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ON SOME FORAMINIFERA FROM THE BORYSZEW BORING (CENTRAL POLAND)

Abstract. — Six species of Foraminifera from the samples collected beside the bore (depth 193—207 m.) drilled in Boryszew near Sochaczew are described. Their individual variability is discussed. The foraminiferal assemblage proves that Boryszew material is of Lower Paleocene age (Montian or Selandian).

INTRODUCTION

In 1955 a bore-hole was drilled in Boryszew near Sochaczew, 60 km. west of Warsaw. It was a wide dimension percussion boring carried out in search of water. Material received for examination consisted of samples of rock from a depth 193 m. — 207 m., taken from a heap beside the bore. All the collected material was carefully washed and sieved. It proved to be very rich in fossils, both micro- and macrofauna.

The boring yielded numerous corals which were studied by Różkowska (1955), a considerable amount of echinid spines, some belonging to *Tylocidaris* genus were described by Kongiel (1958), numerous fragments of bryozoan colonies investigated by Voigt (1964) and a few specimens of brachiopods from the *Crania tuberculata* s. *l.* group studied and described by Rosenkrantz (1964). The material also yielded some otolites and exceptionally numerous tubes of Annelida, not yet investigated.

As to microfauna, the boring in Boryszew yielded valuable material for the study of Ostracoda and Foraminifera. Ostracoda are at present being examinated by Mrs J. Szczechura and the present writer is working on the Foraminifera.

All this valuable material was obtained from sandy, calcareous sediment, rich in glauconite.

Foraminifera were exceptionally plentiful in this material and the great quantity of large forms, up to 4 mm., belonging to Lagenidae family, was a striking feature; the following genera were identified: *Nodosaria, Dentalina, Marginulina, Vaginulina, Planularia, Palmula, Astacolus* and *Robulus.*

In a preliminary note Brotzen and Pożaryska (1957) supplied a list of established species of Foraminifera, underlining the index forms for the Paleocene age; in particular, the representatives of *Ceratobulimina* are

especially characteristic for the Swedish and Danish Selandian as well as for Boryszew beds under discussion. The remaining microfauna yielded many species in common with Selandian and did not contain any species which would contradict this correlation. In connexion with the above, the age of the Boryszew strata was considered as corresponding to the Lower Scandinavian Paleocene, so-called Selandian after Rosenkrantz.

The present author has recently investigated many borings in Poland and has proved the occurrence of Lower Paleocene sediments in central and north Poland independent of the Danian sediments (paper in print). While in general the foraminiferal assemblages are very similar in both stages (Danian and Paleocene), the Danian — Paleocene boundary is marked by the presence of the following species which are lacking in the Danian:

Arenobulimina cuskleyae Jennings
Robulus degolyeri (Plummer)
R. pseudomamilligerus (Plummer)
R. wilcoxensis Cushman & Ponton
Astacolus gryi Brotzen
Saracenaria hamata (Franke)
Planularia bzurae Pożaryska
Pyrulina fusiformis (Roemer)
Sigmomorphina pseudoregularis Cushman & Thomas
Loxostomum applinae (Plummer)
Lamarckina rugulosa Plummer
L. naheolensis Cushman & Todd
Ceratobulimina tuberculata Brotzen
Globigerina kozlowskii Brotzen & Pożaryska
Mississippina midwayensis trinitatensis (Cushman & Renz)
Cibicides succedens Brotzen
C. mammillatus Brotzen
C. lectus Vassilenko

Most of the species cited above occur in Boryszew heap (Brotzen & Pożaryska, 1957, and Pożaryska's paper in print).

Różkowska (1955) came to the conclusion on the base of her work on corals from the same boring that the Boryszew sediments are of Montian age.

Voigt (1964), who studied the Bryozoa remains, is of the opinion that the strata in question could equally be assigned to the uppermost Danian, as well as to the Montian.

Kongiel (1958), on the base on *Tylocidaris spines*, accepted Upper Danian age for the lower part of Boryszew beds, and Montian age for their upper part. In other words the sediment in question corresponds to the passage beds between Danian and Montian.

Rosenkrantz (1964) generally supported Kongiel in this matter. The *Stereocidaris rosenkrantzi* (Ravn) and *Tylocidaris pomifer masoviensis* Kongiel described by Kongiel (1958) from Boryszew were recently found in Zeeland by Rosenkrantz (1964), together with *Tylocidaris bruennichi* Ravn, the index fossil for the Middle Danian beds. Therefore the last named author fixes the age of *Crania* strata at Boryszew as Danian. Besides his recently described new species *Crania* (*Danocrania*) *polonica polonica* "has a sculpture of scattered spinules which is only known in Danocranias from the Lower and Middle Danian" (*l. c.*, p. 523).

The Danian elements of macrofauna cited by the authors mentioned above must be considered in the opinion of the present author only as reworked. According to the present author, they occur in Lower Paleocene sediments in Boryszew not *in situ*. In the light of the foraminiferal assemblage the Danian age is not acceptable for sediments in the Boryszew boring.

In the present paper some of the most common species of Foraminifera occurring in Boryszew boring are described.

All specimens are housed at the Palaeozoological Institute of the Polish Academy of Sciences in Warsaw and are numbered F/VII. 1—104).

DESCRIPTIONS

Family **Lagenidae** Carpenter, 1862
Genus *Robulus* Montfort, 1808
Robulus wilcoxensis Cushman & Ponton, 1932

(Plate I, figs. 1-12)

1932. *Robulus wilcoxensis* Cushman & Ponton; J. A. Cushman & G. M. Ponton, An Eocene foraminiferal fauna..., p. 52, Pl. 7, fig. 3 a-b.

1941. *Robulus wilcoxensis* Cushman & Ponton; L. D. Toulmin, Eocene smaller Foraminifera..., p. 579, Pl. 78, fig. 24—25.

1951. *Robulus wilcoxensis* Cushman & Ponton; J. A. Cushman, Paleocene Foraminifera..., p. 15, Pl. 4, fig. 17.

Material. — 30 specimens well preserved.

Dimensions of two specimens (in mm.):

	1	*2*
Thickness of test	0.25	0.27
Shortest diameter of test	0.17	0.20
Longest diameter of test	0.1	0.11

Description. — Test closely coiled, moderately compressed. Periphery acute, keeled, with angles, slightly nodose. Chambers 8 to 10 in the last whorl, very slightly inflated, increasing gently in size as added, of rather uniform shape, except the two or three last which are lobated or elongated. Sutures distinct, gently curved, flush with surface in the early portion of test, becoming slightly depressed in the remainder of test. Keel small, blunt. Wall smooth, except for the early raised sutures. Aperture radiate.

Variation. — Species not very variable. All specimens closely coiled with last chambers lobate, or even uncoiled. Each specimen has a small but distinct umbilicus, bearing irregular thicknesses on its surface, having the appearance of raised small ribs or spots.

Remarks. — Our specimens do not differ from the holotype described from the Eocene of Wilcox age, Alabama (USA).

Occurrence. — Common in Montian at Boryszew and Sochaczew borings. Known from the Paleocene of Midway group (Texas, Alabama). Not known from the Danian.

Genus *Astacolus* Montfort, 1808

Astacolus gryi Brotzen, 1948

(Plates: I, figs. 20-21; III, figs. 1-25)

1948. *Astacolus gryi* Brotzen; F. Brotzen, The Swedish Paleocene..., p. 44, Pl. 7, fig. 6 a-c; p. 43, text-fig. 8 e-g.

1958. *Astacolus gryi* Brotzen; J. Hofker, Foraminifera from the Cretaceous of Limburg..., XXXIV, p. 64, text-fig. 1 a-b.

1963. *Lenticulina (Astacolus) gryi* Brotzen; O. K. Kapterenko-Černousova and others, Atlas..., p. 135, Pl. 39, fig. 4 a-w.

Material. — 25 specimens well preserved.

Dimensions of 3 specimens (in mm.):

	1	*2*	*3*
Length of test	1.85	2.37	2.55
Max. width of test	1.00	1.30	1.35
Thickness of test	0.30	0.35	0.45

Description. — Test large, elongated, early portion coiled, periphery truncated on ventral side, keeled on dorsal. Chambers numerous, only few in early portion, increasing gradually in size as added, low, three times broader than high. Sutures distinct, raised, slightly curved, with single tubercles in the beginning, later with rows of tubercles along sutures. Keel narrow, sharp, ragged. Facial surface very narrow and very long, bordered by two distinct ribs. Aperture big, radiate at outer peripheral angle.

Variation. — Rather big applying to general shape and ornamentation. Some specimens have a better developed coiled part, others are much narrower while yet others are wide for all their length. Ornamentation is developed in very different ways, the main feature being tubercles extending on the wall of chambers usually parallel to sutures but sometimes touching them. On some specimens they are crowded on the early portion of the test but lacking on the remainder. Sutures generally depressed, but flush with surface or even raised in early portion of test where they merge with tubercles.

Remarks. — Some of our specimens do not differ from the holotype described from the Swedish Paleocene. This species resembles *Astacolus paleocenicus* Brotzen differing only in ornamentation. According to Brotzen's (1948) opinion, *Astacolus gryi* is a species that has evolved from *Astacolus paleocenicus.*

Occurrence. — Common in Montian of Boryszew and Sochaczew. Not so common in Montian of middle Vistula outcrops at Bochotnica, Nasiłów

and Góra Puławska. Present in the Paleocene of Sweden, Denmark and south regions of U. S. S. R. Not known from the Danian.

Genus *Planularia* Defrance, 1824

Planularia bzurae Pożaryska, 1957

(Plates: I, figs. 23; II, figs. 1-16)

pars 1948. *Robulus discus* Brotzen; F. Brotzen, The Swedish Paleocene..., p. 42, Pl. 7.
1957. *Planularia pulavensis bzurae* Pożaryska; K. Pożaryska, Lagenidae du Crétacé supérieur..., p. 104, Pl. 19, fig. 5 a-b.

Material. — About 50 specimens well preserved.

Dimensions of 4 specimens (in mm.):

	1	*2*	*3*	*4*
Longest diameter of test	2.00	2.80	3.20	3.65
Shortest diameter of test	1.95	2.10	1.90	2.35
Thickness of test	0.50	0.30	0.62	0.60

Description. — Test large, coiled evolute, sides flattened, periphery truncate, keel well developed dividing usually into 3 parallel ragged keels, two keels only or even one on the last formed chamber. Chambers numerous, 6—9 in number in the last whorl, slightly convex. Sutures distinct, curved, fairly depressed. Umbo inconsiderable. On the surface some ribs irregularly crossing through sutures and chambers, gradually becoming nearly parallel to the outer edge of the test. Facial surface elongate, very narrow, bordered by two thick costae. Aperture radiate on the top of the last formed chamber.

Variation. — Extremely variable species. This applies to both general size, shape and type of ornamentation. Some specimens can be up to 3 times the size of others, while sutures are on some only slightly developed, in others strongly curved, nearly cycled. Tests are coiled evolute, usually tightly but in some cases the last or two last chambers are so elongated that they give the impression of being uncoiled. The centre of the test with proloculus is usually very slightly elevated or even quite flush with surface, but in some cases there is a tendency to form a small umbo on both sides. Keel very variable, triple for most of the margin changing to double even single, edge always fluted, in some cases ragged. The most variable of all features are the ribs, which can be developed as small striae crossing sutures or as typical ribs following the direction of coiling. Sometimes ribs or striae are so weakly developed that they are almost invisible.

Remarks. — This species is related to *Planularia pulavensis* Poż. (Pl. I, fig. 24), on the one hand, and to *Planularia discus* (Brotzen), on the other. From the first it differs in having an ornamentation, and from the second by having not such a distinct developed umbo and also by distinct ribs and costae.

The holotype was described from the same locality (Pożaryska, 1957).

Occurrence. — Common in Montian of Poland (Boryszew, Sochaczew, Góra Puławska, Bochotnica, Nasiłów). In the paper on Lagenidae by Pożaryska (1957) it was erronously described from Danian, because layers previously assigned as of Danian age, now are assigned as of Montian age. Found neither in Maastrichtian nor in Danian. Present in Lower Paleocene in Klagshamn's conglomerate in Sweden.

Genus *Palmula* Lea, 1833

Palmula robusta Brotzen, 1948

(Plate IV, fig. 1-27)

1948. *Palmula (Flabellina) robusta* Brotzen; F .Brotzen, The Swedish Paleocene..., p. 45, Pl. 8, fig. 4—5, text-fig. 9.
1956. *Palmula robusta* Brotzen; J. Hofker, Les Foraminifères..., p. 198, fig. 75.
1957. *Palmula robusta* Brotzen; K. Pożaryska, Lagenidae..., p. 168, Pl. 20, fig. 8.

Material. — A hundred or so specimens well preserved.

Dimensions of 3 specimens (in mm.):

	1	*2*	*3*
Length of test	1.77	2.65	4.55
Max. width of test	1.30	1.95	3.20
Thickness of test	0.35	0.25	0.40

Description. — Test large, elongate, the greatest width near the middle. Sides strongly flattened, almost plane, periphery truncated or rounded. Chambers numerous, first 2—4 coiled, the next chevron-shaped, very low, overlapping. Sutures distinct, thick, generally fairly raised, not raised between last chambers. Aperture radiate, terminal, on the top of the last formed chamber. Proloculus slightly elevated, with 2 or 3 short ribs. Wall smooth, polished.

Variation. — An individual species, closely related only to *Palmula elliptica* (Nilsson) from Maastrichtian. Varies considerably in size as well as in the development of the early stages. Outline, as a rule, oval but can be deltoidal or pear-shaped or even almond shaped. In the latter case the initial part is rather wide with angular apertural end. In some of more elongated specimens the sides can be almost parallel. The early coiled part of test is small consisting of 2—4 chambers in B-form, while in A-form the chevron shaped chambers follows just after a big proloculus. Sutures are raised not in all specimens. and then only in the early stages.

Remarks. — This species is very similar to *Palmula elliptica* (Nilsson), but is not so slender being broader, nearly rhomboid and having a bigger proloculus with ribs. Our specimens do not differ from the holotype described from the Swedish Paleocene.

Occurrence. — Very common in the Montian in Boryszew and Sochaczew borings and at Bochotnica, not common in Danian at Sochaczew and

Góra Puławska. Cited by Hofker (1956) from the Upper Maastrichtian of Belgium, Holland and Germany, and by Brotzen from the lower part of the Swedish Paleocene.

Genus *Marginulina* d'Orbigny, 1826

Marginulina cf. *plummerae* Cushman, 1937

(Plate V, figs. 1-12)

1937. *Marginulina plummerae* Cushman; J. A. Cushman, Some notes on Cretaceous species..., p. 97, Pl. 13, fig. 21—23.

1946. *Marginulina plummerae* Cushman; J. A. Cushman, Upper Cretaceous Foraminifera..., p. 62, Pl. 22, fig. 6, 9, 10 non fig. 7, 8 (earlier synonymy included).

1957. *Marginulina plummerae* Cushman; K. Pożaryska, Lagenidae..., p. 110, Pl. 13, fig. 5.

1958. *Marginulina plummerae* Cushman; J. Hofker, Foraminifera from the Cretaceous... XXXIV, p. 65, text-fig. 3 a-b.

Material. — Some dozens of specimens, often damaged.

Dimensions of 3 specimens well preserved (in mm.):

	1	2	*3*
Length of test	0.70	1.05	1.62
Max. width of test	0.30	0.32	0.42
Thickness of test	0.22	0.25	0.40

Description. — Test elongate, slightly compressed, especially in early portion which is coiled. Very early becoming to be uncoiled and gradually less compressed until the section becomes nearly circular. One side nearly straight, the other side slightly concave. Chambers numerous, few in coiled portion, in uncoiled portion gradually increasing in size as added, of rather uniform shape, last chamber distinctly inflated, subspherical, sutures distinct, slightly oblique, in the first portion of test flush with surface, in the remainder of test depressed, especially between last chambers. Aperture radiate, asymmetrical, sometimes on an elongate, tapering neck. Wall smooth.

Variation. — An individual species, not similar to others. Its variation is very slight. Most variable feature is the curvature of test which can be pronounced in some specimens, while others are almost straight. Sutures can be more depressed or less, sometimes flush with surface. Early portion of test tightly coiled in B-form.

Remarks. — Our specimens differ from the holotype by not having raised sutures on the early part of test.

Occurrence. — Common in Danian as well as in Montian in all known localities. Very common in Boryszew. This species occurs in Limburg. Described from the uppermost Cretaceous in U. S. A.

Family **Polymorphinidae** d' Orbigny, 1846
Genus Sigmomorphina Cushman & Ozawa, 1928
Sigmomorphina soluta Brotzen, 1948
(Plate I, figs. 13-19)

1948. *Sigmomorphina soluta* Brotzen; F. Brotzen, The Swedish Paleocene..., p. 53, Pl. 8, fig. 6—10.
1956. *Sigmomorphina soluta* Brotzen; J. Hofker, Les Foraminifères..., p. 196, fig. 62.

Material. — About 40 specimens well preserved.
Dimensions of an average specimen (in mm.):

Length of test	0.70
Max. width of test	0.37

Description. — Test compressed, elongate or rhomboidal periphery broadly rounded, greatest width above middle, outline variable, sometimes lobated. Chambers sigmoid, few in number, later biserial, slightly inflated. Sutures distinct, somewhat depressed. Wall smooth. Aperture radiate on the acute apertural end of the last formed chamber.

Variation. — This applies to general shape and to the character of the last chamber. This latter can be flush with surface or raised above it, rather overhanging. The outline of test is also very varying. Specimens can be drop-shaped to fusiform. Some wide and short, others narrower, extreme cases of the latter described as *Sigmomorphina brotzeni* by Hofker (1957). Sutures fairly depressed in wide, flat specimens which are not typical of this species. More common are the narrower ones with depressed sutures.

Occurrence. — Common in Montian at Boryszew, Sochaczew, Bochotnica, Góra Puławska, in Swedish Paleocene, Bunde Formation (Holland). The first appearance of the primitive representatives of this species is from the Swedish and Polish Danian. Present in Danian at Limburg and in Tuffeau de Ciply (Mons Basin). Hofker mentioned it as early as Upper Maastrichtian of Belgium and Holland (1956).

Remarks. — According to Hofker, the most similar species with *Sigmomorphina soluta* is *S. brotzeni* described by Hofker (1957) as closely related.

Palaeozoological Institute
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Warszawa, June 1964

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KRYSTYNA POŻARYSKA

O PEWNYCH OTWORNICACH Z WIERCENIA W BORYSZEWIE

Streszczenie

W pracy opisano szczegółowo 6 gatunków otwornic, które znaleziono w bardzo dużej liczbie w materiale hałdy wiercenia Boryszew koło Sochaczewa, z głębokości 193—207 m. Przedstawiono ich zmienność osobniczą. Trzy z opisanych gatunków,

a mianowicie: *Astacolus gryi* Brotzen, *Planularia bzurae* Pożaryska i *Robulus wilcoxensis* Cushman & Ponton — nie występują w Polsce w osadach starszych niż dolny paleocen. Pozostałe trzy: *Palmula robusta* Brotzen, *Marginulina plummerae* Cushman i *Sigmomorphina soluta* Brotzen — występują w Polsce również w osadach danu.

Na podstawie występowania w Boryszewie szeregu gatunków otwornic nie znanych z danu polskiego, wiek badanych osadów uznano za dolno-paleoceński (mont lub selandian).

KRYSTYNA POŻARYSKA

О НЕКОТОРЫХ ФОРАМИНИФЕРАХ ИЗ СКВАЖИНЫ БОРЫШЕВ (ЦЕНТРАЛЬНАЯ ПОЛЬША)

Резюме

В работе описано 6 видов фораминифер, найденных в многочисленных экземплярах в материале отвала скважины Борышев около Сохачева, из глубины 193—207 м. Представлено их индивидуальную изменчивость. Три из описанных видов, а именно: *Astacolus gryi* Brotzen, *Planularia bzurae* Pożaryska и *Robulus wilcoxensis* Cushman & Ponton, не выступают в Польше в отложениях старших чем нижне-палеоценовые. Остальные три вида: *Palmula robusta* Brotzen, *Marginulina plummerae* Cushman и *Sigmomorphina soluta* Brotzen — известны в Польше тоже из датских отложений.

На основании присутствия в Борышеве ряда видов фораминифер, не известных из польского дата, век изучаемых отложений принято как нижне-палеоценовый (монт или селандиан).

PLATES

Plate I

Figs. 1-12. *Robulus wilcoxensis* Cushman & Ponton; infraspecific variability. Montian (F/VII. 1-12).

Figs. 13-19. *Sigmomorphina soluta* Brotzen; infraspecific variability. Montian (F/VII. 13-19).

Figs. 20-21. *Astacolus gryi* Brotzen; index fossil for Lower Paleocene. Montian (F/VII. 20-21).

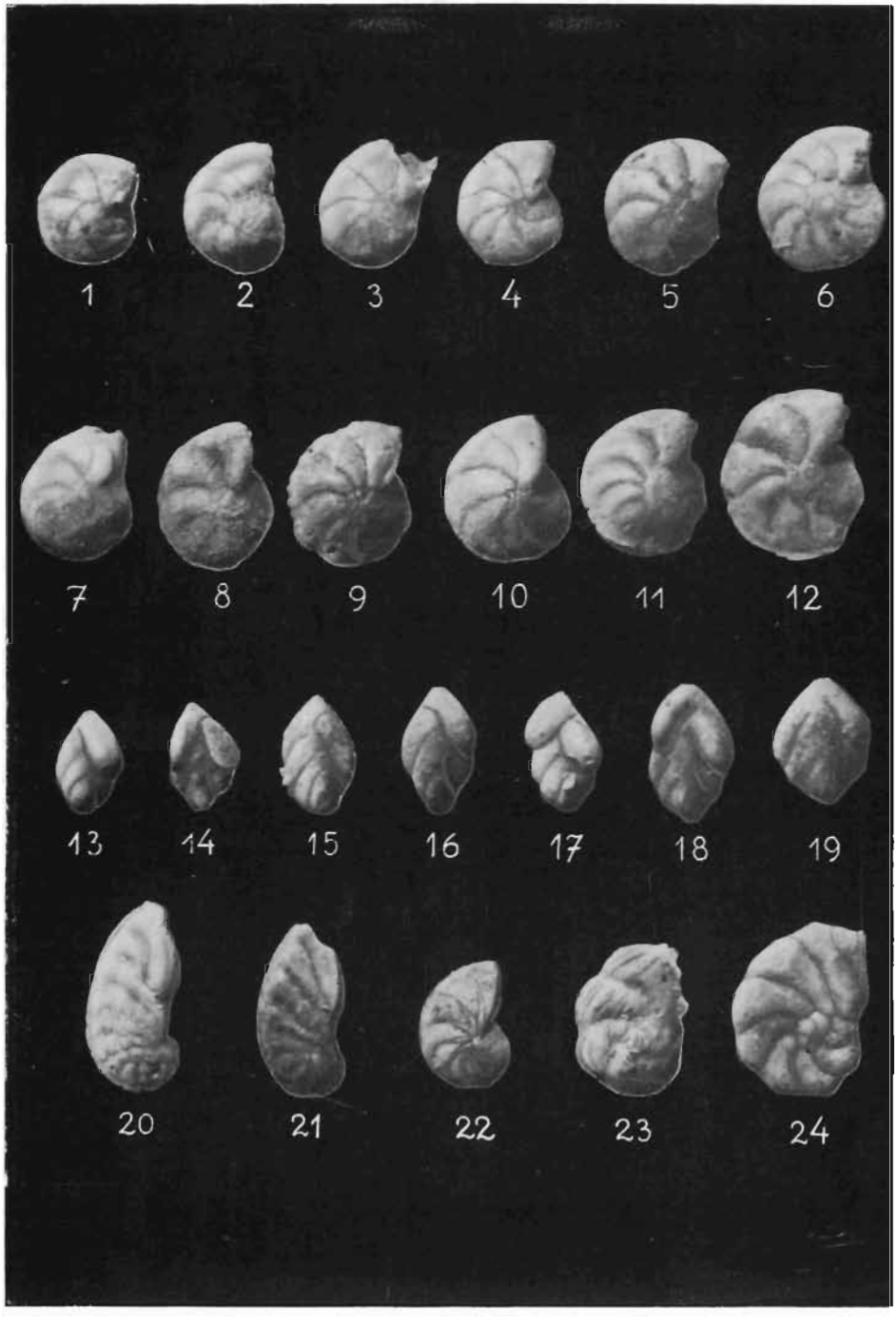
Fig. 22. *Robulus degolyeri* (Plummer); index fossil for Lower Paleocene. Montian (F/VII.22).

Fig. 23. *Planularia bzurae* Pożaryska; index fossil for Lower Paleocene (F/VII. 23).

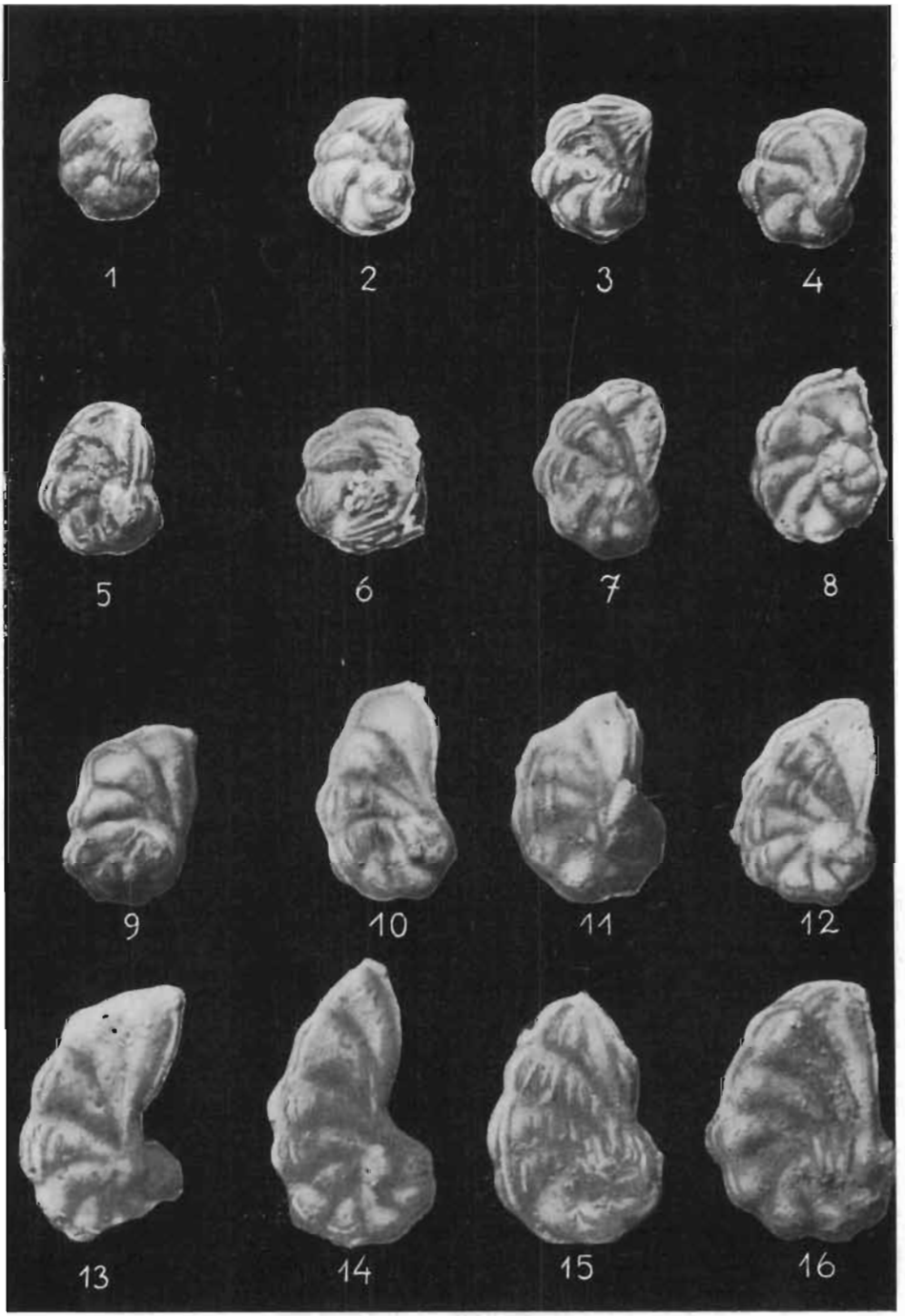
Fig. 24. *Planularia pulavensis* Pożaryska. Danian-Montian (F/VII. 24).

× 10

All specimens from Boryszew boring (heap), 193-207 m.
Collection of the Palaeozoological Institute of the Polish Academy of Sciences, Warsaw.



Phot. L. Łuszczewska



Phot. L. Łuszczewska

Plate II

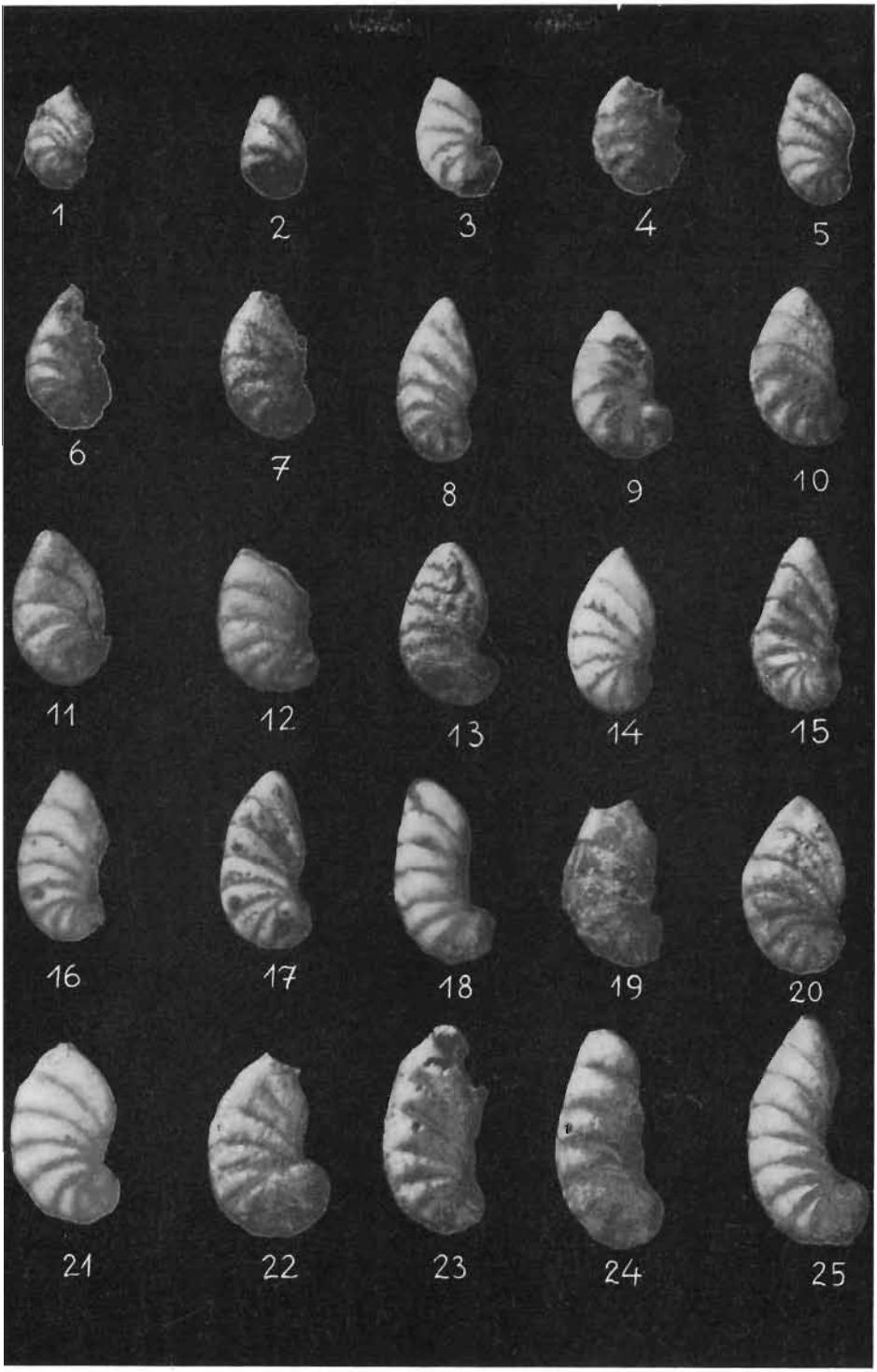
Figs. 1-16. *Planularia bzurae* Pożaryska; infraspecific variability. Montian, Boryszew boring (heap), 193-207 m. (F/VII. 25-40); × 10.

Collection of the Palaeozoological Institute of the Polish Academy of Sciences, Warsaw

Plate III

Figs. 1-25. *Astacolus gryi* Brotzen; infraspecific variability. Montian, Boryszew boring (heap), 193-207 m. (F/VII. 41-65); × 10.

Collection of the Palaeozoological Institute of the Polish Academy of Sciences, Warsaw



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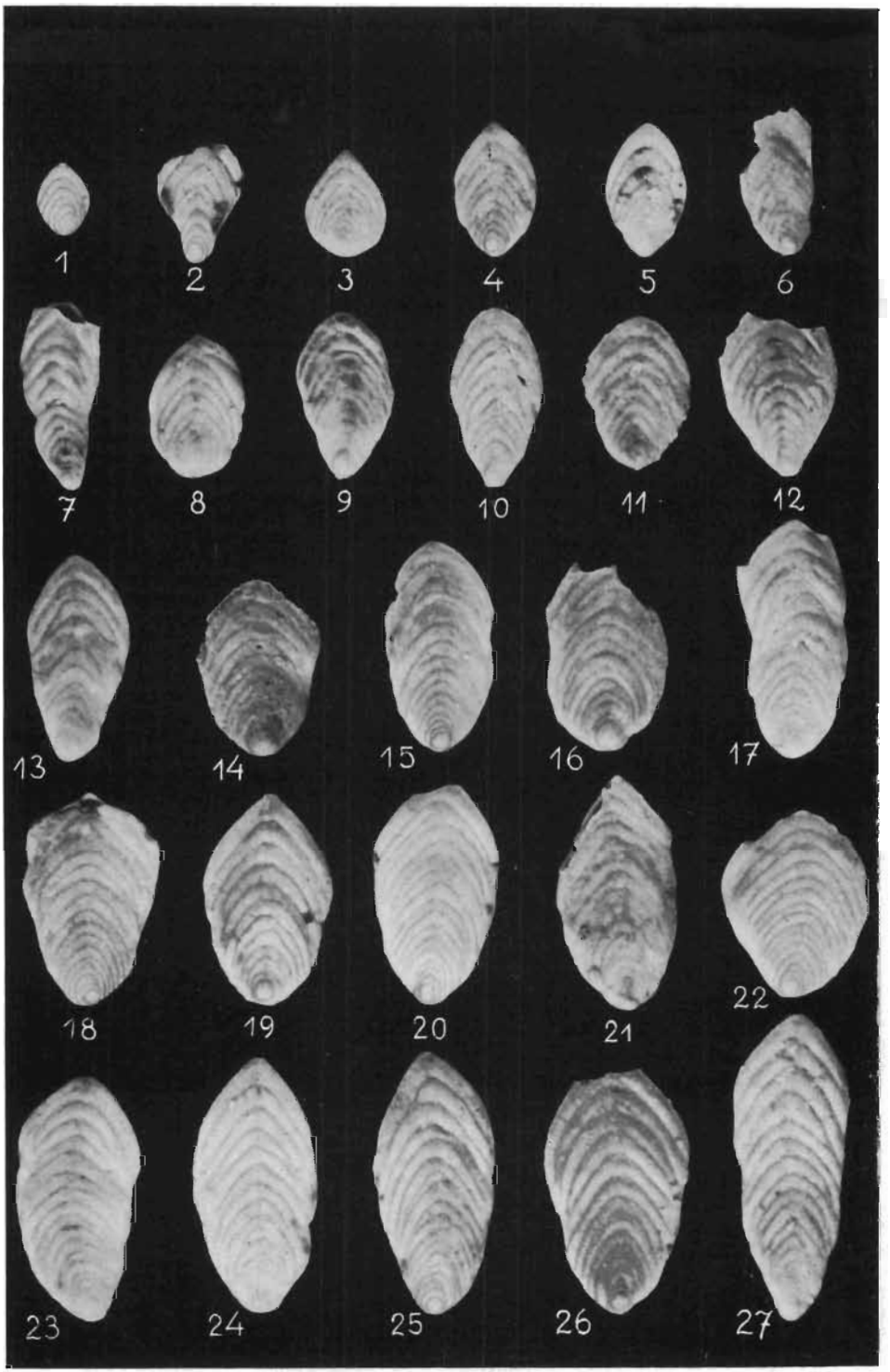

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Plate IV

Figs. 1-27. *Palmula robusta* Brotzen; infraspecific variability. Montian, Boryszew boring (heap), 193-207 m. (F/VII. 66-92); × 5.

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Plate V

Figs. 1-12. *Marginulina* cf. *plummerae* Cushman; infraspecific variability. Montian, Boryszew boring (heap), 193-207 m. (F/VII. 93-104); × 12.

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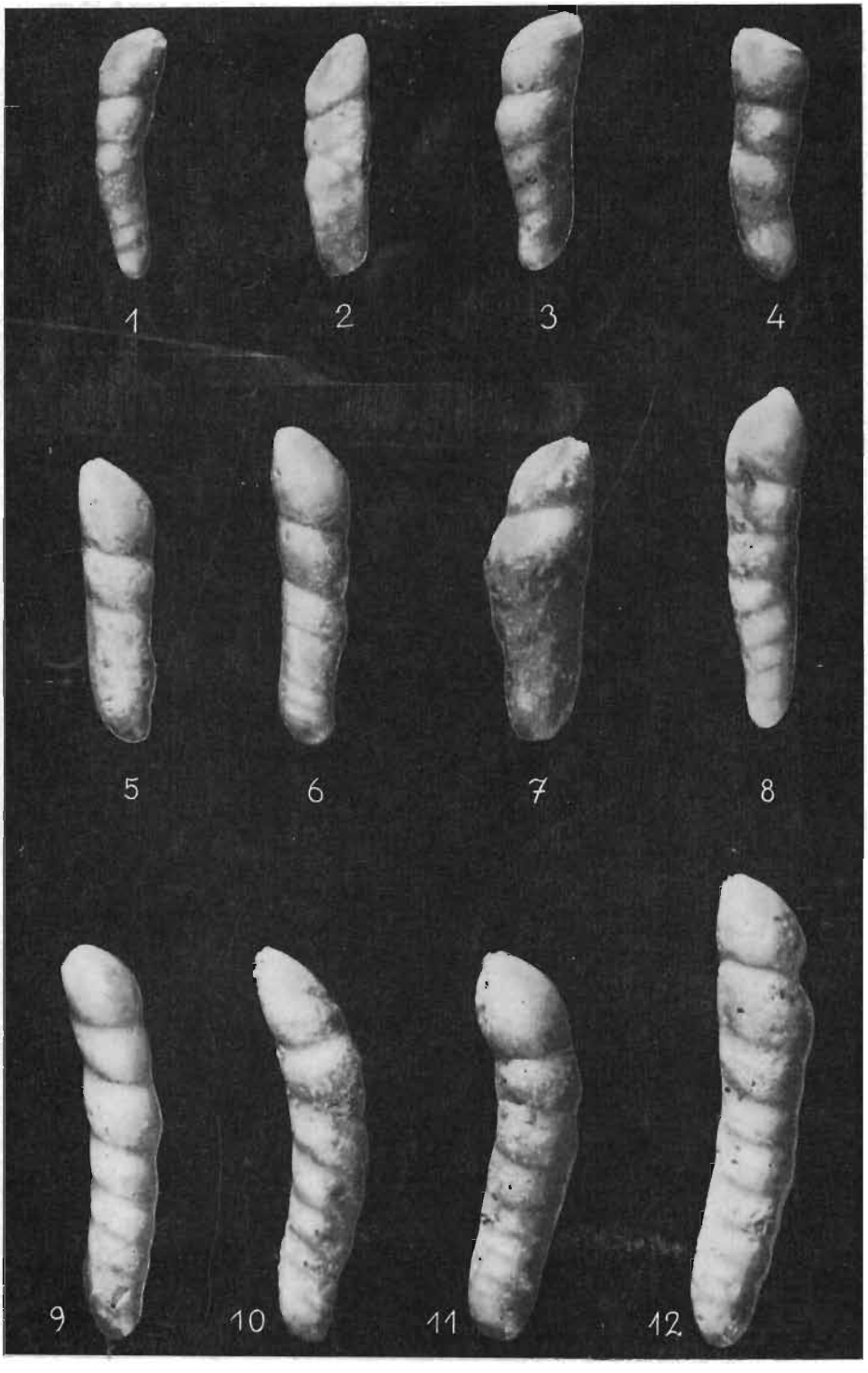

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