ellis and Messina).
1979. *Rotalipora brotzeni* (Sigal); Robaszynski and Caron: 65, pl. 6: 1—2.

Material. — Over ten specimens.
Dimensions (in mm):

	ZPAL F.XXIX/114	ZPAL F.XXIX/116
diameter	0.45	0.40
thickness	0.23	0.21

Distribution. — Ożarów — Uppermost Albian — Lower Cenomanian; Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Rotalipora cushmani (Morrow, 1934)
(pl. 34: 4, 5, 6)

1934. *Globorotalia cushmani* Morrow: 199, pl. 31: 2, 4 (*fide* Ellis and Messina).
1980. *Rotalipora cushmani* (Morrow); Peryt: 59, pl. 11: 1—4.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/118	ZPAL F.XXIX/119
diameter	0.4	0.34
thickness	0.2	0.16

Distribution. — Jakubowice — Lower — mid-Middle Cenomanian condensed sequence.

Rotalipora gandolfii Luterbacher et Premoli-Silva, 1962
(pl. 34: 7; pl. 35: 1, 2. 3, 6, 7)

1962. *Rotalipora appenninica gandolfii*: 267, pl. 19: 3.
1979. *Rotalipora gandolfii* Luterbacher et Premoli Silva; Robaszynski and Caron: 81, pl. 11: 1, 2.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/125	ZPAL F.XXIX/128
diameter	0.4	0.35
thickness	0.19	0.17

Remarks. — *R. gandolfii* Luterbacher et Premoli-Silva, 1979 is a species transitional between *R. appenninica* (Renz, 1936) and *R. brotzeni* (Sigal, 1948). From *R. appenninica* it differs in having periumbilical flanges on all chambers and from *R. brotzeni* — in having a more lobulate periphery and lacking raised umbilical sutures.

Distribution. — Annopol — Lower Cenomanian.

Family **Marginotruncanidae** Pessagno, 1967
Genus *Whiteinella* Pessagno, 1967
Whiteinella praehelvetica (Trujillo, 1960)
(pl. 31: 2)

1960. *Rugoglobigerina praehelvetica* Trujillo: 340, pl. 49: 6.
1979. *Praeglobotruncana praehelvetica* (Trujillo); Robaszynski and Caron: 43, pl. 47: 1, 2.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/90
diameter	0.34
thickness	0.16

Remarks. — The specimens under study have test flat on the spiral and strongly convex on ventral side and five to six chambers in the last whorl. Surface of chambers spinose. Due to the lack of a distinctly developed keel and the presence of portici on the umbilical side, this species has been assigned to the genus *Whiteinella*.

Distribution. — Ożarów — Lower Turonian.

Whiteinella baltica Douglas et Rankin, 1969
(pl. 31: 5, 6)

1969. *Whiteinella baltica* Douglas et Rankin: 197, fig. 9a—i.
1980. *Whiteinella baltica* Douglas et Rankin; Peryt: 70, pl. 23: 4, 5, 6 (with synonymy).

Material. — Over twenty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/93	ZPAL F.XXIX/94
diameter	0.28	0.27
thickness	0.10	0.09

Distribution. — Annopol, Jakubowice — Lower — mid-Middle Cenomanian condensed sequence.

Whiteinella brittonensis (Loeblich et Tappan, 1961)
(pl. 35: 8, 9)

1961. *Hedbergella brittonensis* Loeblich et Tappan: 274, pl. 4: 1—8.
1979. *Whiteinella brittonensis* (Loeblich et Tappan); Robaszynski and Caron: 175, pl. 37: 1; pl. 38: 1, 2.

Material. — Over twenty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/132	ZPAL F.XXIX/133
diameter	0.22	0.20
thickness	0.13	0.11

Remarks. — The specimens under study differ from those described by Robaszynski and Caron (1979) only in smaller dimensions of test.

Distribution. — Ożarów — Upper Albian — Lower Turonian; Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Genus *Dicarinella* Porthault, 1970
Dicarinella algeriana (Caron, 1966)
(pl. 33: 9)

1966. *Praeglobotruncana algeriana* Caron: 74, pl. 16: 8, pl. 17, 8.
1979. *Dicarinella algeriana* (Caron); Robaszynski and Caron: 57, pl. 50: 1—2.

Material. — Over ten specimens.

Dimensions (in mm):

	ZPAL F.XXIX/109
diameter	0.4
thickness	0.2

Remarks. — In the size and shape of test, number and shape of chambers and ornamentation, *D. algeriana* (Caron, 1966) resembles *Praeglobotruncana stephani* (Gandolfi, 1942) from which it differs, however, radically in having two widely spaced keels.

Distribution. — Ożarów — Lower Turonian.

Dicarinella hagni (Scheibnerova, 1962)

(pl. 32: 7, 8, 9; pl. 33: 7)

1962. *Praeglobotruncana hagni* Scheibnerova: 219, fig. 6a—c.

1979. *Dicarinella hagni* (Scheibnerova); Robaszynski and Caron: 79, pl. 56: 1—2; pl. 57: 1—2.

Material. — Over twenty specimens.

Dimensions (in mm):

	ZPAL F.XXIX/103	ZPAL F.XXIX/108
thickness	0.7	0.63
diameter	0.34	0.31

Distribution. — Ożarów — Lower Turonian.

Dicarinella imbricata (Mornod, 1950)

(pl. 32: 3; pl. 33: 1—3, 6, 8)

1950. *Globotruncana imbricata* Mornod: 589, pl. 15: 21—34; fig. 5: 2a—c, 3a—d (*fide* Ellis and Messina).

1980. *Dicarinella imbricata* Mornod; Peryt: 68, pl. 13: 10, 11, 12 (with synonymy).

Material. — Over twenty specimens.

Dimensions (in mm):

	ZPAL F.XXIX/97
diameter	0.31
thickness	0.15

Distribution. — Ożarów — Lower Turonian.

Dicarinella longoriai Peryt, 1980

(pl. 33: 10, 12)

1980. *Dicarinella longoriai* Peryt: 68, pl. 13: 1, 2, 3.

Material. — Several specimens.

Dimensions (in mm):

	ZPAL F.XXIX/97
diameter	0.31
thickness	0.15

Distribution. — Ożarów — Lower Turonian.

Family **Cibicididae** Cushman, 1917
Subfamily **Cibicidinae** Cushman, 1927
Cibicides de Montfort, 1808
Cibicides gorbenkoi Akimez, 1961

(pl. 29: 1, 4)

1961. *Cibicides* (*Cibicidoides*) *gorbenkoi* Akimez: 166, pl. 16: 6, 7.
1972. *Cibicides gorbenkoi* Akimez; Gawor-Biedowa: 91, pl. 12: 5a—c, 6a—c; text-fig. 4.

Material. — Over thirty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/71
greater diameter	0.34
smaller diameter	0.32
thickness	0.16

Remarks. — This species is subject to considerable individual variability in the size of a node on the ventral side and in the shape of test and chambers.

Distribution. — Ożarów — Upper Albian — Middle Cenomanian, Jakubowice, Annopol — Lower — mid-Middle — Cenomanian condensed sequence.

Cibicides kerisensis Vasilenko, 1961

(pl. 25: 7, 8, 9)

1961. *Cibicides kerisensis* Vasilenko: 135, pl. 27: 2, 3, 4, 5.

Material. — Over twenty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/47
greater diameter	0.66
smaller diameter	0.45
thickness	0.3

Remarks. — Test plano-convex to concave-convex, margin slightly sharpened. On the spiral side, chambers flat, triangular, sutures slightly marked; on the ventral side, chambers convex, sutures flat at the beginning of last whorl and strongly depressed between last chambers. The umbilical depression is filled by a transparent node. Most forms have a sharpened margin of test, similar to a specimen illustrated by Vasilenko, 1961, pl. 27: 4.

Distribution. — Ożarów — Middle Cenomanian — Lower Turonian; Jakubowice — Lower — mid-Middle Cenomanian condensed sequence.

Superfamily **Cassidulinacea** d'Orbigny, 1839
Family **Pleurostomellidae** Reuss, 1860
Subfamily **Pleurostomellinae** Reuss, 1860
Genus *Pleurostomella* Reuss, 1860
Pleurostomella nitida Morrow, 1934

(pl. 23: 9, 10)

1934. *Pleurostomella nitida* Morrow: 94, pl. 30: 22 (*fide* Ellis and Messina).
1970. *Pleurostomella nitida* Morrow; Eicher and Worstell: 291, pl. 4: 5, 8—10.

Material. — Several specimens.

Dimensions (in mm):

	ZPAL F.XXIX/34	ZPAL F.XXIX/35
length	0.36	0.4
width	0.11	0.12

Distribution. — Ożarów — Upper Albian.

Superfamily **Robertinacea** Reuss, 1850
Family **Osangularidae** Loeblich et Tappan, 1964
Genus *Globorotalites* (Brotzen, 1942)
Globorotalites multiseptus (Brotzen, 1936)
(pl. 29: 12)

1936. *Globorotalia multisepta* Brotzen: 161, pl. 11: 6, 7: text-fig. 59, 60, 61 (*fide* Ellis and Messina).

1961. *Globorotalites multiseptus* (Brotzen); Vasilenko: 57, pl. 9: 7, 8, 9, 10.

Material. — Several specimens.

Dimensions (in mm):

	ZPAL F.XXIX/77
diameter	0.28
thickness	0.15

Distribution. — Jakubowice — Lower — mid-Middle Cenomanian condensed sequence.

Genus *Gyroidinoides* Brotzen, 1942
Gyroidinoides subconicus (Vasilenko, 1961)
(pl. 29: 2)

1961. *Gyroidina subconica* Vasilenko: 47, pl. 8: 5.

Material. — Over thirty specimens.

Dimensions (in mm):

	ZPAL F.XXIX/72
diameter	0.35
thickness	0.16

Remarks. — Except for their smaller size, the specimens investigated correspond entirely to the holotype.

Distribution. — Ożarów — Upper Albian — Lower Cenomanian; Jakubowice, Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Family **Anomalinidae** Cushman, 1927
Subfamily **Anomalinidae** Cushman, 1927
Genus *Lingulogavelinella* Malapris, 1965
Lingulogavelinella formosa (Brotzen, 1945)
(pl. 27: 1, 2, 4)

1945. *Cibicides formosa* Brotzen: 55, pl. 2: 3 (*fide* Ellis and Messina).

1980. *Lingulogavelinella formosa* (Brotzen): Robaszynski and Magniez-Jannin: pl. 9: 18, 19, 20.

Material. — Over forty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/57
greater diameter	0.4
smaller diameter	0.3
thickness	0.23

Distribution. — Ożarów — Upper Albian — Middle Cenomanian; Jakubowice, Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Lingulogavelinella frankei (Bykova, 1923)
(pl. 28: 1, 2, 3)

1961. *Anomalina (Pseudovalvulineria) frankei* (N. Bykova); Vasilenko: 115, pl. 20: 6; pl. 21: 1, 2.

Material. — Over thirty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/62
greater diameter	0.3
smaller diameter	0.25
thickness	0.17

Distribution. — Ożarów — Upper Albian — Lower Cenomanian; Jakubowice, Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Lingulogavelinella globosa (Brotzen, 1945)
(pl. 28: 4, 5, 6, 7, 12, 13)

1945. *Anomalinoides globosa* Brotzen: 55, pl. 2: 6 (*fide* Ellis and Messina).
1972. *Lingulogavelinella globosa* (Brotzen); Gawor-Biedowa: 107—108, pl. 15: 4, 5.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/64	ZPAL F.XXIX/66
diameter	0.27	0.32
thickness	0.13	0.15

Remarks. — This species displays a fairly high degree of variability in the size of test, number of chambers on the last whorl, shape of chambers and degree of evoluteness of the dorsal side.
Distribution. — Ożarów — Lower Cenomanian.

Lingulogavelinella orbiculata (Kusnezova, 1953)
(pl. 27: 5, 7, 8)

1961. *Anomalina (Pseudovalvulineria) orbiculata* (Kusnezova); Vasilenko: 116, pl. 21: 3, 4, 5.
1972. *Lingulogavelinella orbiculata* (Kusnezova); Gawor-Biedowa: 111, pl. 15: 3.

Material. — Over twenty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/58
diameter	0.43
thickness	0.22

Remarks. — This species is marked by a middle-sized, biconvex and bilaterally involute test, with a fairly strongly lobate margin and having five to six chambers in the last whorl; the last chamber is considerably larger than the remaining ones; the periumbilical peripheries of chambers on the ventral side are arranged in a starlike pattern.

L. orbiculata (Kusnezova, 1953) differs from *L. frankei* (Bykova) in larger dimensions, a more lobate margin of test and in the size and shape of the last chamber. From *L. globosa* (Brotzen, 1945), it differs in a completely involute dorsal side and lower number of chambers in the last whorl of test.

Distribution. — Ożarów — Lower — Middle Cenomanian; Jakubowice, Annopol — Lower — mid-Middle Cenomanian condensed sequence.

Lingulogavelinella ornatissima (Lipnik, 1961)

(pl. 28: 8, 9, 10, 11)

1972. *Lingulogavelinella? ornatissima* (Lipnik); Gawor-Biedowa: 110, pl. 15: 6; text-fig. 8.

Material. — Twenty specimens.

Dimensions (in mm):

	ZPAL F.XXIX/68
diameter	0.32
thickness	0.15

Remarks. — Test biconvex, with a slightly lobate margin, bilaterally involute. In the middle of the test, all chambers terminate, on both sides, in lamellate, triangular flaps. *L. ornatissima* (Lipnik, 1961) differs from the remaining species of this genus in the presence of periumbilical flaps on both sides of the test.

Distribution. — Ożarów — Lower — Middle Cenomanian; Jakubowice, Annopol — Lower — mid-Middle Cenomanian condensed sequence.

Lingulogavelinella spinosa (Plotnikova, 1962)

(pl. 26: 1, 2, 3, 13)

1962. *Cibicides* (*Cibicides*) *spinosus* Plotnikova: 54, pl. 2: 4.
1972. *Lingulogavelinella spinosa* (Plotnikova); Gawor-Biedowa: 114—115, pl 17: 1.

Material. — Over twenty specimens.

Dimensions (in mm):

	ZPAL F.XXIX/48	ZPAL F.XXIX/56
diameter	0.32	0.26
thickness	**0.15**	0.13

Remarks. — Test plano-convex, flat on the ventral and strongly convex on the dorsal side, involute and with only the chambers of last whorl visible on both sides of test; a small umbilical depression, surrounded by short, lamellar flaps of chambers, forming a starlike ornament, occurs on the ventral side. On the dorsal side, tests are ornamented by high, thick ribs, arranged subradially and covering dorsal sutures.

Distribution. — Ożarów — Upper Albian — Middle Cenomanian; Annopol, Jakubowice — Middle Albian — mid-Middle Cenomanian condensed sequence.

Genus *Gavelinella* Brotzen, 1942
Gavelinella baltica Brotzen, 1942
(pl. 25: 4—6; pl. 26: 4, 5, 8)

1942. *Gavelinella baltica* Brotzen: 50—51, pl. 1: 7 (*fide* Ellis and Messina).
1977. *Gavelinella baltica* Brotzen; Carter and Hart: 46, pl. 1: 36—38.

Material. — Over thirty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/46
diameter	0.5
thickness	0.22

Distribution. — Ożarów — Upper Albian — Middle Cenomanian; Jakubowice, Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Gavelinella cenomanica (Brotzen, 1945)
(pl. 25: 1, 2, 3)

1945. *Cibicidoides cenomanica* Brotzen: 54, pl. 2: 2a—c (*fide* Ellis and Messina).
1977. *Gavelinella cenomanica* (Brotzen); Carter and Hart: 46, pl. 1: 33—35.

Material. — Over thirty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/45
diameter	0.7
thickness	0.34

Distribution. — Ożarów — Upper Albian — Lower Cenomanian; Jakubowice, Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Gavelinella intermedia (Berthelin, 1880)
(pl. 26: 6, 7, 11, 12)

1880. *Anomalina intermedia* Berthelin: 67, pl. 4: 14a—c (*fide* Ellis and Messina).
1972. *Gavelinella* (*Berthelina*) *intermedia* (Berthelin); Gawor-Biedowa: 120, pl. 15: 7, 8, 9; text-fig. 12.

Material. — Over twenty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/52	ZPAL F.XXIX/55
diameter	0.41	0.3
thickness	0.22	0.15

Remarks. — *G. intermedia* (Berthelin, 1880) differs from *G. baltica* Brotzen in having more convex chambers on both sides of the test in particular in the initial chambers of the last coil which results in the fact that, in the lateral view, the test of *G. intermedia* is considerably wider as compared with that of *G. baltica*. In addition, *G. intermedia* is nearly subinvolute also on the dorsal side and has a more convex dorsal side of test.

Distribution. — Ożarów — Upper Albian — Lower Cenomanian; Jakubowice, Annopol — Middle Albian — mid-Middle Cenomanian condensed sequence.

Gavelinella schloenbachi (Reuss, 1862)
(pl. 26: 9, 10)

1862. *Rotalia schloenbachi* Reuss: 84, pl. 10: 5 (*fide* Ellis and Messina).
1965. *Planulina schloenbachi* (Reuss); Neagu: 32, pl. 8: 3.
1972. *Gavelinella* (*Gavelinella*) *schloenbachi* (Reuss); Gawor-Biedowa: 129, pl. 16: 2.

Material. — Over twenty specimens.
Dimensions (in mm):

	ZPAL F.XXIX/54
diameter	0.28
thickness	0.13

Distribution. — Ożarów — Upper Albian — Middle Cenomanian; Jakubowice — Lower — mid-Middle Cenomanian condensed sequence.

Genus *Stensioeina* Brotzen, 1936
Stensioeina praeexculpta (Keller, 1935)
(pl. 24: 2, 3)

1935. *Gyroidina praeexculpta* Keller: pl. 3: 28—32 (*fide* Ellis and Messina).
1954. *Stensiöina praeexculpta* (Keller); Pożaryska: 265, text-fig. 23.

Material. — Several specimens.
Dimensions (in mm):

	ZPAL F.XXIX/41
diameter	0.43
thickness	0.21

Distribution. — Ożarów — Lower Turonian (sample contaminated during preparation).

Family **Ceratobuliminidae** Cushman, 1927
Subfamily **Epistomininae** Wedekind, 1937
Genus *Hoeglundina* Brotzen, 1948
Hoeglundina chapmani (Ten Dam, 1948)
(pl. 29: 6, 7, 11)

1948. *Epistomina chapmani* Ten Dam: 166, pl. 1: 5 (*fide* Ellis and Messina).

Material. — Over twenty specimens.
Dimensions (in (mm):

	ZPAL F.XXIX/73
diameter	0.26
thickness	0.15

Distribution. — Ożarów — Lower — Middle Cenomanian; Jakubowice — Lower — mid-Middle Cenomanian condensed sequence.

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DANUTA PERYT

OTWORNICE I MIKROBIOSTRATYGRAFIA ŚRODKOWEJ KREDY PÓŁNOCNO-WSCHODNIEGO MEZOZOICZNEGO OBRZEŻENIA GÓR ŚWIĘTOKRZYSKICH (POLSKA CENTRALNA)

Streszczenie

Z osadów albu, cenomanu i turonu antykliny Annopola (odsłonięcia Annopol i Jakubowice) oraz monoklinalnej części północno-wschodniego mezozoicznego obrzeżenia Gór Świętokrzyskich (odsłonięcie Ożarów) opracowano zespół otworni-

cowy liczący ponad 80 gatunków. W oparciu o ten zespół stwierdzono obecność następujących standartowych poziomów otwornicowych: *Rotalipora appenninica, Rotalipora brotzeni, Rotalipora cushmani* i *Praeglobotruncana helvetica.* Jedynie w antyklinie Annopola, gdzie osady te są silnie skondensowane i wymieszana jest w nich różnowiekowa fauna, nie wyznaczono granic między poziomami. W omawianych osadach w oparciu o rozprzestrzenienie otwornic bentonicznych ustanowiono lokalne poziomy otwornicowe.

W oparciu o otwornice planktoniczne potwierdzono obecność dolnego i niższej części cenomanu środkowego w antyklinie Annopola.

Otwornice potwierdziły również wcześniejsze opinie o kondensacji stratygraficznej i wymieszaniu różnowiekowych faun w środkowym i górnym albie oraz w dolnym i środkowym cenomanie antykliny Annopola.

W oparciu o otwornice planktoniczne ustalono wiek górnej granicy luki stratygraficznej w profilu Ożarowa na środek poziomu *Inoceramus labiatus.*

EXPLANATION OF THE PLATES 21—35

Plate 21

1. *Textularia* sp., Annopol, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/1, × 83.
2. *Marssonella ozawai* Cushman, Ożarów, U. Albian, ZPAL F. XXIX/2, × 100.
3. *Tritaxia macfadyeni* Cushman, Ożarów, M. Cenomanian, ZPAL F.XXIX/3, × 67.
4. *Verneuilinoides borealis* Tappan, Ożarów, L. Albian, ZPAL F.XXIX/4, × 100.
5. *Arenobulimina advena* Cushman, Ożarów, L. Cenomanian, ZPAL F.XXIX/5, × 167.
6. *Pseudotextulariella cretosa* (Cushman), Ożarów, L. Cenomanian, ZPAL F.XXIX/6, × 67.
7. *Arenobulimina macfadyeni* Cushman, Annopol, M. to U. Albian condensed sequence, ZPAL F.XXIX/7.
8. *Lagena globosa ovalis* Reuss, Annopol, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/8, × 200.
9. *Arenobulimina chapmani* Cushman, Ożarów, U. Albian, ZPAL F.XXIX/9, × 67.
10. *Eggerellina mariae* Ten Dam. Ożarów, L. Cenomanian, ZPAL F.XXIX/10, × 133.

Plate 22

1. *Verneuilinoides borealis* Tappan,, Annopol, M. to U. Albian condensed sequence, ZPAL F.XXIX/11, × 80.
2. The same species, Annopol, M. to U. Albian condensed sequence, ZPAL F.XXIX/12, × 50.

3. *Verneuilinoides fischeri* Tappan, Annopol, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/13, × 53.
4. *Tritaxia pyramidata* Reuss, Ożarów, M. Cenomanian, ZPAL F. XXIX/14, × 67.
5. *Trochammina* cf. *wetteri* Stelck and Wall, Annopol, M. to U. Albian condensed sequence, ZPAL, F.XXIX/15, × 80.
6, 10. *Spiroplectinata annectens* (Parker and Jones), Annopol, M. to U. Albian condensed sequence, ZPAL F.XXIX/16, 20, × 100.
7, 8. *Verneuilinoides* sp., Annopol, M. to U. Albian condensed sequence, ZPAL F.XXIX/17, 18, × 133.
9. *Ataxophragmium variabile* (d'Orbigny), Ożarów, U. Albian, ZPAL F.XXIX/19, × 80.
11. *Textularia chapmani* Lalicker, Jakubowice, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/21, × 100.
12. *Arenobulimina macfadyeni* Cushman, Annopol, M. to U. Albian condensed sequence ZPAL F.XXIX/22, × 133.
13. *Lagena sulcatiformis* Pożaryska and Urbanek, Jakubowice, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/23, × 133.
14. *Trochammina* cf. *wetteri* Stelck and Wall, Annopol, U. Albian, ZPAL F.XXIX/24, × 100.

Plate 23

1. *Dentalina gracilis* d'Orbigny, Ożarów, U. Albian, ZPAL F.XXIX/26, × 93.
2. *Dentalina* sp., Annopol, M. to U. Albian condensed sequence, ZPAL F.XXIX/27, × 133.
3, 4, 5. *Nodosaria obscura* Reuss, Ożarów, U. Albian-Cenomanian, ZPAL F.XXIX/28, 29, 30; 3 × 200, 4, 5, × 133.
6. *Marginulina aequivoca* Reuss, Ożarów, U. Albian, ZPAL F.XXIX/31, × 133.
7. *Marginulina* sp., Ożarów, U. Albian, ZPAL F.XXIX/32, × 133.
8. *Dentalina pseudolinearis* Magniez-Jannin, Ożarów, U. Albian, ZPAL F.XXIX/33, × 133.
9, 10. *Pleurostomella nitida* Morrow, Ożarów, U. Albian, ZPAL F.XXIX/34, 35, × 133.
11. *Planularia complanata* (Reuss), Ożarów, U. Albian, ZPAL F.XXIX/36, × 133.
12. *Praebulimina reussi* (Morrow), Jakubowice, L. Cenomanian, ZPAL F.XXIX/37, × 133.
13, 14. *Marginulina jonesi* Reuss, Ożarów, U. Albian, ZPAL F.XXIX/38, 39, × 167.

Plate 24

1. *Arenobulimina anglica Cushman*, Ożarów, L. Cenomanian, ZPAL F.XXIX/40, × 133.
2, 3. *Stensioeina praeexculpta* (Keller), Ożarów, L. Turonian, ZPAL F.XXIX/41, × 100 (from contamination).
4, 5. *Lenticulina* sp., Ożarów, U. Albian, ZPAL F.XXIX/42, × 133.
6, 9. *Lenticulina rotulata* Lamarck, Ożarów, L. Cenomanian, ZPAL F.XXIX/43, × 67.
7, 8. *Lenticulina muensteri* (Roemer), Ożarów, U. Albian, ZPAL F.XXIX/44, × 67.

Plate 25

1, 2, 3. *Gavelinella cenomanica* (Brotzen), Ożarów, L. Cenomanian, ZPAL F.XXIX/45, × 80.
4, 5, 6. *Gavelinella baltica* Brotzen, Ożarów, L. Cenomanian ZPAL F.XXIX/46; 4, 5, × 100; 6, × 100.
7, 8, 9. *Cibicides kerisensis* Vasilenko, Ożarów, L. Cenomanian, ZPAL F.XXIX/47; 7, 9, × 80; 8, × 100.

Plate 26

1. 2, 3. *Lingulogavelinella spinosa* (Plotnikova). Annopol, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/48, 49, 50, × 133.
4, 5. *Gavelinella baltica* Brotzen, Annopol, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/51, × 80.
6, 7. *Gavelinella intermedia* (Berthelin), Annopol, L. to mid-M. Cenomanian, condensed sequence, ZPAL F.XXIX/52, × 100.
8. *Gavelinella baltica* Brotzen, Annopol, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/53, × 100.
9, 10. *Gavelinella schloenbachi* (Reuss), Annopol, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/54, × 133.
11, 12. *Gavelinella intermedia* (Berthelin), Annopol, L. to mid-M. Cenomanian, condensed sequence, ZPAL F.XXIX/55, × 133.
13. *Lingulogavelinella spinosa* (Plotnikova), Annopol, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/56, × 167.

Plate 27

1, 2, 4. *Lingulogavelinella formosa* (Brotzen), Ożarów, U. Albian, ZPAL F.XXIX/57, × 133.
5, 7, 8. *Lingulogavelinella orbiculata* (Kusnezova), Ożarów, L. Cenomanian, ZPAL F.XXIX/58, 59, 60, × 100.
3, 6. *Lingulogavelinella* sp., Ożarów, L. Cenomanian, ZPAL F.XXIX/61, × 133.
9. The same specimen, × 167.

Plate 28

1. *Lingulogavelinella frankei* (Bykova), Annopol, M. to U. Albian condensed sequence, ZPAL F.XXIX/62, × 200.
2, 3. The same species, Annopol, M. to U. Albian condensed sequence, ZPAL F.XXIX/63, × 200.
4, 5, 6. *Lingulogavelinella globosa* (Brotzen), Ożarów, L. Turonian, ZPAL F.XXIX/64; 4, 6 × 133, 5 × 167.
7. The same species, Ożarów, L. Turonian, ZPAL F.XXIX/65, × 267.
8, 9. *Lingulogavelinella ornatissima* (Lipnik), Annopol, M. to U. Albian condensed sequence, ZPAL F.XXIX/68, × 133.
10. The same species, Ożarów, L. Cenomanian, ZPAL F.XXIX/69, × 100.
11. The same species, Ożarów, L. Cenomanian, ZPAL XXIX/70, × 100.
12. *Lingulogavelinella globosa* (Brotzen), Ożarów, L. Turonian, ZPAL F.XXIX/66, × 133.
13. The same species, Ożarów, L. Turonian, ZPAL F.XXIX/67, × 167.

Plate 29

1, 4. *Cibicides gorbenkoi* Akimez, Ożarów, L. Turonian, ZPAL F.XXIX/71, × 127.
2. *Gyroidinoides subconicus* (Vasilenko), Ożarów, U. Albian, ZPAL F.XXIX/72, × 140.
3. *Lagena globosa ovalis* Reuss, Annopol, M. to U. Albian condensed sequence, ZPAL F. XXIX/137, × 133.
5. *Tristix excavatus* (Reuss), Annopol, M. to U. Albian condesed sequence, ZPAL F.XXIX/73, × 87.
6. 7, 11. *Hoeglundina chapmani* (Reuss), Jakubowice, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/73, 74, × 133
8, 9, 10. *Valvulineria lenticula* (Reuss), Ożarów, U. Albian, ZPAL F.XXIX/75, × 200.
12. *Globorotalites multiseptus* (Brotzen), Jakubowice, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/77, × 167.
13. *Tappanina eouvigeriniformis* (Keller), Annopol, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/78, × 200.

Plate 30

1. *Heterohelix reussi* (Cushman), Jakubowice, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/79, × 267.
2, 3. *Guembelitria cenomana* (Keller), Ożarów, U. Albian, ZPAL F.XXIX/80, 81, × 300.
4. *Heterohelix moremani* (Cushman), Jakubowice, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/82, × 167.
5, 7. *Globigerinelloides bentonensis* (Morrow), Ożarów, U. Albian, ZPAL F.XXIX/83, 84, × 200.
6. *Bifarina calcarata* (Berthelin), Ożarów, U. Albian, ZPAL F.XXIX/85, × 200.
8, 10. *Hedbergella delrioensis* (Carsey), U. Albian, ZPAL F.XXIX/86, × 167, ZPAL F.XXIX/88, × 200.
9. *Hedbergella planispira* (Tappan), Ożarów, U. Albian, ZPAL F.XXIX/87, × 300.

Plate 31

1. *Dicarinella imbricata* (Mornod), Ożarów, L. Turonian, ZPAL F. XXIX/89, × 100.
2. *Whiteinella praehelvetica* (Trujillo), Ożarów, L. Turonian, ZPAL F.XXIX/90, × 133.
3. *Whiteinella* sp., Ożarów, L. Turonian, ZPAL F.XXIX/91, × 100.
4. *Hedbergella planispira* (Tappan), Ożarów, U. Albian, ZPAL F.XXIX/92, × 300.
5, 6. *Whiteinella baltica* Douglas and Rankin, Annopol, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/93, 94, × 170.
7, 9. *Hedbergella simplex* (Morrow), Ożarów, U. Albian, ZPAL F.XXIX/95, × 200.
8. *Praeglobotruncana stephani* (Gandolfi), Ożarów, L. Turonian, ZPAL F.XXIX/96, × 100.

Plate 32

3. *Dicarinella imbricata* (Mornod), Ożarów, L. Turonian, ZPAL F.XXIX/97, × 133.
1, 2, 4, 5. *Praeglobotruncana gibba* Klaus, Ożarów, L. Turonian, ZPAL F.XXIX/100, 101, × 100, ZPAL F.XXIX/98, 99, × 133.
6. *Praeglobotruncana stephani* (Gandolfi), Ożarów, L. Turonian, ZPAL F.XXIX/102, × 100.
7, 8, 9. *Dicarinella hagni* (Scheibnerova), Ożarów, L. Turonian, ZPAL F.XXIX/103, × 67.

Plate 33

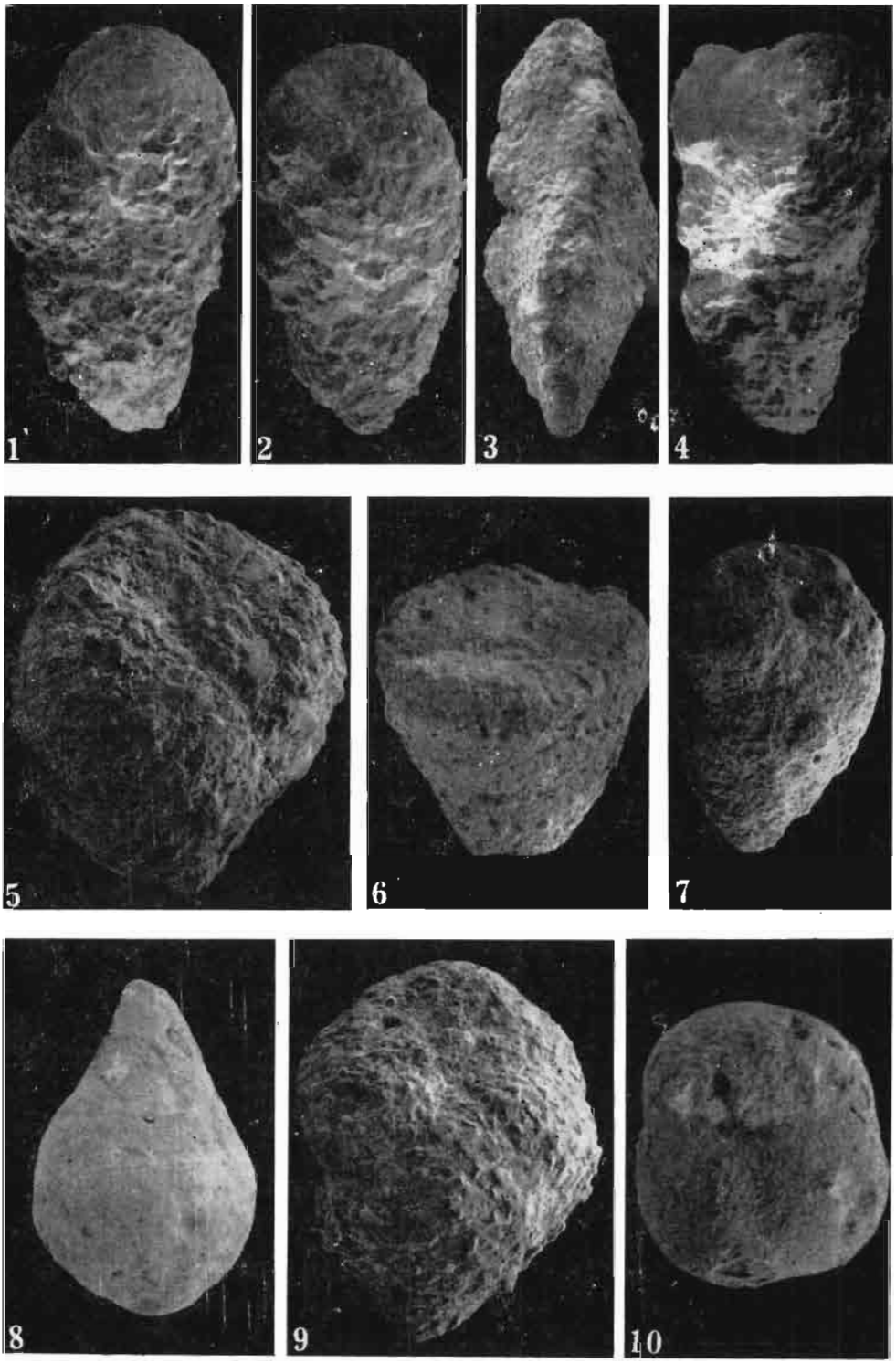
1, 2, 3. *Dicarinella imbricata* (Mornod), Ożarów, L. Turonian, ZPAL F.XXIX/104, 105, × 133.
4, 5. *Praeglobotrncana delrioensis* (Plummer), Jakubowice, L. Cenomanian, ZPAL F.XXIX/106, 107, × 133.
6, 8. *Dicarinella imbricata* (Mornod), Ożarów, L. Turonian, ZPAL F.XXIX/97, × 133.
7. *Dicarinella hagni* (Scheibnerova), Ożarów, L. Turonian, ZPAL F.XXIX/108, × 67.
9. *Dicarinella algeriana* (Caron), Ożarów, L. Turonian, ZPAL F.XXIX/109, × 100.
10, 12. *Dicarinella longoriai* Peryt, Ożarów, L. Turonian, ZPAL F.XXIX/110, 111; 10 × 100, 12 × 167.
11. *Praeglobotruncana delrioensis* (Plummer), Jakubowice, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/112, × 133.

Plate 34

1, 2, 3, 8, 9. *Rotalipora brotzeni* (Sigal); 1 — Ożarów, L. Cenomanian, ZPAL F.XXIX/113, × 167; 2, 3, 8, 9, — Annopol, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/114, 115, 116, 117, × 100.
4, 5, 6. *Rotalipora* cushmani (Morrow), Jakubowice, L. to mid-M. Cenomanian, condensed sequence, ZPAL F. XXIX/118, 119; 4, × 100; 5, 6, × 167.
7. *Rotalipora gandolfii* Luterbacher and Premoli-Silva, Annopol, L. to mid-M. Cenomanian condensed sequence, ZPAL F.XXIX/120, × 100.
10, 11, 12, 13. *Rotalipora appenninica* (Renz), Annopol, M. to U. Albian condensed sequence, ZPAL F.XXIX/121, 122, 123, 124; 11, × 100; 10, 12, 13, × 167.

Plate 35

1, 2, 3, 6, 7. *Rotalipora gandolfii* Lutherbacher and Premoli-Silva, Annopol, M. to U. Albian condensed sequence, ZPAL F.XXIX/125, 126, 127, 128, 129; 1, 2, 3, × 100; 6, 7, × 133.
4, 5. *Rotalipora appenninica* (Renz), Annopol, M. to U. Albian condensed sequence, ZPAL F.XXIX/130, 131; 4, × 167; 5, × 100.
8, 9. *Whiteinella brittonensis* (Loeblich and Tappan), Annopol, M. to U. Albian condensed sequence, ZPAL F.XXIX/132, 133, × 167.
10. *Hedbergella trocoidea* (Gandolfi), Annopol, M. to U. Albian condensed sequence, ZPAL F.XXIX/133, × 173.
11. *Hedbergella* sp., Annopol, M. to U. Albian condensed sequence, ZPAL F.XXIX/134, × 173.
12. *Heterohelix moremani* (Cushman), Annopol, M. to U. Albian condensed sequence ZPAL F.XXIX/135, 233.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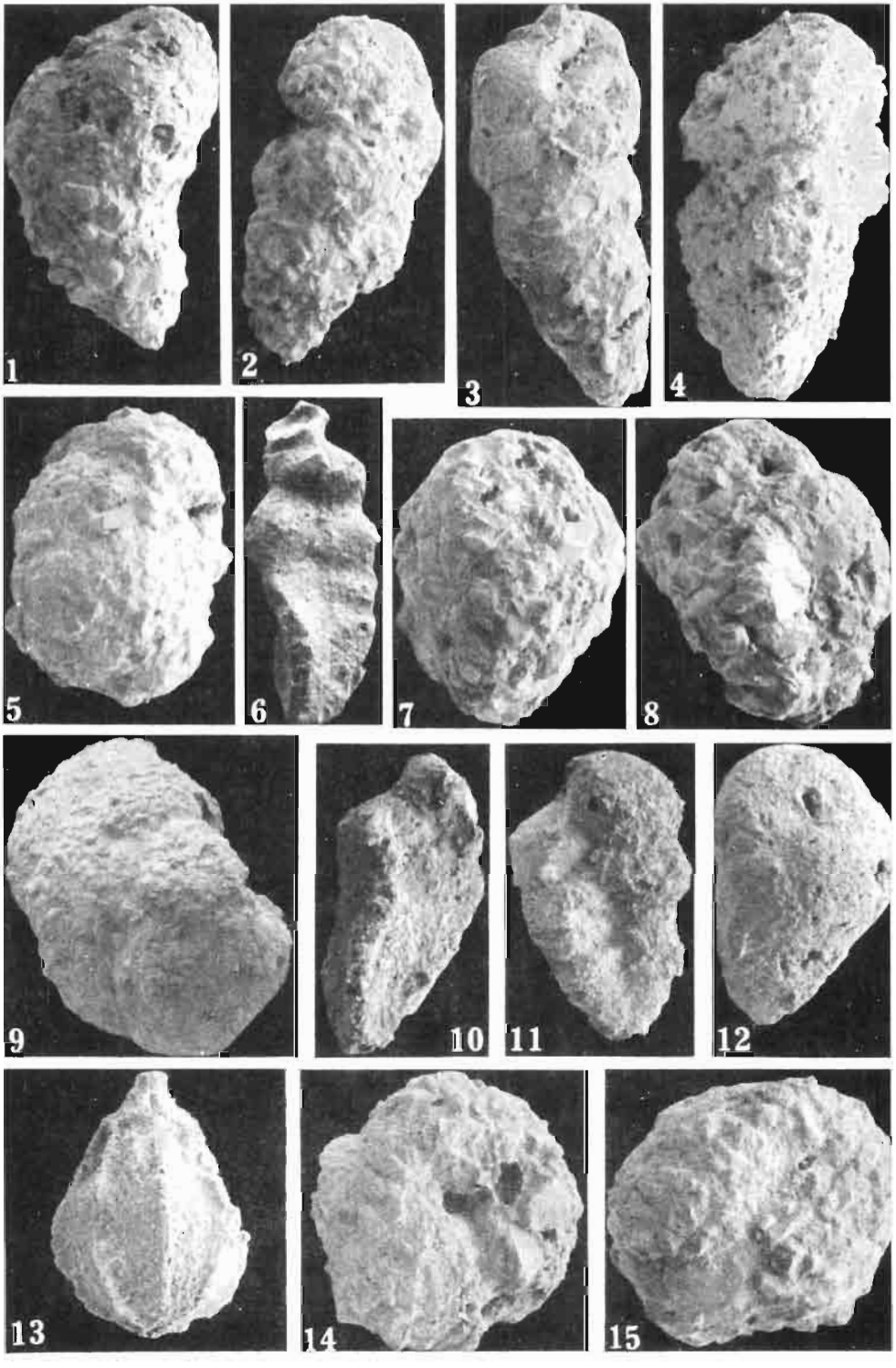
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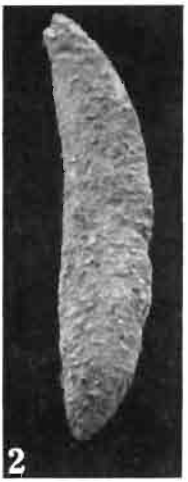
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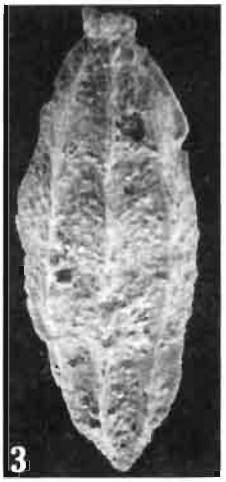
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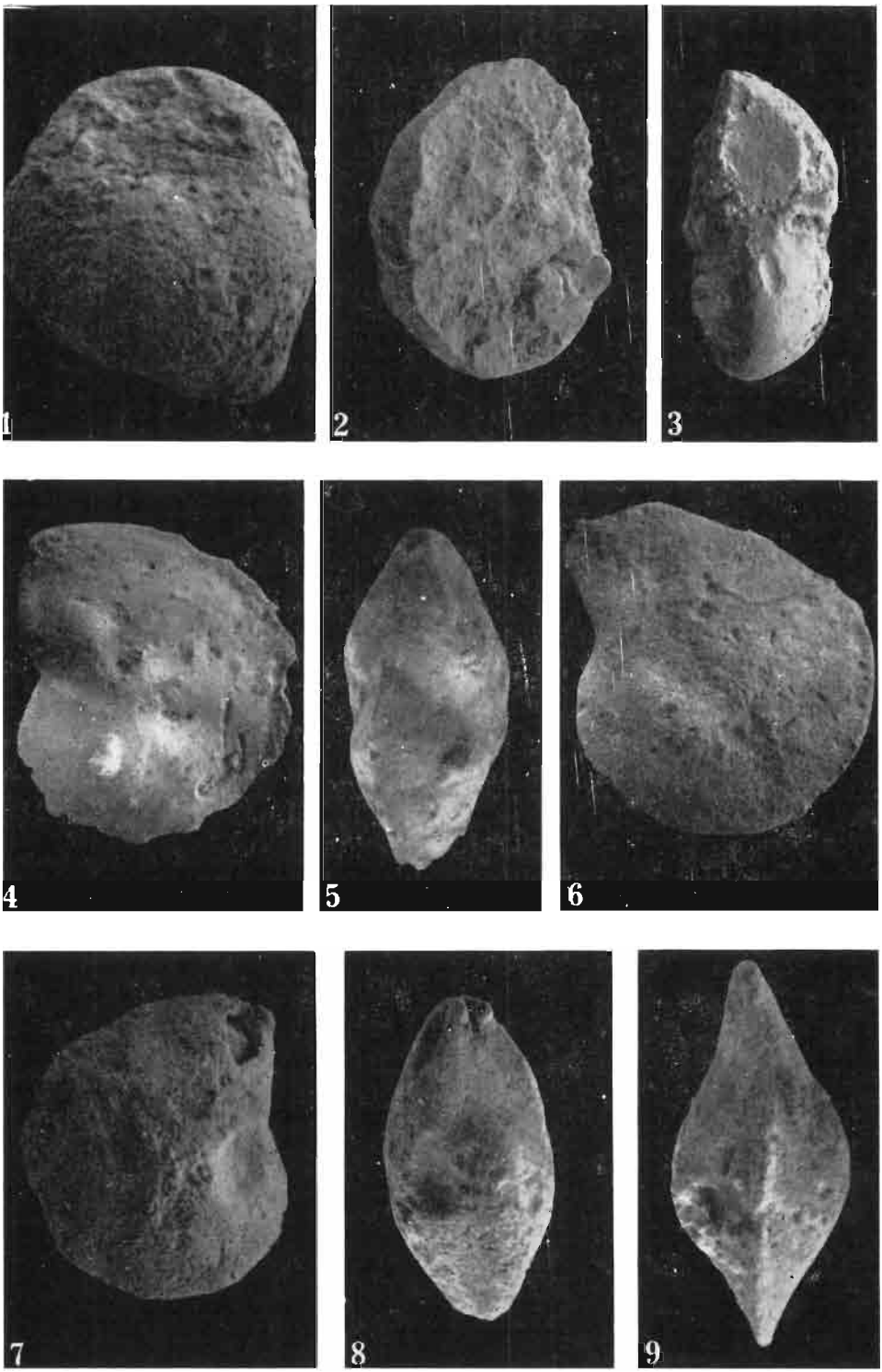
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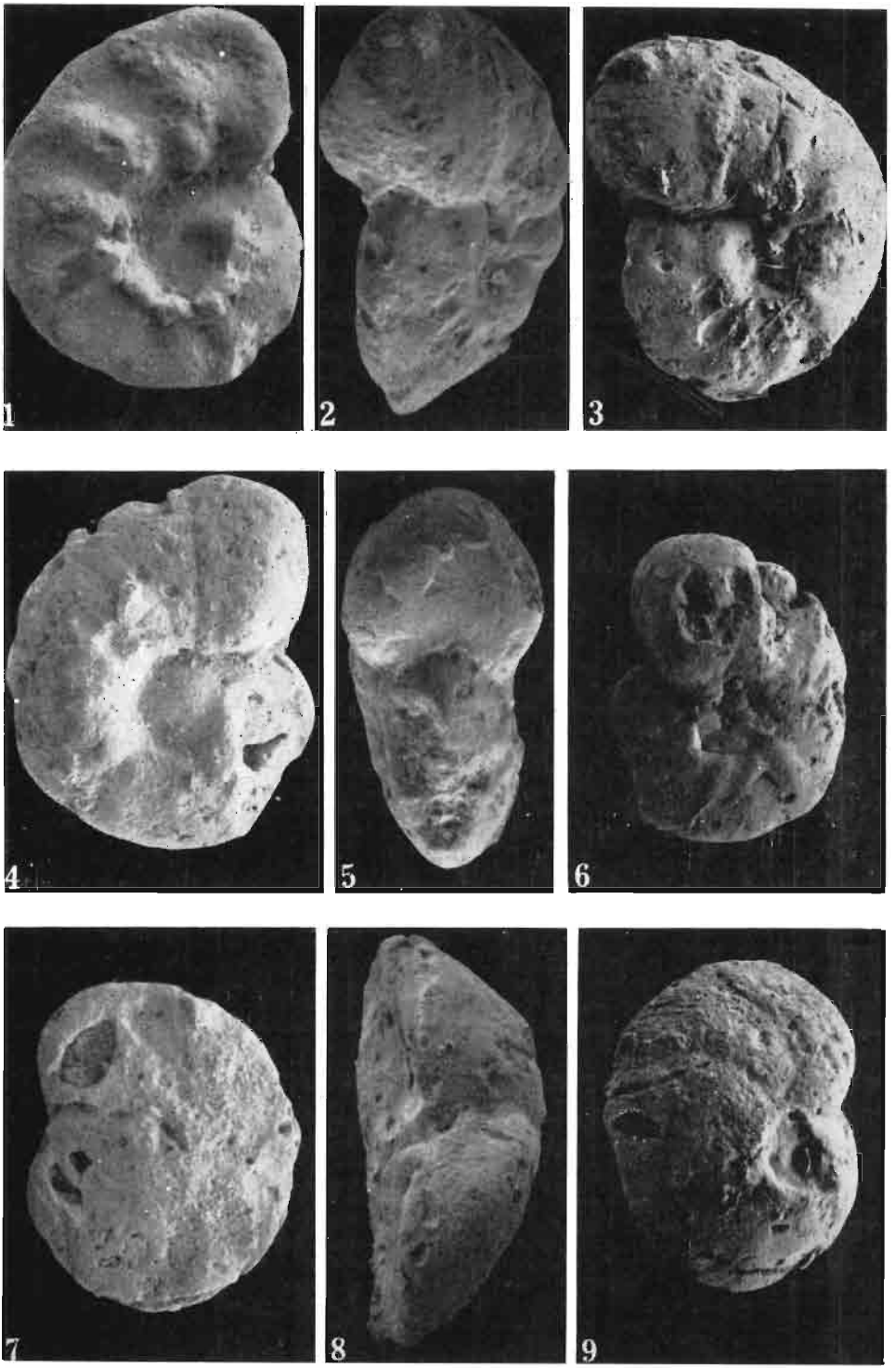
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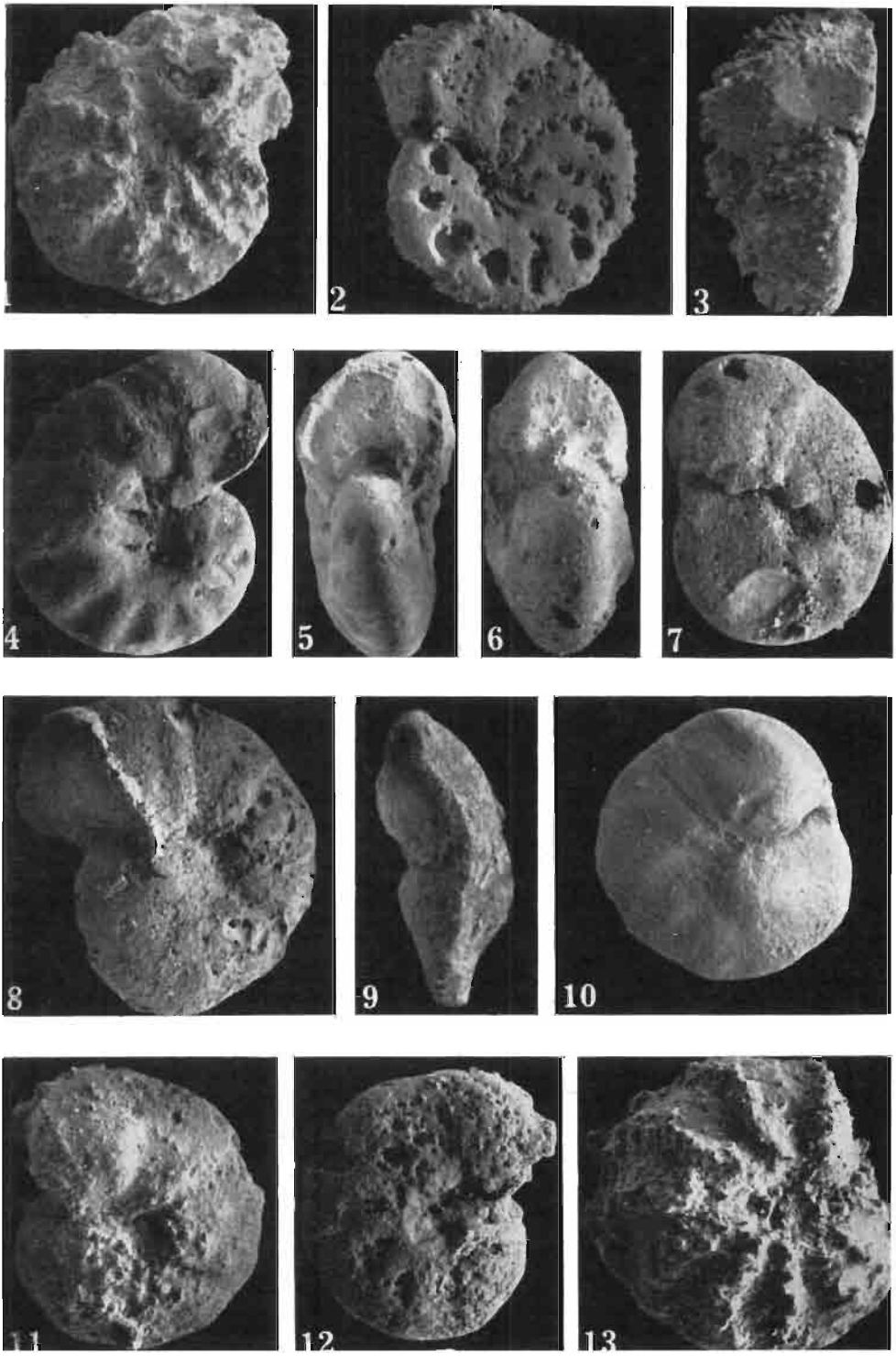
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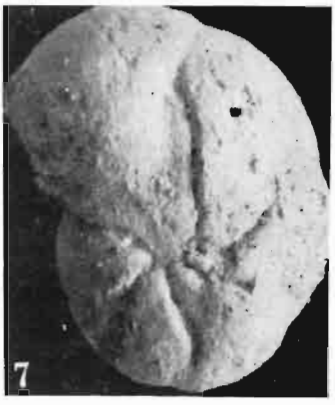
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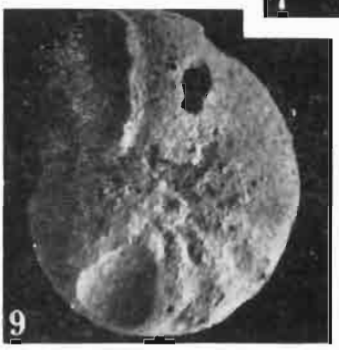
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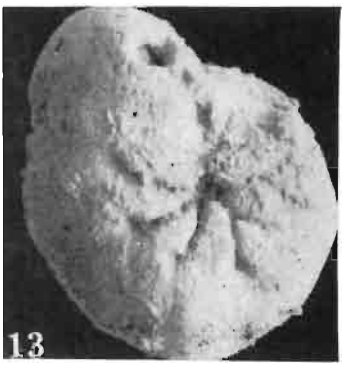
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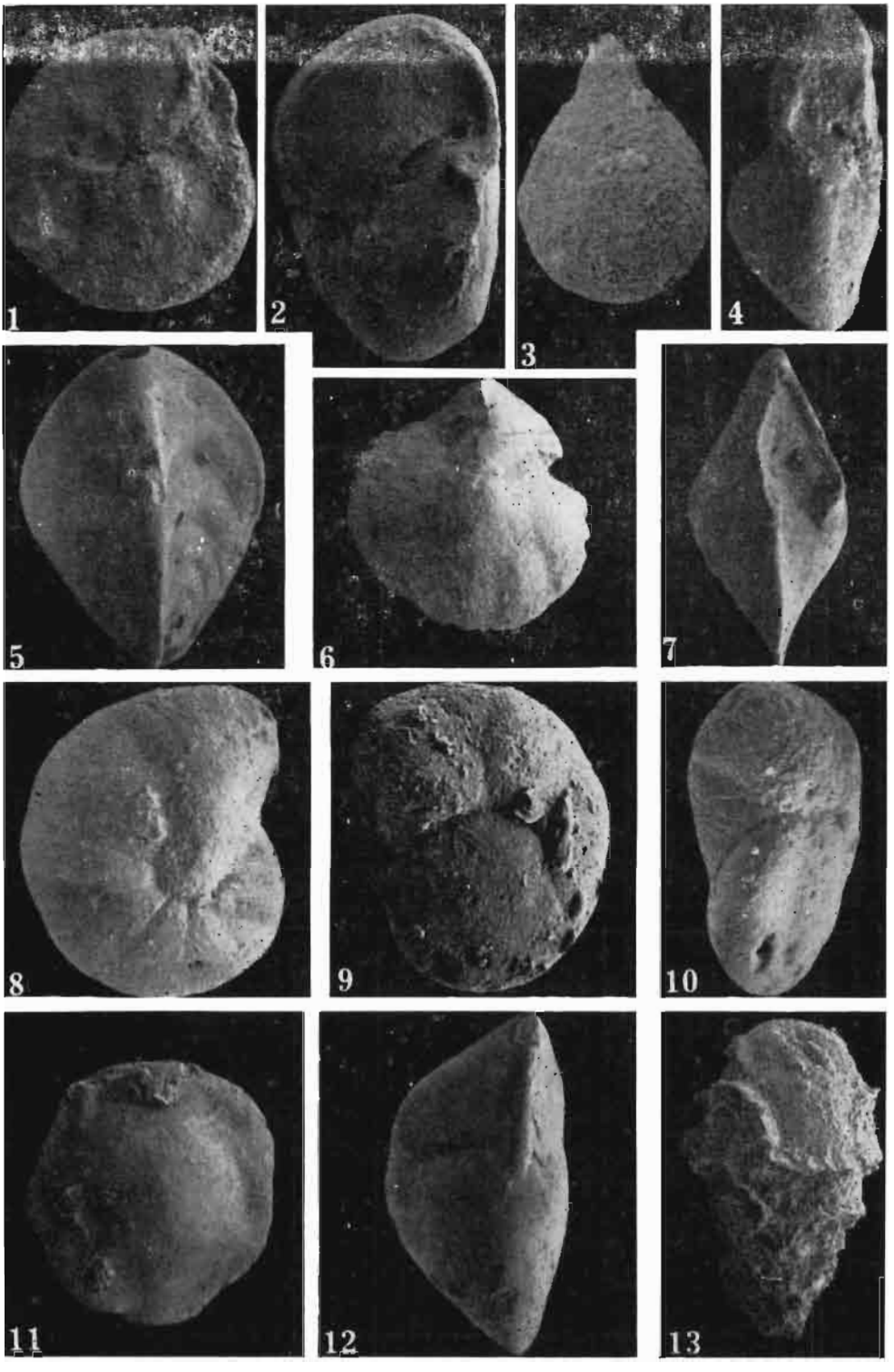
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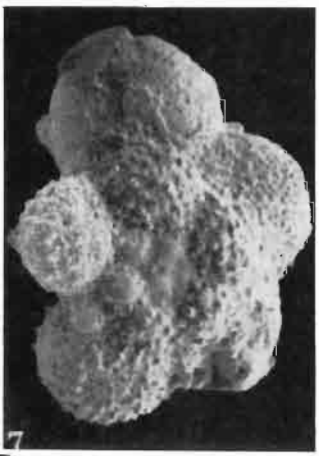
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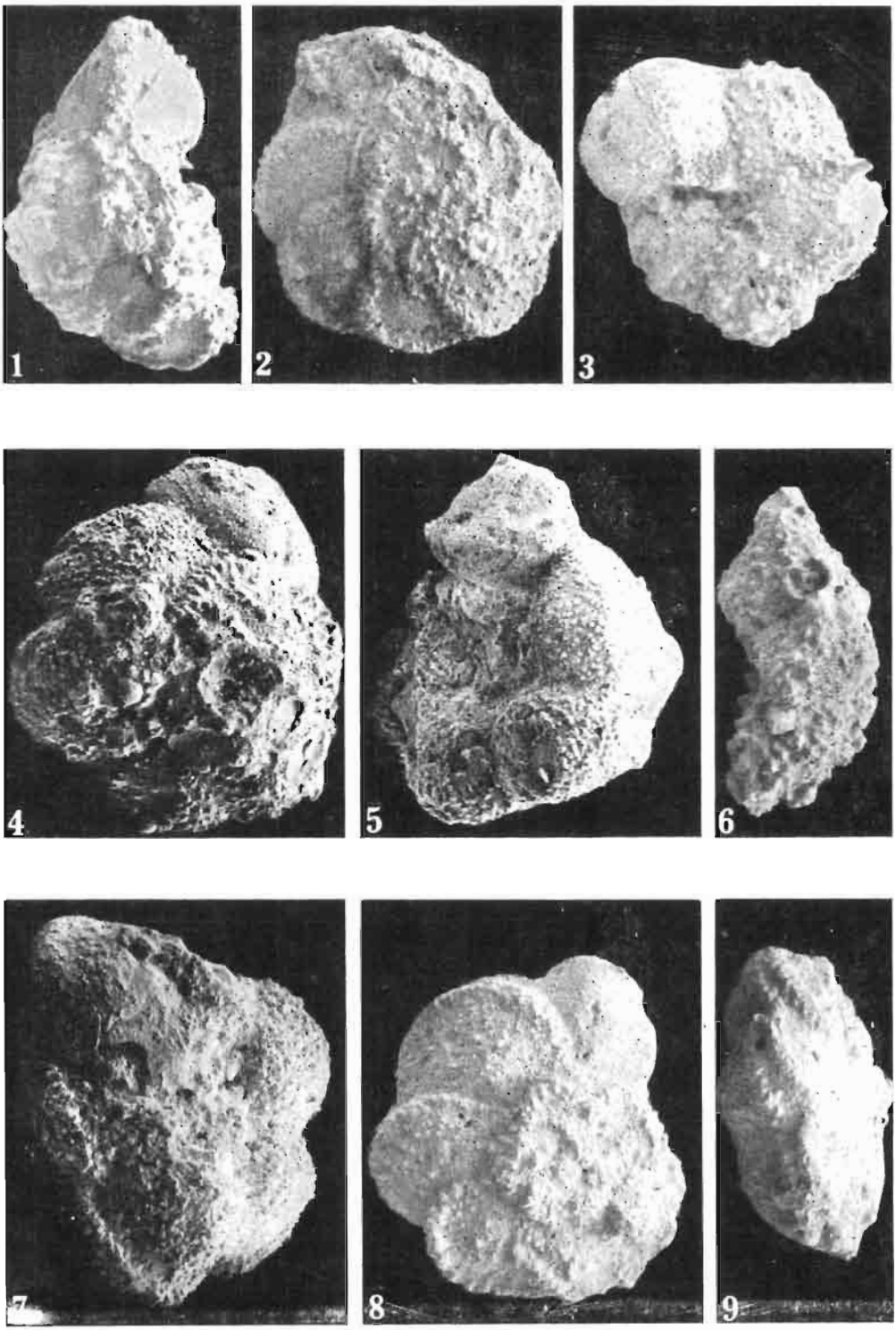
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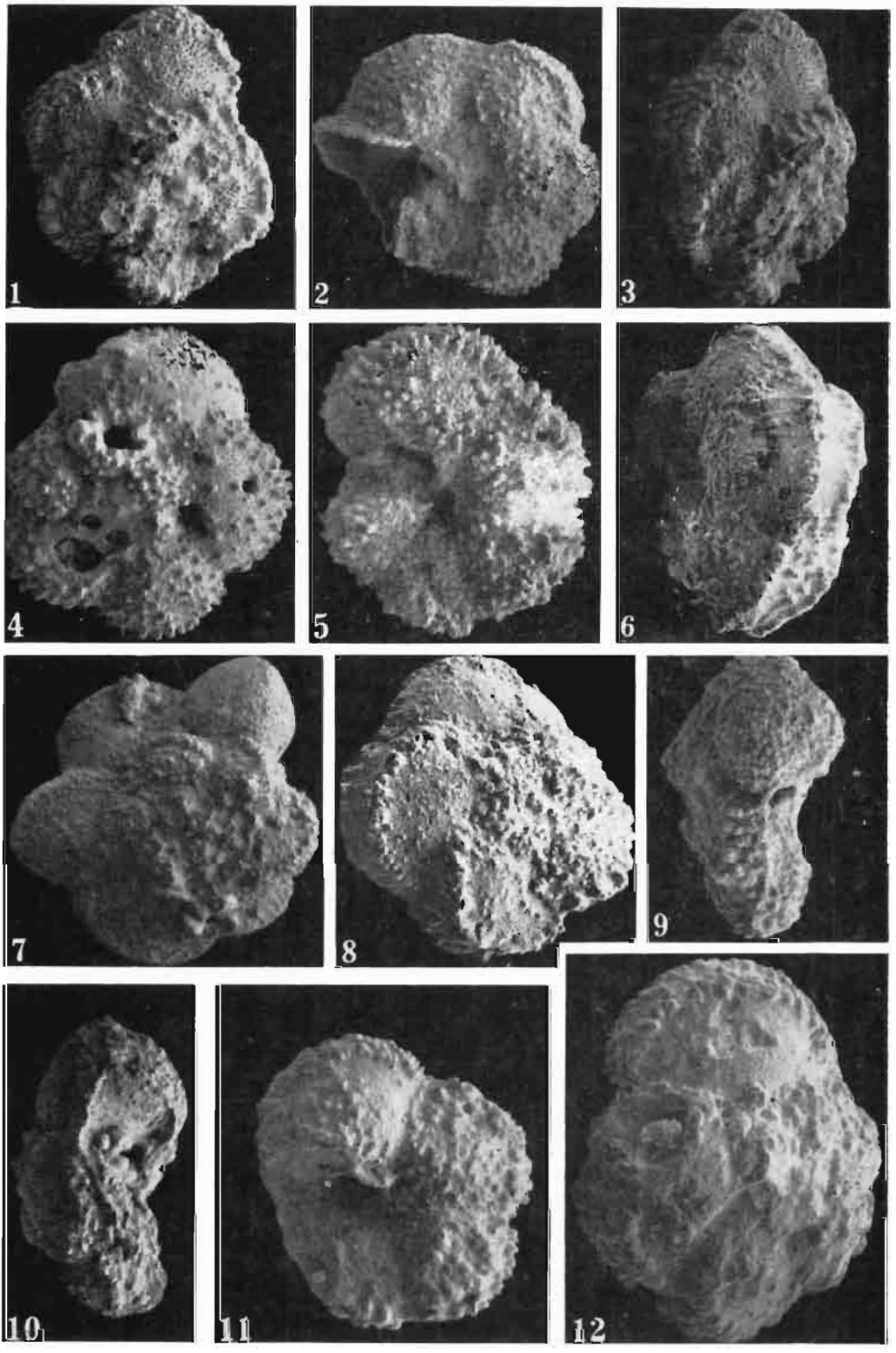
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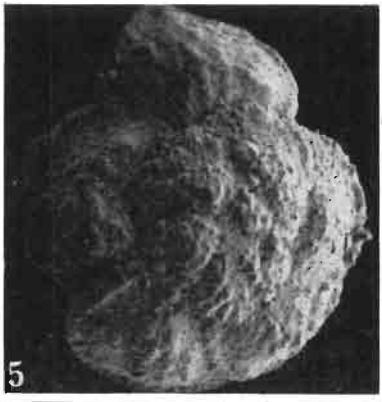
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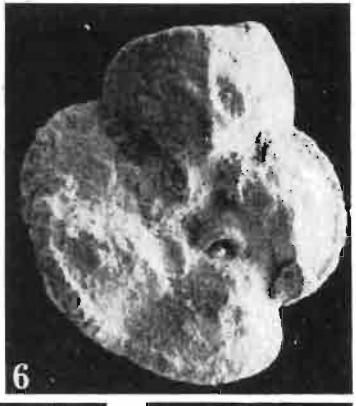
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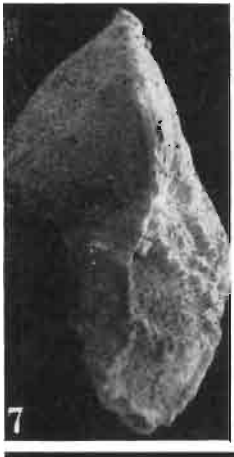
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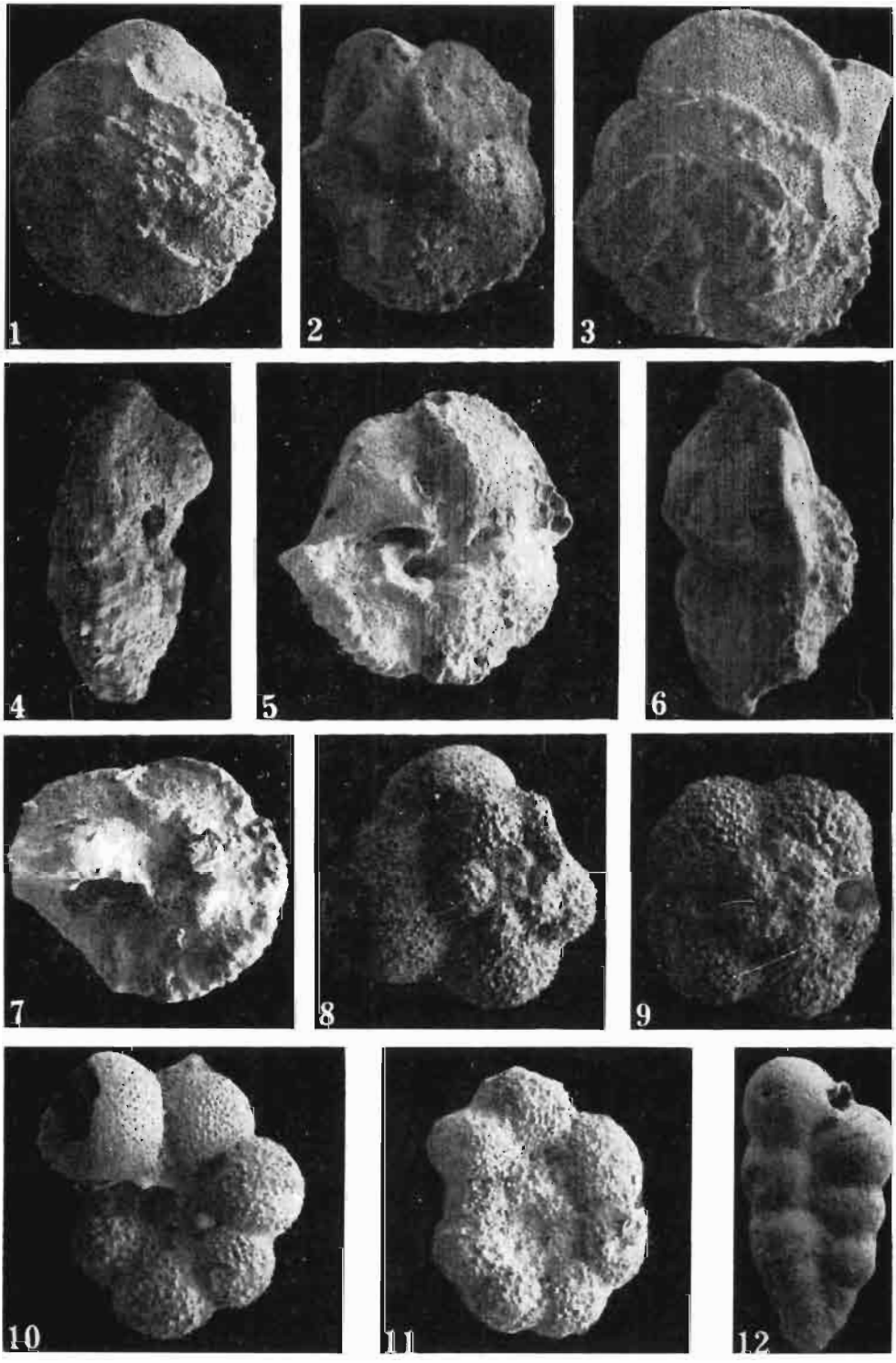
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