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THE MONTIAN WARM-WATER FORAMINIFERS IN THE MERIDIONAL PROVINCE OF EUROPE

Contents

Abstract. — The geographical range of the Montian Meridional Province in non-Alpine Europe and its foraminiferal fauna are discussed as a continuation of the authors' previous studies (Pożaryska & Szczechura, 1968 *a*, *b*; 1970). The foraminiferal fauna from the Upper Montian of the Crimea is taken as an example and compared with that of other parts of Europe. Most of the 33 species distinguished, including 3 new ones, represent stenothermal forms, analogous to those occurring in the Montian stratotype of Belgium (Puits Goffin). The geographical range of the Meridional Province, which stretches from the Pyrenees up to the Crimea in the form of an arc parallel to the northern margin of the Alpes and Carpathians, has been traced more accurately. The directions of the migration of foraminiferal faunas, within the Meridional Province whose cradle should be looked for as early as in the Upper Maastrichtian in the Belgian-Dutch basin, have been determined. These faunas reached France and West Germany in the early Montian, East Germany and Poland in the somewhat later Montian and the Crimea in the uppermost Montian. That was also the region in which the duration of a warm sea with tropical fauna was the shortest.

INTRODUCTION

The present study is an attempt to compare warm-water Montian foraminiferal faunas of the western Europe, Poland and Crimea. It is a continuation of the previous considerations of the authors (Pożaryska & Szczechura, 1968 *a*, *b*, 1970) on the boundary between Meridional and Boreal palaeogeographical Provinces recognized by the authors in the Lower Paleocene of the non-Alpine Europe.

The considerations concerning the area outside Poland are mainly based on the comparative materials and the published data. As regards tropical province, known as Meridional Province, reference has been made mainly to papers by van Bellen (1946), Hofker (1937—1966), Indans (1965) and Kiesel (1970) for the area of Belgium, Holland and Germany, by Marie (1937, 1964 and MS) for the area of France, and by Schutzkaja (1958) and Jartzeva (1966) for the area of Crimea. The data for the area of Poland were based on the works of the authors (Pożaryska & Szczechura, 1968*a*, 1970). In the above papers, the authors distinguished in Poland and Europe two assemblages of Montian foraminifers connected with different climatic conditions, i.e. with Meridional (southern) and Boreal (northern) Provinces.

Apart from samples collected by the authors in Canal d'Albert and other exposures, the Belgian material comprised a series of samples from the Puits Artésien, collected on the area of the Institute of Technology at Mons about 100 years ago, made available through the courtesy of Professor R. Marlière (Polytechnic College, Mons, Belgium). The essential thing was that the authors had at their disposal some of the material recovered by the senior author (K. Pożaryska) from the inside of molluscan shells collected in the original Puits Goffin well, the stratotype of the Montian, and described by Cornet & Briart (1865). Moreover, the authors obtained, through the kindness of Professor J. de Heinzelin, Dr M. Glibert and Dr. L. van de Poel (I. R. Sci. Nat., Brussels, Belgium), comparative materials from Puits Coppée (Belgium), a well dug out nearby the Puits Goffin well, where the Montian deposits were also drilled through. Core material from borehole Bunde (Holland), obtained through the courtesy of Dr. J. Hofker sr. (The Hague, Holland) and Dr. J. H. van Voorthuysen (Geol. Institute, Haarlem, Holland), was also taken into account.

The authors also had at their disposal some samples from the Dano-Montian profile from Crimea, supplied by M. M. Moskvin (University of Moscow, USSR) and E. K. Schutzkaja (VNIGNI, Moscow, USSR). Previously, the warm-water Crimean microfauna of the Montian was described as an exclusively endemic by Schutzkaja (1958). However, recently Jartzeva (1966) (Trust Kievgeologija, Kiev, USSR) published a list of species (without illustrations) from Crimea and stated their connections with Montian assemblage from the western Europe, and more precisely

from Holland (Bunde). Therefore, the authors paid special attention to that Crimean assemblage, considering it significant for accurate delimiting of boundaries between palaeogeographical provinces in the Montian time.

An analysis of all the available materials concerning small Montian foraminifers from various regions of outside-Alpine Europe enabled the authors to make a more precise delineation of the northern margin of warm Meridional Province, and especially a transitional zone between the Paleocene Boreal and Meridional Provinces where the influences of warm- and cold-water assemblages intermingle. In order to draw more detailed conclusions it was necessary to identify the species and varieties of warm-water foraminifers noted by various authors from the whole range of the warm climatic zone in Europe, from the Pyrenees to Crimea. The paper presents the results obtained at a certain stage of the studies on microfaunal provinces of the Paleocene. At this stage, a detailed analysis of the most significant Paleocene assemblage of foraminifers and particularly of its warm-water elements, known from the western Europe, Crimea and Poland, was made and geographical distribution of this assemblage in the Montian of epicontinental Europe was traced. Uniform systematical concepts for foraminifers studied were established on the basis of the comparative materials.

The authors greatfully acknowledge the samples of core material, from outcrops and from the museums as well as the published and unpublished materials made available through the courtesy of Professor R. Marlière from Mons, Professor E. K. Schutzkaja and M. M. Moskvin from Moscow, Dr. P. Marie from Paris, and others.

The photos of foraminifers were made by Mrs. M. Bączyk, the drawings, on the basis of sketch drawings of the authors, were made by Mrs. K. Budzyńska and Mrs. E. Gadomska, all from Palaeozoological Institute of Polish Academy of Sciences in Warszawa.

MATERIAL

The foraminifer-bearing samples from the western Europe, Poland and Crimea, collected by the authors for analyses and comparisons, are highly differentiated both in number of species and in the number of specimens of particular species. These differences may be discerned even between the Montian samples from the same basin, e.g. the Mons Basin or Limbourg Basin. The preservation of specimens is also differing; however, it may be stated that, in general, the majority of specimens are more or less damaged, crushed and rounded and therefore insufficiently preserved for identification. In core samples from borehole at Puits Artésien (Mons), tests of almost all specimens underwent recrystallization.

The foraminiferal assemblage from tropical Montian of Crimea is rich both in species identified and in their representatives. However, almost all specimens are damaged and crushed, and a remarkable number of them is unidentifiable. Therefore, the number of specimens assigned with certainty to particular species is usually small. The Crimean assemblage under discussion was described for the first time by Schutzkaja (1958). Schutzkaja recognized it as endemic, but assigned it to the Montian and stressed its tropical character. Next, Jartzeva (1966) revised identifications of warm-water foraminifers from the Montian of Crimea and identified about 30 species in common with the Montian of the western Europe. On the basis of the present studies of foraminifers, the authors recorded only 5 species which seem to be unknown outside of Crimea. Within the Crimean assemblage studied, 33 species (3 of which are new) belonging to 26 genera of 10 families, have been identified. According to the authors, the majority of individuals, as well as most of the species (about 60 per cent) identified, seem to be stenothermal.

The Crimean forms, in comparison with the representatives of respective species from the western Europe and Poland, are usually significantly larger, their tests are thicker, more strongly ornamented and more coarsely perforated. Moreover, the variation of Crimean forms is higher. Some forms, which are also known from the western Europe, are characterized by a larger number of chambers, e.g. *Discorbis* aff. *marginata*, *Thalmannita* aff. *pomeraniana* and *Pararotalia tuberculifera*. On the other hand, forms cosmopolitan in distribution, i.e. those also known from the Boreal Province, e.g. *Epistominella* cf. *limburgensis*, *Cibicides cuvillieri*, *Protelphidium sublaeve* and *Elphidiella prima*, are rare and dwarfish in comparison with the other, overwhelmingly meridional microfauna.

The microfauna from the stratotype of the Montian, i.e. from the Puits Goffin of the Mons Basin, is taxonomically very close to that of the tropical Montian of Crimea (cf. Table 1). It includes about 50 per cent of the species occurring in Crimea. The forms recorded from Belgium are generally smaller; numerous representatives of the species of the family Miliolidae were found, which are absent in the examined Crimean samples. It should be mentioned that Schutzkaja (1958, after Morozova, 1946) mentions numerous miliolids from Crimea, but they have been recorded in the layer younger than that where the foraminiferal assemblage under discussion was recorded. In both foraminiferal assemblages of tropical Montian from Belgium and Crimea, a lack of planktonic foraminifers is striking.

In the foraminiferal assemblage of the Montian of Poland, only 15 per cent of stenothermal foraminifers (50 per cent of which are known from the tropical Montian of Crimea) were recorded. Contrary to the remaining cosmopolitan microfauna, the warm-water forms are represented by very small number of individuals, poorly developed, weakly

Table 1

Distribution of Foraminifera in the Montian of Europe

Species \ Country	France	Belgium	Holland	Germany	Poland	U.S.S.R.
Clavulina sp.	.	.	?	.	.	+
Valvulina limbata Terq.*	+	+	.	+	.	+
Vacuovalvulina keijzeri (van Bellen)*	+	+	+	+	+	+
Quinqueloculina sp.	?	?	?	.	.	+
Globulina sp.	.	.	.	.	.	+
Guttulina ex gr. *G. problema* d'Orb.*	?	?	?	?	?	+
Guttulina sp.	.	.	.	.	.	+
Sigmomorphina sp.	.	.	.	.	.	+
Discorbis aff. marginata (d'Orb.)*	?	?	?	.	?	+
Epistominella cf. *limburgensis* (Visser)	.	+	.	+	+	+
Rosalina parisiensis d'Orb.*	.	.	.	.	.	+
Rotorbinella mariei (van Bellen)	+	+	+	.	+	+
Epistomaria rimosa (Parker & Jones)*	+	+	+	.	.	+
Rotalia schutzkajae n. sp.	.	.	.	.	.	+
Rotalia saxorum d'Orb.*	+	+	+	+	+	+
Pararotalia tuberculifera (Reuss)*	.	+	+	.	+	+
Storrsella? crimensis n. sp.	.	.	.	.	.	+
Storrsella sp.	.	.	.	.	.	+
Thalmannita aff. *pomeraniana* Poż. & Szcz.*	?	?	?	?	?	+
Elphidiella prima (Ten Dam)*	+	.	+	+	+	+
Elphidiella belbekensis Schutzkaja*	.	.	.	.	.	+
Protelphidium sublaeve (Ten Dam)*	.	.	+	.	+	+
Globorotalia globigeriniformis v. Bellen	.	+	+	+	+	+
Eponides toulmini Brotzen	+	+	+	+	+	+
Cibicides cuvillieri Rouvillois	.	+	+	.	+	+
Cibicides sp.	.	?	?	.	?	+
Anomalina danica (Brotzen)*	+	+	+	+	+	+
Boldia rotundaeformis (Schutzkaja)*	.	.	.	.	.	+
Boldia variabilis n. sp.	.	+	+	.	.	+
Boldia sp.*	.	?	?	.	?	+
Hanzawaia? bundensis (van Bellen)*	.	+	+	+	+	+
Schlosserina asterites (Gümbel)*	.	.	.	.	?	+
Gen. et sp. indet.	.	.	.	.	.	+

* Species are, by the present authors opinion, listed — mostly under another names — by Jartzeva (1966) from the Montian of Crimea.

? Supposed occurrence of a given or related species.

ornamented and attaining small size. Tropical species from the Montian of Poland (borehole Pamiętowo) are illustrated on Plates XIV and XV.

Quantitative predominance of cosmopolitan microfauna over warm-water one is still more obvious in Germany (vicinity of Berlin), where in the Wassmannsdorf Beds the latter are extremely rare (cf. Kiesel, 1970).

The material is housed in the collection of the Institute of Paleozoology, Polish Academy of Sciences, Warsaw (abbreviated as: Z. Pal.).

REMARKS ON PALAEOGEOGRAPHY AND SEDIMENTATION DURING THE MONTIAN TIME IN NON-ALPINE EUROPE

During the Lower Paleocene a shallow epicontinental sea occupied almost the whole non-Alpine Europe. The sea included a number of small basins, almost completely separated from one another and barely connected by narrow straits. In the Lower Paleocene, the character of sedimentation in that sea depended almost entirely on the changes in shore line, which presumably resulted from synorogenic Laramic movements. These movements resulted in the rapid diminution of the Upper Cretaceous basin, which was already of a relic size on the area under discussion. This may explain the sandy-glauconitic or calcareous-zoogenic depositions. The latter were deposited when in the Lower Paleocene sedimentation of the Cretaceous type was continuing. The most uniform in facies is the area of Belgium and, on the other hand, the area of Crimea, where calcareous-zoogenic facies continued during the whole Lower Paleocene. The changes occurring on the Danian-Montian boundary, so distinct in Denmark and Sweden, were not observed either in Belgium or in Crimea.

In Belgium, the Lower Paleocene series consists of Danian deposits, known as "tuffeau de Ciply", and Montian deposits called "Calcaire de Mons", which gradually pass into one another without any clearly marked boundary (Marlière, 1964). The Lower Paleocene deposits from Crimea, well-exposed in the south-western vicinities of Bakchisaray, near Simpheropol, discordantly overlay the Maastrichtian deposits and have been known for very long under the name of Dano-Montian series. This series, consisting of organo-detrital and platy limestones with cherts, may be divided into the Danian and Montian mainly on the basis of microfossils (Morozova, 1959; Maslakova, 1959). Similarly as at Mons (Belgium), Danian and Montian deposits of Crimea are very insignificantly differentiated in lithology, therefore the boundary between the Danian and Montian is a controversial subject for the Soviet palaeontologists.

In the other European countries, e.g. in Denmark and southern Sweden, the white bryozoan limestones of the Danian age are overlayed

discordantly by sediments of the Montian age, beginning with the basal conglomerate and developed in facies of green, sandy-glauconitic deposits. In the non-Carpathian Poland the Lower Paleocene is represented by marly sandy-glauconitic deposits, passing laterally into calcareous gaizes; thickness of the Danian deposits is commonly strongly reduced. The boundary between the Danian and Montian was established exclusively on the basis of foraminiferal fauna in Poland.

In the Lower Paleocene, the northern, central and eastern parts of Europe, i.e. Denmark, Scania, Poland, Lithuania, Byelorussia and Ukraine were occupied by the vast boreal sea, significantly influenced by the North-Atlantic ocean. The sea basin was markedly shallow and predominance of sandy-glauconitic-marly deposits is distinct. Foraminiferal fauna was cold-water in character and overwhelmingly benthonic; contribution of planktonic forms was minimal. Foraminiferal tests are relatively small, poorly ornamented and thin.

At the same time, in the Lower Paleocene, the western, central (south from Scandinavia) and south-eastern parts of Europe, were occupied by shallow, epicontinental, warm meridional sea. This sea was presumably connected both with the Tethys and Atlantic. Zoogenic calcareous-detrital deposits of that sea, called "tuffeau", are known from the Paris Basin (France), Mons Basin (Belgium), Limbourg Basin (eastern Belgium and southern Holland) and from the adjoining parts of Germany (vicinity of Krefeld). The conditions of the warm sea continued here since the uppermost Cretaceous, more precisely since the Upper Maastrichtian. Therefore, Lower Paleocene deposits are a continuation of the sedimentation which begins in the Upper Maastrichtian. Further to the East, deposits of that type were recorded in the vicinity of Berlin, wherefrom Lazar (1965) described stenothermal Montian molluscans, and Kiesel (1970) described a few species of stenothermal foraminifers, and in northern Poland (Pamiętowo). Foraminiferal faunas inhabiting this warm meridional sea are richer in its western parts and are characterized by a large number of stenothermal species with well developed, thick and richly ornamented tests. The number of these species gradually decreases toward the East, becoming very small in the eastern Germany and Poland. Although in the Polish assemblage the same species were recorded as in the western Europe, development of their tests is significantly worse. Foraminiferal microfauna of the lowermost Tertiary of the Meridional Province, similarly as that from the Boreal one, is predominantly benthonic.

Further to the South-East deposits of the meridional sea of the Lower Tertiary were recorded, as far as on the Crimean peninsula, where they were found and described by Schutzkaja (1958). Warm-water character of the Montian deposits of Crimea was later confirmed by Makarenko (1961), who recorded therefrom molluscans similar to those known from

the Montian of Belgium (Cornet & Briart, 1865). Foraminiferal assemblage found by Schutzkaja in the top part of the Dano-Montian series was stenothermal, but considered by this author as completely endemic. It was not until 1966 when Jartzeva having a sample of the sediments from Bunde (Holland) identified Crimean assemblage with that of van Bellen (1946) from the Montian of Holland. The present authors, having both the samples from the bed from the Crimea and from the stratotype of the Montian, wholly confirm the viewpoint of Jartzeva. The Crimean forms essentially represent the same assemblage as that known from Belgium, Holland, Germany and Poland (Pożaryska & Szczechura, 1968*a*), which delimits the eastern extent of Meridional Province. The western extent reached the Pyrenees, from where Mangin (1959—1960) recorded numerous miliolids, rotalids, rotorbinellids and some other stenothermal foraminifers, hitherto unidentified more precisely, except for a typical warm-water form — *Rotalia trochidiformis*.

In the assemblage of foraminifers characterizing the Meridional Province not only warm-water forms occur, but also some other forms commonly recorded from the Lower Paleocene of the Boreal Province; similarly, the tropical elements are sometimes recorded in the southern margins of the Boreal Province. This mixing of faunas confirms the existence of marine connection, which made possible a migration of foraminiferal fauna in both directions from the boundary between these provinces (Fig. 1). An analysis of the sections of the Lower Tertiary deposits from Paris, Mons and Limbourg Basins and from the areas of Krefeld, Berlin, Pamiętowo and Crimea reveals directions and extent of migrations of warm-water forms. Quantitatively the contribution of boreal forms to the meridional assemblage is higher than that of meridional forms to the boreal assemblage. Stenothermal warm-water microfauna entered only the boundary zone between both provinces and has not passed onto the area located further to the North, i.e. to Denmark, Sweden, Lithuania and even Donetz Basin. On the other hand, migration of boreal components was more active and entered as far as the Carpathians on the South.

The expansion of the fauna of warm meridional sea grew with time, reaching Poland by the Upper Montian and Crimea in the uppermost Montian, where the tropical Montian sea lasted very shortly. Sediments of the Montian s.s. from Crimea form lens intercalating compact calcareous sediments. The warm-water microfauna appeared remarkably earlier in the western peripheries of Europe, where adequate climatic conditions existed since the uppermost Cretaceous (Hofker, 1966), whereas in the south-eastern parts of the Basin in Crimea, it appeared in the top part of the series called Dano-Montian (Schutzkaja, 1958) by the end of the Lower Paleocene. Therefore displacement of these faunas proceeded un-

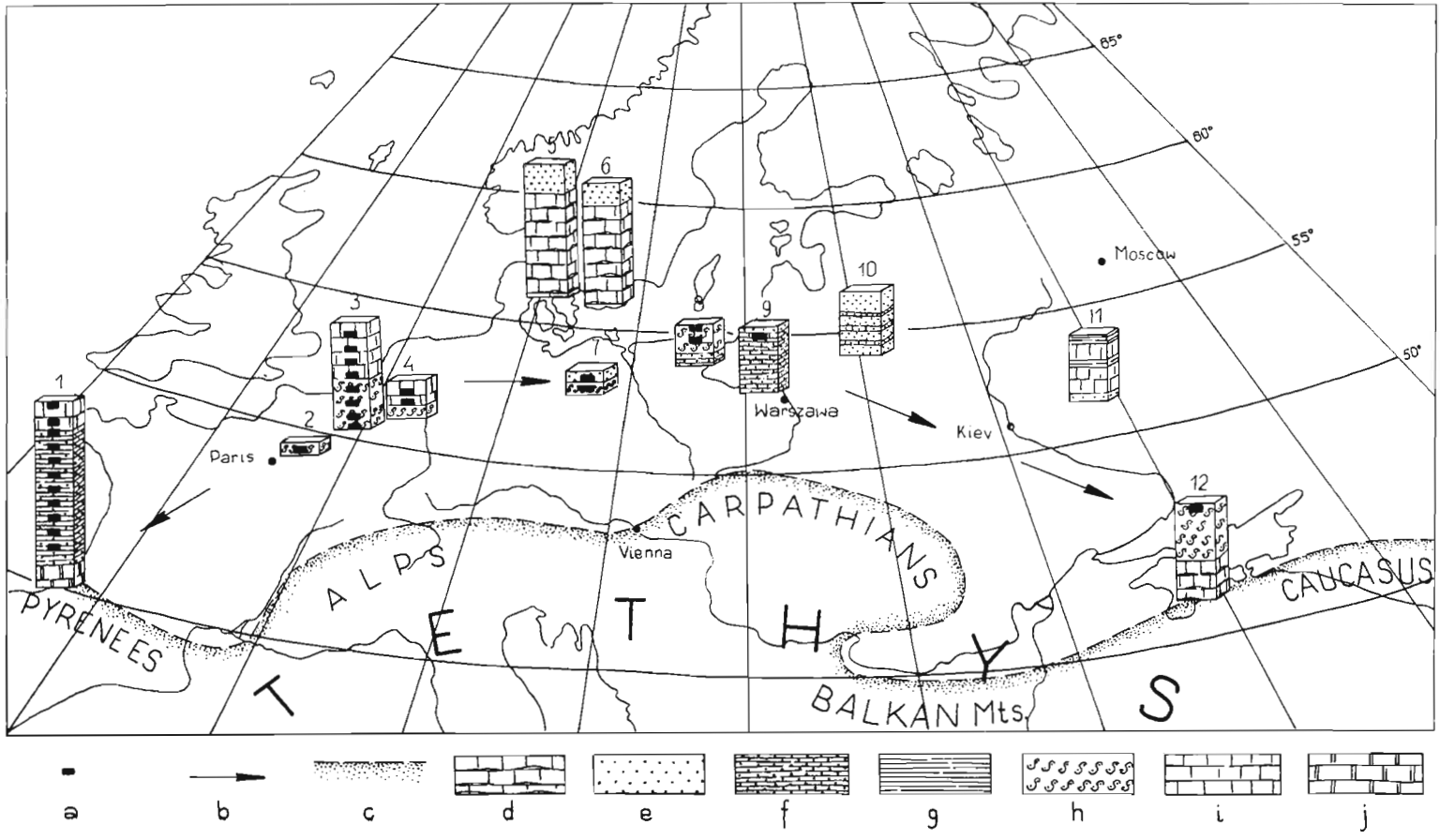
doubtedly from the West to East and the warm-water assemblage presumably originated in the western Europe. It seems that the optimal conditions for the warm-water fauna existed during the Montian in Crimean Basin, where the development of this fauna is the most complete both in the specific differentiation and in the development of tests.

The ecological conditions and facies distribution in Europe were highly differentiated during the Lower Paleocene. Characteristics of the area of the former Tethyan ocean exceeds the scope of this paper. In the North of the Tethys, in shallow shelf seas, facies differentiation of sediments was closely connected with the Tethys, more precisely with its shore line and the distance from it.

The distribution of biofacies and corresponding microfaunal assemblages confirm the existence of two geographic provinces in the Montian of epicontinental Europe, i.e. cold, northern, Boreal and warm, southern, Meridional Provinces (cf. Pożaryska & Szczechura, 1968 *a*,*b*).

When palaeogeography and stratigraphy of the Lower Paleocene are compared, a problem of interrelations between these two provinces or biofacies in the Paleocene section arises. They are characterized by a high variability, resulting in a difficulty to delineate their boundaries. The meridional biofacies appeared earlier, already in the Upper Maastrichtian of Belgium. Warm-water elements of both small and large foraminifers predominate. This biofacies continues through the Upper Maastrichtian and Danian, being replaced in the uppermost Montian by fresh-water sedimentation. In the South, in France and in the North in Holland, the facies of organo-detrital limestones called "tuffeau" were predominating in the Dano-Montian. Further to the East this facies is known only in the Montian, whereas in Poland it did not appear until the Upper Montian. This facies is accompanied by an assemblage of warm-water foraminifers (Pożaryska & Szczechura, 1968*a*), commonly with other faunal assemblages, e. g. ostracodes in Poland (Szczechura, 1965), molluscans in Germany (Lazar, 1965) and Crimea (Makarenko, 1961). The assemblage of warm-water or even tropical foraminifers reached at the latest stage the Crimea, close to the end of deposition of calcareous series. This series was previously assigned by Schutzkaja (1958) to the Dano-Montian and its upper part in fact belongs undoubtedly to the Montian (Jartzeva, 1966).

Spatial pattern of these biofacies connected with different geographical provinces is latitudinal. The facies of organo-detrital limestones (tuffeau) extends along the belt parallel to the margins of the Alps and Carpathians (Fig. 1). The next facies of sandy-marly deposits with an admixture of glauconite, more terrigenous facies (Pożaryska & Szczechura, 1968b) continues along the former, further to the North. Both of them represent sedimentation in the shallow shelf sea. Although sediments of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PYRENEES
ALPS
CARPATHIANS
CAUCASUS
BALKAN Mts.
T E T H Y S
a
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these facies differ in mineral composition and other features, the boundary between the facies is difficult to delineate, because it is somewhat gradational and changed with time. In some places these facies interfinge or passes gradually laterally into one another (e.g. in the section at Pamiętowo, cf. Pożaryska & Szczechura, 1968a). Boreal sediments with two or more intercalations containing warm-water microfauna are known from numerous sections of the Lower Paleocene, e.g. in borehole Pamiętowo boreal sediments are twice intercalating deposits containing meridional fauna at the depth 273 m and 207 m. So far, only one such intercalation has been reported from the Crimea, differing so much in microfaunal composition from adjoining sediments, that it has been interpreted as a lens (Schutzkaja, 1958). In Germany, the part of Lower Tertiary deposits richer in warm-water elements was distinguished as the so-called "Wassmansdorfer Schichten" (Kiesel, 1970); the opposite phenomenon was observed in Belgium and Holland, where cosmopolitan cold-water elements occur with assemblage of microfauna of overwhelming tropical affinities.

Recently Bykova and Jartzeva (MS) reported the occurrence of some warm-water foraminifer species typical for the Montian of western Europe, Poland and Crimea, in foraminifer assemblage of the Paleocene of Ukraine (Luzanowka). Warm-water elements form a small admixture in this boreal assemblage.

Thus it may be stated that these two European provinces of the Montian, Meridional and Boreal Provinces, were not completely separated from one another, but connected by presumably numerous marine connections. Migration of faunas and exchange of warm and cold waters continued probably through these connections. In both provinces shallow-water deposits predominate. In Meridional Province, zoogenic, organo-detrital and near-reef deposits are the most typical, whereas sandy-marly deposits with glauconite dominate in the Boreal Province. Generally faunas were shifting with time from the West (presumably from the basin of Belgium) towards the East.

Sketch sections of Lower Paleocene deposits and inferred extend of the Meridional Province in the Alpine Europe

a warm-water foraminifers recorded, delimiting the northern range of Meridional Province, *b* supposed directions of migration of warm-water foraminifers, *c* northern margin of Alpides, *d* bryozoan limestone, *e* glaukonite sand, *f* marly sand and galze, *g* marls, *h* organo-detritic, limestone, so-called "tuffeau", *i* compact limestone, *j* dolomite;

1 — SW Pyrenees (Mangin, 1959–60), 2 — Paris Basin (Marie, 1964), 3 — Mons Basin (Marlière, 1964), 4 — Limbourg Region (Hofker, 1966), 5 — Zealand Island, Stevns Klint and Fakse (Rosenkrantz, 1960), 6 — Scania (Klagshamn) (Brotzen, 1948), 7 — Berlin region (Kiesel, 1970), 8 — North Poland (Pamiętowo) (Pożaryska Szczechura, 1968), 9 — Central Poland (Sochaczew) (Pożaryska, 1965), 10 — Lithuania (Grigelis, 1960), 12 — Dnieper-Donetz Basin (Vassilenko, 1950), 12 — Crimea (Schutzkaja, 1958, Jartzeva, 1966).

SYSTEMATIC DESCRIPTIONS

Family **Ataxophragmiidae** Schwager, 1877
Genus *Clavulina* d'Orbigny, 1826
Clavulina sp.
(Pl. II Fig. 5)

Material. — One specimen with presumably recrystallized test and apertural end partly damaged.

Dimensions (in mm):

	F. XIII/1
Length	1,18
Maximal width	0,44

Remarks. — Crimean specimen resembles the form from the Montian of Holland, assigned to *Clavulina corrugata* Deshayes, 1830, by van Bellen (1946). The above species is only known from description and has not been figured by Deshayes that is why it is difficult to establish whether the specimens recorded by van Bellen and by the present authors really represent the species *C. corrugata* Deshayes.

Occurrence. — Paleocene (Montian) of Crimea.

Genus *Valvulina* d'Orbigny, 1826
Valvulina limbata Terquem, 1882
(Pl. II, Fig. 6)

1882. *Valvulina limbata* Terquem; O. Terquem, Les Foraminifères de l'Eocène..., p. 102, Pl. 11, Fig. 7.
1946. *Valvulina triangularis* d'Orbigny; R. C. van Bellen, Foraminifera from the Middle Eocene..., p. 28, Pl. 1, Figs. 20—22.
1958. *Verneuilina tavrica* Schutzkaja; E. K. Schutzkaja, Foraminifery verchnich sloev..., p. 198, Pl. 1, Fig. 1.
?1963. *Valvulina limbata* Terquem; J. E. van Hinte, Stratigraphie und Micropaleontologie..., p. 109, Pl. 15, Fig. 1.
1964. *Pyramidovalvulina limbata* (Terquem); P. Marie, Les Faciès du Montien..., Pl. 1, Fig. 1.
1966. *Valvulammina limbata* (Terquem); J. Hofker, Maestrichtian, Danian..., p. 239, Pl. 49, Fig. 57; p. 251, Pl. 50, Figs. 8—10.

Material. — Four poorly-preserved specimens.

Dimensions (in mm):

	F. XIII/2	F. XIII/3
Length	1.08	1.08
Maximal width	0.78	1.69

Remarks. — Specimens from the Montian of Crimea are conspecific with those from the Paleocene and Eocene of the western Europe, ident-

ified as *Valvulina limbata*. A specimen from the Lower Eocene of Austria, included in this species by van Hinte (1963), seems to be too globular in its upper part, being at the same time somewhat twisted in comparison with true representatives of *V. limbata* and hence it is only tentatively synonymized.

Occurrence. — Paleocene (Montian) of Crimea, France (Paris Basin), Belgium (Limbourg province), western Germany; Eocene of France and Austria (?).

Genus *Vacuovalvulina* Hofker, 1966

Vacuovalvulina keijzeri (van Bellen, 1946)

(Pl. XIII, Figs. 4, 5)

1946. *Marssonella keijzeri* van Bellen; R. C. van Bellen, Foraminifera from the Middle Eocene..., p. 30, Pl. 2, Figs. 3—5.

1958. *Patellinella capidulaeformis* Schutzkaja; E. K. Schutzkaja, Foraminifery verchnich sloev..., p. 200, Pl. 2, Figs. 1—3; Pl. 6, Figs. 1—3.

1964. *Conicovalvulina keijzeri* (van Bellen); P. Marie, Les Faciès du Montien..., p. 1, Fig. 3.

1966. *Vacuovalvulina keijzeri* (van Bellen); J. Hofker, Maestrichtian Danian..., p. 250, Pl. 49, Figs. 1—7.

1968. *Vacuovalvulina keijzeri* (van Bellen); K. Pożaryska & J. Szczechura, Foraminifera from the Paleocene..., p. 36, Pl. 3, Figs. 9—12.

Material. — Sixteen poorly preserved specimens.

Dimensions (in mm):

	F. XIII/4	F. XIII/5	F. XIII/6
Length	0.54	0.39	0.54
Maximal width	0.58	0.52	0.59

Variation. — Variation concerning mainly the size and shape of tests; the latter feature changes from low-conical to elongated, cup-shaped and widened upward. Apertural flaps from the umbilical side also undergo some changes.

Remarks. — Specimens from the Montian of Crimea, included in *Vacuovalvulina keijzeri*, do not differ from those known from the Montian of Poland and western Europe. Crimean forms are significantly larger, especially than those from Poland.

Occurrence. — Paleocene (Montian) of Crimea, Poland, France (Paris Basin), Belgium (Mons Basin), Holland (Limbourg province), North-West Germany. *Vacuovalvulina keijzeri* is typical of the Montian of the Meridional Province of Europe.

Family **Miliolidae** Ehrenberg, 1839
Genus *Quinqueloculina* d'Orbigny, 1826
Quinqueloculina sp.
(Pl. I, Fig. 1)

Material. — Five poorly-preserved specimens.
Dimensions (in mm):

	F. XIII/7	F. XIII/8
Length	0.39	0.39
Width	0.27	0.34

Remarks. — According to the present authors, all the specimens included in this species are non-typically developed, i.e. dwarfish, as compared with other individuals from the foraminiferal assemblage from the Montian of Crimea, and also with the average size of representatives of the genus *Quinqueloculina* d'Orbigny. For the above reason and because of the poor preservation of the specimens, a comparison with the species hitherto known seems to be impossible.

Occurrence. — Paleocene (Montian) of Crimea.

Family **Polymorphinidae** d'Orbigny, 1839
Genus *Globulina* d'Orbigny, 1839, in de la Sagra
Globulina sp.
(Pl. II, Figs. 3, 4)

Material. — Four well-preserved specimens.
Dimensions (in mm):

	F. XIII/9	F. XIII/10
Length	0.54	0.54
Maximal width	0.39	0.44

Remarks. — Specimens from the Montian of Crimea are similar to those from the Montian of Poland identified as *Globulina* sp. (Pożaryska & Szczechura, 1968*a*), being however higher and less prominently ribbed. Similar forms, only one of which was schematically drawn, have been recorded from the Montian of Belgium by Marie (MS).

Occurrence. — Paleocene (Montian) of Crimea.

Genus *Guttulina* d'Orbigny, 1839, in de la Sagra
Guttulina ex gr. *G. problema* d'Orbigny, 1826
(Pl. I, Fig. 4)

Material. — Four well-preserved specimens.
Dimensions (in mm):

	F. XIII/75
Height	0.69
Width	0.54

Remarks. — Specimens identified as *Guttulina* ex gr. *G. problema* d'Orbigny, 1826, from the Montian of Crimea, seem to represent forms included to the species *Guttulina problema*, widely known from the Tertiary of Europe and from other continents.

Occurrence. — Paleocene (Montian) of Crimea.

Guttulina sp.
(Pl. I, Figs. 2, 3)

Material. — Three well-preserved specimens.
Dimensions (in mm):

	F. XIII/11	F. XIII/12
Height	0.89	0.78
Width	0.69	0.59

Remarks. — Specimens included into *Globulina* sp., from the Montian of Crimea, are somewhat similar to *Guttulina hantkeni* Cushman & Ozawa (1930), the species known from the Lower Tertiary of Europe and some other places; however, they differ from the latter in their less elongated chambers and less elongated apertural part of the test.

Occurrence. — Paleocene (Montian) of Crimea.

Genus *Sigmomorphina* Cushman & Ozawa, 1928
Sigmomorphina sp.
(Pl. 1, Fig. 5)

Material. — Two poorly-preserved specimens:
Dimensions (in mm):

	F. XIII/13
Height . . .	1.08
Width . . .	0.50

Remarks. — Specimens included here are similar to the specimen from the Paleocene of Surinam (Guiana) identified as *Pyrulina* sp. by Voorthuysen (1969), differing in the development of initial parts. Arrangement of chambers and general appearance of tests suggest that all of them belong to the genus *Sigmomorphina* Cushman & Ozawa, 1928.

Occurrence. — Paleocene (Montian) of Crimea.

Family **Discorbidae** Ehrenberg, 1838
Genus *Discorbis* Lamarck, 1804
Discorbis aff. *marginata* (d'Orbigny, 1826)
(Pl. III, Figs. 1—3)

1958. Discorbis conusaeformis Schutzkaja; E. K. Schutzkaja, Foraminifery verchnich sloev..., p. 201, Pl. 2, Fig. 4.

Material. — Twelve poorly-preserved specimens.

Dimensions (in mm):

	F. XIII/14	F. XIII/15	F. XIII/16
Longest diameter	0.61	0.69	0.96
Shortest diameter	0.52	0.61	0.88
Height	0.27	0.42	0.44

Variation. — Specimens included here in *Discorbis* aff. *marginata* are characterized by conspicuous variation, mainly concerning their size, number of chambers and development of umbilical region (cf. Pl. III, Figs. 1*c*, 2*c*, 3*c*); the last feature undergoes similar changes as those in *Rotalia* (recte *Discorbis*) *marginata* recorded from the Montian of Poland (Pożaryska & Szczechura, 1968*a*). The number of chambers is about 10 in small forms, increasing to 14 in the largest ones. Development of sutural slits on umbilical side is also variable; they are not always open and only occasionally, mainly between the youngest chambers, they are obliquely diverging.

Remarks. — Systematic position of this species is based on its distinct similarity to the species from the Montian of the western Europe and Poland (see Pl. XV, Fig. 5), identified by Pożaryska and Szczechura (1968*a*) as *Rotalia* (recte *Discorbis*) *marginata*. Differences between comparative specimens from the Montian of Crimea and western Europe essentially concern the number of chambers (commonly 7—9 chambers in West European specimens and about 14 in large individuals from Crimea). *Rotalia* (recte *Discorbis*) *marginata* was described by d'Orbigny from the Eocene of France. Illustrations and a description of this species by d'Orbigny are insufficient, that is why the present authors based their identification on the designation by van Bellen (1946). According to the authors, the systematic position of *D. marginata* should be revised on the basis of an analysis of d'Orbigny's collection and an other comparative material, particularly from the Tertiary of France, as it may be assumed that *Discorbis marginata* is conspecific or related to *D. pseudodiscoides* van Bellen, 1946, *D. discoides* (d'Orbigny, 1826), *D. propinqua* (Terquem, 1882) and *D. turbo* (d'Orbigny, 1826), all of them known from the Tertiary of western Europe. Differences among those species seem to lie in slightly different development of umbilical side of their representatives. As regards large variability of tests within these species, it seems obvious that the number of species representing genus *Discorbis* may be reduced at least for the Lower Tertiary of Europe.

Occurrence. — Paleocene (Montian) of Crimea.

Genus *Epistominella* Husezima & Maruhasi, 1944
Epistominella cf. *limburgensis* Visser, 1951)
(Pl. I, Fig. 6)

?1951. *Pseudoparrella limburgensis* Visser; A. M. Visser, Monograph on the Foraminifera..., p. 278, Pl. 7, Fig. 10.
1968. *Epistominella* cf. *limburgensis* (Visser); K. Pożaryska & J. Szczechura, Foraminifera from the Paleocene..., p. 50, Text-fig. 11 (*here additional synonymy included).*

Material. — Three well-preserved specimens.
Dimensions (in mm):

	F. XIII/17	F. XIII/18
Longest diameter . . .	0.52	0.47
Shortest diameter . . .	0.44	0.44
Height	0.25	0.25

For remarks — see Pożaryska & Szczechura (1968*a*). Within the foraminiferal assemblage of Crimea, *Epistominella* cf. *limburgensis* is represented by remarkably smaller and rarer specimens than other species.

Occurrence. — Paleocene of Europe (U.S.S.R., Poland, Denmark, Belgium, France, England). The species *Epistominella limburgensis* is markedly cosmopolitan occurring in different deposits from Danian to Thanetian. According to Visser (1951), it appears already in the Maastrichtian of Limbourg.

Genus *Rosalina* d'Orbigny, 1826
Rosalina parisiensis d'Orbigny, 1826
(Pl. IV, Figs. 3—4)

1826. *Rosalina parisiensis* d'Orbigny; A. d'Orbigny, Tableau méthodique..., vol. 7, p. 271, no. 5, modèle 35, planches inédites, Pl. 3, Figs. 1, 2.
1958. *Cibicides* (*Planulina*) *perdecorus Schutzkaja*; E. K. Schutzkaja, Foraminifery verchnich sloev..., p. 209, Pl. 5, Fig. 3; Pl. 7, Figs. 5 ,6.
1961. *Discorbis parisiensis* (d'Orbigny); J. P. H. Kaasschieter, Foraminifera of the Eocene..., p. 208, Pl. 2, Figs. 9, 10.
1970. *Rosalina parisiensis* d'Orbigny; Y. Le Calvez, Contribution à l'étude..., p. 143, Pl. 29, Figs. 1, 2.

Material. — Twenty two specimens, partly damaged.
Dimensions (in mm):

	F. XIII/19	F. XIII/20
Longest diameter . . .	0.71	0.83
Shortest diameter . . .	0.54	0.64
Height	0.20	0.25

Variation. — Variation significant, concerning the size, shape and ornamentation of tests. Ornamentation, consisting of pillar-like tubercles

occurring mostly on the ventral sides, differs in its development from one individual to another; unornamented parts of test are coarsely perforated. Differences in shape are expressed by different degree of convexity of chambers on the dorsal side resulting in moderate variation of height of specimens and in concavity or elevation of sutures, which are, however, always thickned.

Remarks. — Specimens from the Montian of Crimea are very similar to the representatives of this species described by Le Calvez (1970) from the Eocene of France; they are conspecific with Crimean specimens included by Schutzkaja (1958) in *Cibicides* (*Planulina*) *perdecorus*. The latter specimens differ from these from the Eocene of Belgium, identified by Kaasschieter (1961) as *Discorbis parisiensis* (d'Orbigny, 1826) in thicker walls and coarser perforation.

It seems that *Rotorbinella montiana*, described by Pożaryska & Szczechura (1968*a*) from the Montian of Poland (see Pl. XV, Fig. 1) and recorded from the western Europe from deposits similar in age, where it was unjustly identified as *Discorbis corrugata* (Cushman & Bermudez, 1937), is related to *Rosalina parisiensis*, differing only in the development of the dorsal side. In *Rosalina parisiensis* the dorsal side is uniformly perforated and inflated whereas in *Rotorbinella montiana* the perforation is limited to the top of the last chambers, and inflation of the dorsal side is not uniform, generally increasing on the successive chambers and limited to their central part.

Occurrence. — Paleocene (Montian) of Crimea and Eocene of France (Paris Basin) and Belgium.

Genus *Rotorbinella* Bandy, 1944
Rotorbinella mariei (van Bellen, 1946)
(Pl. VIII, Fig. 5)

1946. *Parrella mariei* van Bellen; R. C. van Bellen. Foraminifera from the Middle Eocene..., p. 70, Pl. 10, Figs. 1—6.

1968. *Rotorbinella mariei* van Bellen; K. Pożaryska & J. Szczechura, Foraminifera from the Paleocene..., p. 54, Pl. 4, Figs. 1—3; Pl. 27, Figs. 1—4 (*here additional synonymy included*).

Material. — Five poorly-preserved specimens.

Dimensions (in mm):

	F. XIII/21	F. XIII/22
Longest diameter . . .	0.47	0.36
Shortest diameter . . .	0.39	0.34
Height	0.25	0.25

Variation. — Variation of specimens included in the species *Rotorbinella mariei* is insignificant and falls within the limits of its variability

defined by Pożaryska and Szczechura (1968*a*; see also present paper, Pl. XIV, Fig. 5). Crimean forms are the most similar to those from the borehole Bunde (Holland) illustrated by the authors (cf. Pożaryska & Szczechura, 1968*a*, Pl. 17, Figs. 3, 4).

Remarks. — Specimens included in *Rotorbinella mariei* are very rare and very small in comparison to the specimens of the other species of foraminiferal assemblage from the Montian of Crimea. Remarks concerning similarities and affinities with other species are presented in the paper by Pożaryska and Szczechura (1968*a*).

Occurrence. — Paleocene (Montian) of Crimea, Poland, France, Holland, and Belgium. The occurrence of *Rotorbinella mariei* is limited only to the tropical Montian, therefore this species appears to be a guide-microfossil for the Paleocene of Meridional Province.

Family **Epistomariidae** Hofker, 1954
Genus *Epistomaria* Galloway, 1933
Epistomaria rimosa (Parker & Jones, 1865)
(Pl. II, Figs. 1, 2)

1865. *Discorbina rimosa* Parker & Jones; W. K. Parker & T. R. Jones, On some Foraminifera..., p. 385, Pl. 19, Fig. 6.
1946. *Ceratobulimina bundensis* van Bellen; R. C. van Bellen, Foraminifera from the Middle Eocene..., p. 68, Pl. 9, Figs. 13—18.
1958. *Epistomina tavrica* Schutzkaja; E. K. Schutzkaja, Foraminifery verchnich sloew..., p. 206 Pl. 4, Figs. 1, 2.
1959. *Epistomaria rimosa* (Parker & Jones); D. M. Rauzer-Chernousova & A. V. Fursenko, Osnovy Paleontologii.., p. 277, Text-figs. 514—516.
1962. *Epistomaria bundensis* (van Bellen); J. Hofker, Correlation of the Tuff Chalk..., p. 1083, Text-fig. 27A.
1963. *Epistomaria rimosa* (Parker & Jones); O. K. Kaptarenko-Chernousova, Atlas charakternych foraminifer..., p. 141, Pl. 32, Fig. 6.
1964. *Epistomaria rimosa* (Parker & Jones); A. Loeblich Jr. & H. Tappan, Treatise..., p. 6, 592, Fig. 472 (1—3).
1966. *Epistomaria bundensis* (van Bellen); J. Hofker, Maestrichtian, Danian..., p. 261, Pl. 53, Figs. 74—76; Pl. 54, Figs. 74, 79.
1970. *Epistomaria rimosa* (Parker & Jones); Y. Le Calvez, Contribution à l'étude..., p. 153, Pl. 32, Figs. 1—3 (*here the additional synonymy included*).

Material. — Five poorly-preserved specimens.
Dimensions (in mm):

	F. XIII/23	F. XIII/24
Longest diameter . . .	0.93	0.59
Shortest diameter . . .	0.64	0.39
Height	0.49	0.37

Variation. — Variation small, concerning mainly the size of test.

Remarks. — Crimean specimens of *Epistomaria rimosa* (Parker & Jones, 1965), (described by Schutzkaja (1958) as *Epistomina tavrica*), are identic-

al to those found in tropical Montian of Holland and Belgium (including those from the stratotype of the Montian from Puits Goffin). It can be seen from the illustration of *E. rimosa* (see Le Calvez, 1970), from French Eocene, that the Crimean forms are also similar to those occurring in the Eocene of Paris Basin. Unfortunately, Le Calvez does not give the side view of her specimens of *Epistomaria rimosa*.

According to the authors, *E. rimosa* is conspecific with *Ceratobulimina* (recte *Epistomaria*) *bundensis*, a species described by van Bellen (1946) from the Eocene (recte Montian) of Holland. From the illustration of the lectotype of *E. rimosa* (see Loeblich & Tappan, 1964) it can be seen that the latter is a more flattened form than is *E. bundensis* (van Bellen); this might prove that those forms are not censpecific. However, from the illustrations of the representatives of *E. rimosa* (Parker & Jones) occurring in the Lutetian of France and Ukraine it comes out that this species has a high variability. This concerns both the test height and — to a minor degree — the remaining features. Thus the forms from the eastern and those from the western Europe may be recognized as conspecific.

Occurrence. — Paleocene (Montian) of Crimea, Belgium and Holland (Mons Basin and Limbourg region), France; Eocene of U.S.S.R. (Ukraine) and France.

This species is characteristic for the Montian of the Meridional Province.

Family **Rotaliidae** Ehrenberg, 1839

Genus *Rotalia* Lamarck, 1804

Rotalia schutzkajae n.sp.

(Pl. V, Figs. 1—4)

Holotypus: Specimen figured on Pl. V, Fig. 2 (F. XIII/25.

Paratypus: Specimen figured on Pl. V, Fig. 1 (F. XIII/26.

Stratum typicum: Paleocene (Montian), uppermost layer of Dano-Montian Beds.

Locus typicus: South-west Crimea, left bank of the Katscha river, Bakchisaray region, vicinity of Simpheropol.

Derivatio nominis: Named in honour of Professor E. K. Schutzkaja, an outstand ing Soviet micropalaeontologist.

Diagnosis. — Test biconvex, with entire to slightly lobulate peripheral outline and somewhat acute peripheral margin. Last whorl contains 8—9 chambers, on ventral side separated by raised sutures. Around opened or filled umbilicus there are sickled sutural slits and tena. More or less granular ornamentation borders umbilical depression.

Material. — Thirty-two poorly-preserved specimens.

Dimensions (in mm):

	F. XIII/25	F. XIII/26	F. XIII/27
Longest diameter . . .	0.56	0.67	0.52
Shortest diameter . . .	0.49	0.59	0.47
Height	0.25	0.32	0.25

Description. — Test trochospiral, biconvex; peripheral outline entire to slightly lobulate; peripheral margin somewhat acute, particularly along older chambers. Chambers coiled in more than two whorls of which only the outer one is visible on ventral side; 8—9 chambers in the last whorl. Arrangement of chambers indistinct on spiral side or weakly marked by more or less raised sutures; on ventral side, chambers are separated by radial to somewhat sickled sutural slits and are inflated to various degree; tena, more or less projected, occur around umbilical opening, occasionally forming irregular to regular granular ornamentation bordering umbilical depression. Umbilicus open or filled with a plug. Primary aperture an interiomarginal slit at the base of the last chamber reaching the umbilicus. Secondary slit-like sutural opening may occur. Both sides of the test scarsely perforated.

Variation. — Marked variation among specimens included in *Rotalia schutzkajae* n.sp. concerns differences in overall shape, degree of perforation and development of umbilical part of tests. In an extreme case (cf. Pl. V, Figs. 3, 4), tests are plano-convex, almost smooth, i.e. non-perforated, with very wide and deep sutural slits on the umbilical side; contrary to typical representatives of the species plano-convex tests have weakly convex chambers on the ventral side and umbilicus marked more distinctly. It is possible that they should be included in a different species.

Remarks. — There is some similarity between the specimens included in *R. schutzkajae* n.sp. and *R. saxorum* (d'Orbigny). The differences mainly concern morphology of ventral part — *R. saxorum* is characterized by always flat ventral side, non-perforated admarginal part of test and umbilicus almost always filled with plug, whereas the typical *R. schutzkajae* is characterized by convexity of chambers on the ventral side, the whole surface distinctly perforated and umbilicus occasionally open.

Occurrence. — Paleocene (Montian) of Crimea.

Rotalia saxorum d'Orbigny, 1850
(Pl. IV, Figs. 1, 2)

1850. *Rotalia saxorum* d'Orbigny; A. d'Orbigny, Prodrome de Paléontologie..., p. 407, Fig. 5 (*fide* Ellis & Messina, Catalogue of Foraminifera).

1968. *Rotalia saxorum* d'Orbigny; K. Pożaryska & J. Szczechura, Foraminifera from the Paleocene..., p. 61, Pl. 5, Figs. 1, 3, 4; Pl. 18, Figs. 5—9 (*here additional synonymy included*).

1970. *Rotalia germanica* Kiesel; Y. von Kiesel, Die Foraminiferenfauna..., p. 333, Pl. 23, Fig. 4.

1970. *Discorbis perovalis* Terquem 1882; Y. Le Calvez, Contribution à l'étude..., p. 136, Text-fig. 45.

Material. — A few tens of specimens, some well-preserved.

Dimensions (in mm):

	F. XIII/29	F. XIII/30
Longest diameter . . .	0.76	0.59
Shortest diameter . . .	0.67	0.49
Height	0.34	0.26

Variation. — Variation in *Rotalia saxorum* concerns mainly the size, ornamentation and general shape of the test. Peripheral outline lobulate to rounded. Porous area may extend outside the ventral part reaching test margin or it is limited to the central part. Moreover tena may be weakly projected or strongly developed, that is also observable in the material from borehole Bunde, Holland (cf. Pożaryska & Szczechura, 1968*a*, Pl. 18, Figs. 5—9; see also present paper, Pl. XV, Fig. 5). In extreme cases, tena are not developed, thus the specimens become similar to *Rotalia perovalis* (Terquem, 1889) figured by Le Calvez (1970, p. 136, Fig. 45) and Hofker (1966, Pl. 55, Fig. 77).

Remarks. — Besides the remarks given previously by the present authors (1968), it should be noted that specimens from the Montian of the western Europe, Lower Paleocene of Germany ("Wassmannsdorfer Schichten"; Kiesel, 1970) and Montian of Poland and Crimea, are undoubtedly conspecific. For the Montian forms from the western Europe and Poland, Kiesel (1970) established a new species — *Rotalia germanica*, for distinction from *R. saxorum* from the Lower Eocene of France. However, according to the present authors, thus it is hard to decide definitely whether this distinction is justified or not. The present identification by the authors is based on the determination of van Bellen (1946), and Hofker (1959*a*—1966). It seems that in view of large individual variability within the assemblage included by the authors in *R. saxorum*, the differences between that species and *R. germanica* pointed out by Kiesel (1970) are not sufficiently important.

Rotalia saxorum d'Orbigny, 1850 is identified by the various authors independently from *R. perovalis* (Terquem, 1882). The former was recorded from the Lower Eocene of Aquitain Basin, the latter from the Lower Eocene of Paris Basin. According to the authors, the specimens of both species fall within the limits of variability of one species thus should be considered as conspecific, and the prioritic specific name of *R. saxorum* d'Orbigny should be used. Differences in size and occurrence or lack of pores on the ventral side, which differ these species, according to Hofker (1959*a*, p. 287; 1966, p. 263, Pl. 55, Fig. 97) are not sufficiently important for maintaining these two specific names. Comparison of the

original specimens of d'Orbigny and Terquem should univocally solve this problem.

Occurrence. — Paleocene (Montian) of Crimea, Poland, Belgium, Holland (Mons Basin and Limbourg region), Germany and France (Paris Basin); Eocene of France (Paris and Aquitain Basin). According to Hofker (1966), *R. saxorum* appears already in the Upper Maastrichtian of Belgium and France.

R. saxorum is very characteristic of the Paleocene of Meridional Province.

Genus *Pararotalia* Le Calvez, 1949

Pararotalia tuberculifera (Reuss, 1862)

(Pl. VI, Figs. 1—6)

1862. *Rotalia tuberculifera* Reuss; A. E. Reuss, Die Foraminiferen des Kreides..., p. 313, Pl. 2, Fig. 2.
1946. *Rotalia armata* (d'Orbigny); R. C. van Bellen, Foraminifera from the Middle Eocene..., p. 60, Pl. 7, Figs. 16—19.
1957*a*. *Pararotalia tuberculifera* (Reuss); J. Hofker, Foraminifera from the Cretaceous..., XXIV, p. 32, Text-figs. 1—16 (non 17—18).
1958. *Rotalia lithothamnica* Uhlig, var. *katschanensis* var. nov. Schutzkaja; E. K. Schutzkaja, Foraminifery verchnich sloev..., p. 203, Pl. 3, Fig. 1; Pl. 6, Figs. 5—7.
1960. *Pararotalia tuberculifera* (Reuss); J. Hofker, Foraminifera from the Cretaceous..., L, p. 79, Text-figs. 1—7.
1965. *Pararotalia tuberculifera* (Reuss); K. Pożaryska, Foraminifera and biostratigraphy..., p. 118, Pl. 20, Fig. 3.
1966. *Pararotalia tuberculifera* (Reuss); J. Hofker, Maestrichtian, Danian..., p. 262, Pl. 56, Figs. 114—116 (non 113).
1968. *Pararotalia tuberculifera* (Reuss); K. Pożaryska & J. Szczechura, Foraminifera from the Paleocene..., p. 59, Text-fig. 13; Pl. 7, Figs. 1—10.
?1970. *Rotalia audouini* d'Orbigny; Y. Kiesel, Die Foraminiferenfauna der Paläozänen..., p. 332, Pl. 22, Fig. 17 (non 18—20).

Material. — Fifty two specimens, almost all partly damaged.

Dimension (in mm):

	F. XIII/31	F. XIII/32	F. XIII/33
Largest diameter . . .	0.88	0.54	1.18
Shortest diameter . . .	0.74	0.39	0.88
Height	0.34	0.25	0.44

Variation. — Specimens from Crimea, included in *Pararotalia tuberculifera*, are characterized by significant variability in size and shape of the test, number of chambers and ornamentation, that was already pointed out by Hofker (1957*a*) and later by Pożaryska and Szczechura (1968a).

Remarks. — The specimens included in *Pararotalia tuberculifera* (Reuss) from the Montian of Crimea only slightly differ from the specimens of this species recorded in Poland and the western Europe, especially from those found in tropical Montian (local Zone R — Hofker, 1966). The main differences concern the number of chambers which are the most numerous (up to 14) in the representatives cf. *P. tuberculifera* from Crimea. According to the illustrations presented in Hofker's papers (1957*a*, 1960, 1966), the number of chambers in this species does not exceed 11. Moreover, among the specimens from the Montian of Crimea, large forms of the greatest variability in ornamentation predominate.

The smallest specimens identified as *P. tuberculifera,* recorded from Crimea, correspond to those found in the Montian of the northern Poland (Pożaryska & Szczechura, 1968*a*; see also present paper, Pl. XIV, Fig. 3). Among the latter, no specimens attaining equally large size and differentiated ornamentation as those from Crimea were recorded. The smallest specimens of *P. tuberculifera* from the Montian of Crimea seem to be identical as that illustrated by Kiesel (1970), described from the Paleocene of Germany as *Rotalia audouini.*

Hofker (1957, 1966) included the species *Rotalia choctawensis,* described by van Bellen (1946, non Cushman & McGlamery, 1938) from the Eocene (recte Montian) of Belgium, to the synonymics of *P. tuberculifera.* However, according to the authors, the specimens identified by van Bellen as *Rotalia choctawensis* are almost planispiral, whereas *Pararotalia tuberculifera* is characterized by trochospiral coiling; moreover, there is a difference in the location of the aperture; thus van Bellen's specimens are certainly not conspecific with *P. tuberculifera.*

The above discussed forms from the Montian of Crimea were identified as *Rotalia lithothamnica* Uhlig var. *katschanensis* n.var. by Schutzkaja (1958).

Occurrence. — Paleocene (Montian) of Crimea, Poland, Holland (Limbourg province), Belgium (Mons Basin).

According to Hofker (1966), *P. tuberculifera* appears already in the Upper Maastrichtian of Limbourg region.

Genus *Storrsella* Drooger, 1960

Storrsella? crimensis n.sp.

(Pl. VII, Fig. 1; Pl. IX, Figs. 1—3)

Holotypus: Specimen figured on Pl. IX, Fig. 2 (F. XIII/39).

Paratypus: Specimen figured on Pl. IX, Fig. 3 (F. XIII/40).

Stratum typicum: *Montian* (the uppermost layer of Dano-Montian Beds).

Locus typicus: South-West Crimea, left bank of the Katscha river, Backchisaray region, vicinity of Simpheropol.

Derivatio nominis: *crimensis* — species named after the region where it was found.

Diagnosis. — Test nearly symmetrically biconvex with ventral side inflattened, peripheral outline weakly lobulate, especially along the last chambers. Margin narrowly rounded. The last whorl, the only one to be seen on both sides, contains about twenty chambers. Sickled sutures well seen only in the younger part of the test. Surface rugose and spiny, especially well so in the central parts of both sides of the test.

Material. — Twelve specimens, partly damaged.

Dimensions (in mm):

	F. XIII/37	F. XIII/38	F. XIII/39
Longest diameter . . .	0.59	0.54	0.69
Shortest diameter . . .	0.44	0.44	0.59
Height	0.29	0.27	0.37

Description. — Test almost symmetrically biconvex, with ventral side more uniformly inflattened. Peripheral outline weakly lobulate along the latest formed chambers only, rather entire; margin narrowly rounded. Approximately twenty chambers can be seen on the last and the only whorl seen on both sides. Chamber sutures observable in the younger part of the test, obscured by ornamentation on the older parts; sutures sickled, deeply traced by test ornamentation, particularly in the older part of the test where they do not reach the surface. Surface rugose and spiny; ornamentation particularly well-marked in the central parts on both sides.

Rich ornamentation of the test makes the distinction of ventral and dorsal sides difficult. Aperture interiomarginal seems to extend slightly onto the ventral side.

Variation. — Variation significant, mainly concerning differences in size and ornamentation. Ornamentation is more or less regular and weaker or stronger; on some specimens it is rugose, on others — chevron-shaped; occasionally, particularly well-marked ornamentation results in the formation of tena-like protuberances around central part of the test.

Remarks. — Poor preservation precluded examination of the interior of the specimens. Generic assignment is mainly based on the general appearance of the specimens, hence it should be considered as tentative.

Specimens identified as *Storrsella? crimensis* n.sp. are similar to some Paleocene forms from Surinam (Guiana), identified by Drooger (1960) as *S. haastersi* (van den Bold), differing mainly in richer ornamentation, *Storrsella? crimensis* n.sp. is also similar to *Pararotalia tuberculifera* (cf. Pl. VI, Figs. 1—6), differing in almost uniform ornamentation on both sides of the test, in comparison with the differentiated ornamentation of *P. tuberculifera.* In comparison with *Elphidiella belbekensis* (cf. Pl. IX, Fig. 4), the specimens discussed differ in more numerous chambers, development of peripheral margin and a smaller umbilical part. *Storr-*

sella? *crimensis* n.sp. differs from *Storrsella* sp. (cf. Pl. XI, Figs. 4.5) in a considerably less globulous shape.

Occurrence. — Paleocene (Montian) of Crimea.

Storrsella sp.
(Pl. XI, Figs. 4, 5)

Material. — Four specimens, partly damaged.

Dimensions (in mm):

	F. XIII/41	F. XIII/42
Longest diameter . . .	0.69	0.54
Shortest diameter . . .	0.54	0.44
Height	0.54	0.37

Remarks. — Individuals included here, in comparison with those identified as *Storrsella*? *crimensis* n.sp., are more sphaerical in shape and less ornamented; moreover, their ornamentation is less differentiated, i.e. their umbilical part is weakly marked. Axial section of one specimen is almost identical with that of *S. haastersi* (van den Bold) recorded by Drooger (1960) from the Paleocene of Surinam (Guiana), thus its inclusion in the genus *Storrsella* seems to be right.

Occurrence. — Paleocene (Montian) of Crimea.

Genus *Thalmannita* Bermudez, 1952

Thalmannita aff. *pomeraniana* (Pożaryska & Szczechura, 1968)
(Pl. VII, Figs. 2—4)

1958. *Anomalina confragosa* Schutzkaja; E. K. Schutzkaja, Foraminifery verchnich sloev..., p. 206, Pl. 4, Figs. 3, 4; Pl. 7, Figs. 2, 3.

Material. — A few tens of rather poorly-preserved specimens.

Dimensions (in mm):

	F. XIII/43	F. XIII/44	F. XIII/45
Longest diameter . . .	0.76	0.76	0.83
Shortest diameter . . .	0.61	0.54	0.61
Height	0.34	0.29	0.25

Variation. — Variation within specimens included in *Thalmannita* aff. *pomeraniana* (Pożaryska & Szczechura, 1968) is significant, concerning mainly the size, shape and ornamentation of the tests. Peripheral outline changes from rounded to more or less ovate; height of specimens variable, particularly in their central parts; the last chambers are more or less swollen, occasionally asymmetric, that is usually more inflated on the umbilical side and results in asymmetry of aperture. Smaller (?juvenile) specimens have less numerous chambers than the larger ones. Variability

in ornamentation mainly concerning stronger or weaker granulation in central part of the test: moreover, there are differences in the pattern of ornamentation, which may consists of continuous ribs on the test wall, usually most distinct on the last chambers, or tubercle-like protuberances.

Remarks. — Specimens identified as *Thalmannita* aff. *pomeraniana* (Pożaryska & Szczechura, 1968*a*), differ from those from the Montian of the western Europe and Poland identified as *Cuvillierina*? *pomeraniana* (recte *Thalmannita pomeraniana*), in a bigger number of chambers and slightly in general outline. Crimean specimens are distinctly larger than those hitherto included in *T. pomeraniana*, moreover, they are more flattened and have about 14 chambers in comparison with 6—9 in the typical representatives of the latter species (cf. Pl. XIV, Fig. 4). The differences may be sufficient for establishing a new species for these Crimean forms; however, the undoubtful affinity between foraminiferal assemblages from Crimea and from Poland and the western Europe allows to assume that also this species is related to the one hitherto known from Poland, Holland, Belgium, France, Germany, etc. The species *Cuvillierina*? (recte *Thalmannita*) *pomeraniana* was erected by Pożaryska and Szczechura, 1968, for the specimens from the Montian of western Europe, assigned incorrectly by Hofker (1961, 1966) to *Thalmannita madrugaensis* (Cushman & Bermudez).

Occurrence. — Paleocene (Montian) of Crimea.

This species representing the genus *Thalmannita,* characteristic of the Meridional Province, is a valuable ecological index.

Family **Elphidiidae** Galloway, 1933
Genus *Elphidiella* Cushman, 1936
Elphidiella prima (Ten Dam, 1944)
(Pl. VIII, Fig. 1)

1944. *Elphidium primum* Ten Dam; A. Ten Dam, Die stratigraphische Gliederung..., p. 109, Pl. 3, Fig. 15.
1966. *Elphidiella prima* (Ten Dam); J. Hofker, Maestrichtian, Danian..., p. 267, Pl. 57, Fig. 6.
1968. *Elphidiella prima* (Ten Dam); K. Pożaryska & J. Szczechura, Foraminifera from the Paleocene..., p. 64, Pl. 9, Figs. 16—19 (*here the additional synonymy included*).

Material. — Three poorly-preserved specimens.

Dimensions (in mm):

	F. XIII/46	F. XIII/47
Longest diameter	0.56	0.59
Shortest diameter	0.49	0.59
Height	0.29	0.29

Remarks. — Specimens from the Montian of Crimea, which are included in *Elphidiella prima* (Ten Dam), fall completely within the limits of variability of this species known from the lowermost Tertiary of Europe, both from Boreal and Meridional Provinces.

Occurrence. — Paleocene (Montian) of Crimea and Germany; Paleocene (Danian and Selandian) of Sweden; Paleocene (Montian and Thanetian) of Holland and France.

Elphidiella belbekensis Schutzkaja, 1958
(Pl. IX, Fig. 4)

1958. Elphidiella(?) belbekensis n.sp.; E. K. Schutzkaja, Foraminifery verchnich sloev..., p. 199, Pl. 1, Figs. 2, 3.

Material. — One specimen somewhat damaged.

Dimensions (in mm)

	F. XIII/48
Longest diameter	1.00
Shortest diameter	0.78
Height	0.49

Description. — Test planispiral, symmetrically biconvex; peripheral margin somewhat acute;peripheral outline angularly lobulate, particularly along the last chambers; chambers, more than 10 in number (11—13, according to Schutzkaja, 1958), weakly inflated and separated by sickled and incised sutures. Umbilicus filled up with prominent umbilical plug, ornamented with irregular protuberances. Surface of the test covered with rib-like knobs, almost perpendicular to sutures, with spiny tubercles. Aperture interiomarginal, multiple at the base of the last formed chamber. Sutural openings obscured.

Remarks. — The form described is identical with that of Schutzkaja (1958), identified as *Elphidiella*(?) *belbekensis*. Its generic identification is based on the general appearance of the test as well as on the type of its aperture. Unfortunately, sutural openings mentioned by Schutzkaja (1958) were not recorded.

Occurrence. — Paleocene (Montian) of Crimea.

Genus *Protelphidium* Haynes, 1956
Protelphidium sublaeve (Ten Dam, 1944)
(Pl. VIII, Fig. 3)

1944. *Nonion sublaeve* Ten Dam; A. Ten Dam, Die stratigraphische Gliederung..., p. 109, Pl. 3, Fig. 8.

1966. *Protelphidium sublaeve* Ten Dam; J. Hofker, Maestrichtian, Danian..., p. 267, Pl. 57, Fig. 5.

1968. *Nonion sublaeve* Ten Dam; K. Pożaryska & J. Szczechura, Foraminifera from the Paleocene..., p. 81, Pl. 9, Figs. 13—15 (*here additional synonymy included*).
1970. *Protelphidium sublaeve* (Ten Dam); Y. Le Calvez, Contribution à l'étude..., p. 166, Pl. 27, Fig. 3.

Material. — Nine poorly preserved specimens with recrystallized tests.

Dimensions (in mm):

	F. XIII/49	F. XIII/50
Longest diameter	0.49	0.59
Shortest diameter	0.39	0.49
Height	0.27	0.25

Variation. — Variation is limited to different size of tests and the ratio of plug size to the height of the last whorl, i.e. the larger plug, the lower the last whorl of the test.

Remarks. — *Protelphidium sublaeve* from the Montian of Crimea is characterized by a larger number of chambers in the last whorl (13—14 chambers) than in the specimens from the Paleocene of western Europe. In the assemblage of tropical foraminifera from the Montian of Crimea this species is represented by relatively scarce specimens attaining small size.

Occurrence. — Paleocene (Montian) of Crimea, Poland and Holland; Paleocene (Thanetian) of France and England.

Family **Globorotaliidae** Cushman, 1927
Genus *Globorotalia* Cushman, 1927
Globorotalia globigeriniformis van Bellen, 1946
(Pl. VIII, Fig. 2)

1946. *Globorotalia globigeriniformis* van Bellen; R. C. van Bellen, Foraminifera from the Middle Eocene..., p. 71, Pl. 10, Figs. 10—12.
1968. *Globorotalia globigeriniformis* van Bellen; K. Pożaryska & J. Szczechura, Foraminifera from the Paleocene..., p. 65, Pl. 7, Figs. 11—19 (*here additional synonymy included*).

Material. — Nine specimens more or less damaged.

Dimensions (in mm):

	F. XIII/51	F. XIII/52
Longest diameter	0.25	0.39
Shortest diameter	0.20	0.25
Height	0.12	0.20

Remarks. — Specimens identified as *G. globigeriniformis*, from the Montian of Crimea, are remarkably smaller than those from the Montian of western Europe and Poland (cf. Pl. XV, Fig. 3).

Occurrence. — Paleocene (Montian) of Crimea, Poland, Holland, (Limbourg region), Belgium (Mons Basin) and Germany.

Family **Eponididae** Hofker, 1951
Genus *Eponides* de Montfort, 1808
Eponides toulmini Brotzen, 1948
(Pl. X, Fig. 4)

1948. *Eponides toulmini* Brotzen; F. Brotzen, The Swedish Paleocene..., p. 78, Pl. 10, Fig. 16.
1959. *Alabamina bigibbera* Le Calvez: Y. Le Calvez, Études de quelques Foraminifères..., p. 94, Pl. 1, Figs. 5—7.
1961. *Globorotalites perforatus* Vassilenko; V. P. Vassilenko, Foraminifery verchnego mela..., p. 61, Pl. 10, Fig. 5.
1965. *Eponides toulmini* Brotzen; K. Pożaryska, Foraminifera and biostratigraphy..., p. 110, Pl. 17, Figs. 4 a-c.
1966. *Eponides toulmini* Brotzen; J. Hofker, Maestrichtian, Danian..., p. 261, Pl. 54, Figs. 83,84; Pl. 58, Fig. 15; Pl. 62, Fig. 75.
1968. *Eponides toulmini* Brotzen; K. Pożaryska & J. Szczechura, Foraminifera from the Paleocene..., p. 72, Pl. 15, Figs. 1—4.
1970. *Eponides toulmini* Brotzen; Y. Le Calvez, Contribution à l'étude..., p. 176, Pl. 37, Fig. 8.
1970. *Eponides toulmini* Brotzen; Y. Kiesel, Die Foraminiferenfauna..., p. 292, Pl. 16, Fig. 13.

Material. — Nine well-preserved specimens.

Dimensions (in mm):

	F. XIII/53	F. XIII/54	F. XIII/55
Longest diameter	0.69	0.69	0.64
Shortest diameter	0.54	0.59	0.54
Height	0.44	0.44	0.37

Variation. — Variation insignificant, concerning mainly the overall shape of the tests and generally concordant with characteristics previously given for this species by Pożaryska and Szczechura (1968*a*).

Remarks. — Specimens from tropical Montian of Crimea fall within the limits of variability of the species *Eponides toulmini,* described by Brotzen (1948) and common in the Lower Tertiary of Europe. Moreover, specimens of *Globorotalites perforatus,* recorded from the Danian of Mangyshlak and Carpathians by Vasilenko (1961), are very similar in shape to some specimens identified as *Eponides toulmini* recorded from the Paleocene of Poland (Pożaryska & Szczechura, 1968*a*, Pl. 15, Fig. 4).

Occurrence. — *Eponides toulmini* is known from the Maastrichtian to Eocene both from the western (France, Holland, Belgium), central Europe (Poland, Germany, Sweden) and eastern Europe (U.S.S.R.). This cosmopolite species is recorded in Boreal as well as Meridional Province.

PLATES
I—XV

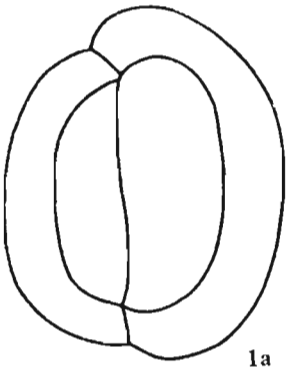
Plates I—XIII — Specimens from Montian of Crimea Bakchisaray region.

Plates XIV—XV — Specimens from Pamiętowo bcring (northern Poland), Montian.

Plate I

Fig. 1. *Quinqueloculina* sp.: *a*, *b* opposite sides views, c apertural view (F. XIII/7).
Figs. 2, 3. *Guttulina* sp., side views (F. XIII/11,12).
Fig. 4. *Guttulina* ex gr. *G. problema* d'Orbigny, side view (F. XIII/75).
Fig. 5. *Sigmomorphina* sp.: *a* side view, *b* apertural view (F. XIII/13).
Fig. 6. *Epistominella* cf. *limburgensis* (Visser): *a* peripheral view, *b* dorsal view, *c* ventral view (F. XIII/17).

(Scales correspond to 0.1 mm)



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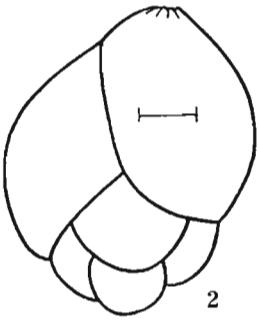

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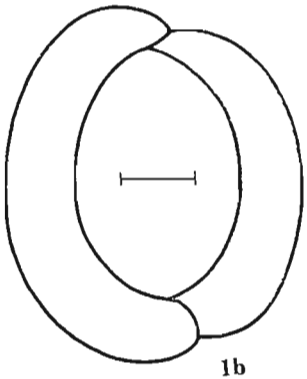

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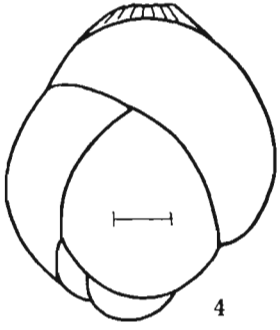
5a



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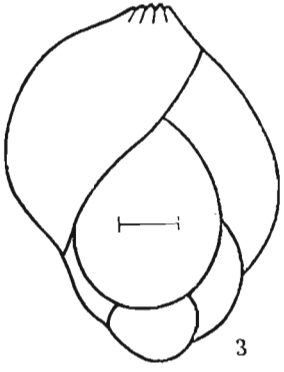

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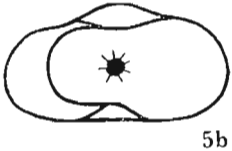

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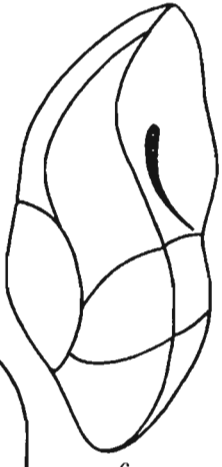

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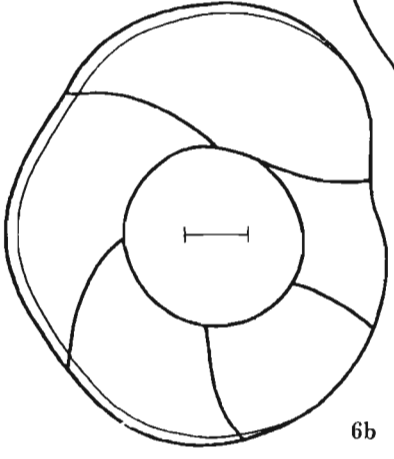

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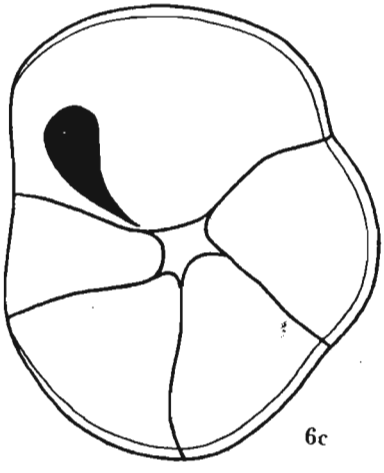

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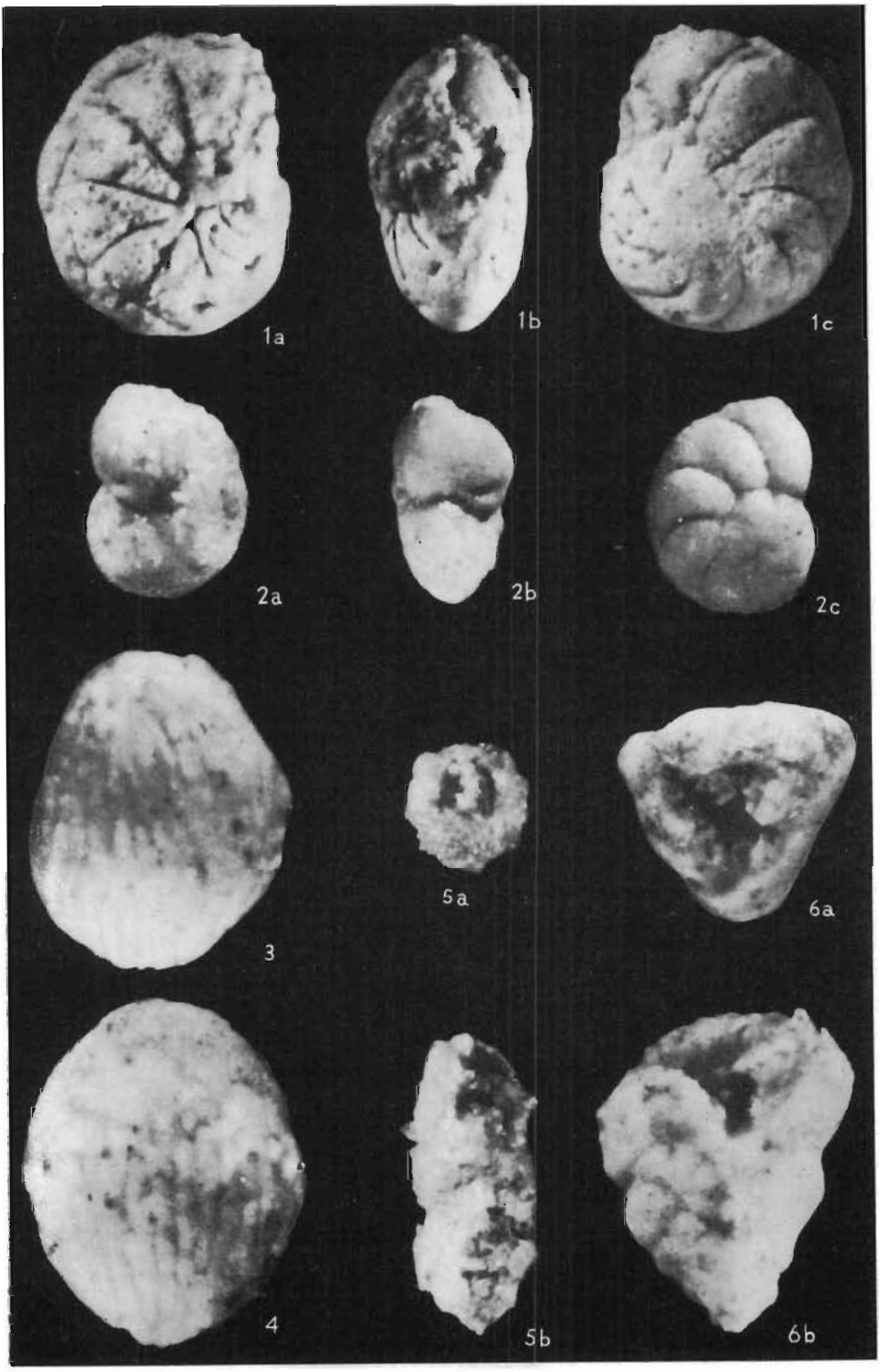
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5a
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6b

Plate II

Figs. 1,2. *Epistomaria rimosa* (Parker & Jones): *a* ventral views, *b* peripheral views, *c* dorsal views (F. XIII/23,24); × 50

Figs. 3,4. *Globulina* sp., side views (F. XIII/9,10); × 90.

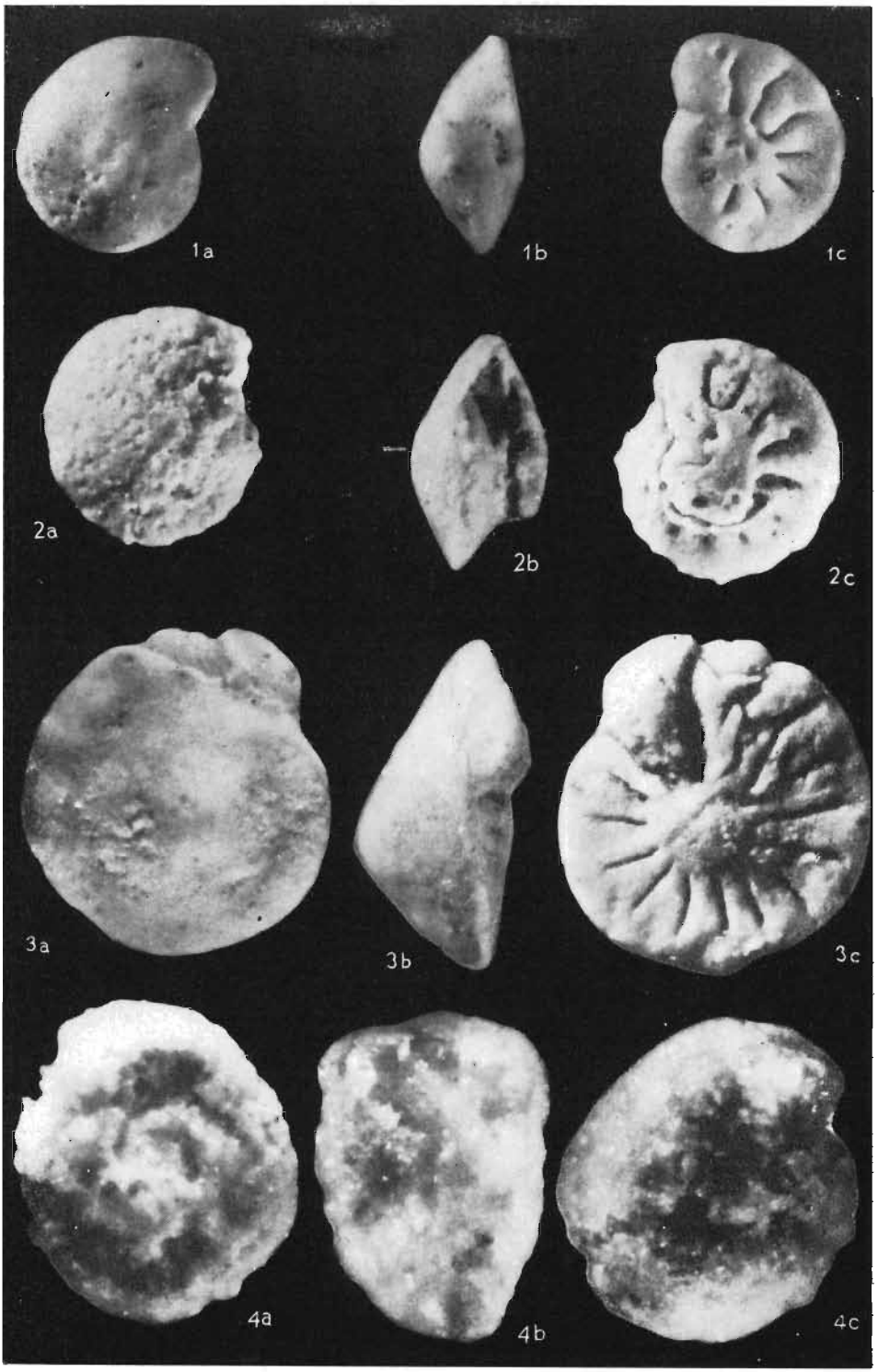
Fig. 5. *Clavulina* sp.: *a* apertural view, *b* side view (F. XIII/1); × 36.

Fig. 6. *Valvulina limbata* Terquem: *a* apertural view, *b* side view (F. XIII/2); × 40.

Plate III

Figs. 1—3. *Discorbis* aff. *marginata* (d'Orbigny): *a* dorsal views, *b* peripheral views, *c* ventral views (F. XIII/14—16); × 52.

Fig. 4. *Boldia* sp.: *a* dorsal view, *b* peripheral view, *c* ventral view (F. XIII/67); × 95.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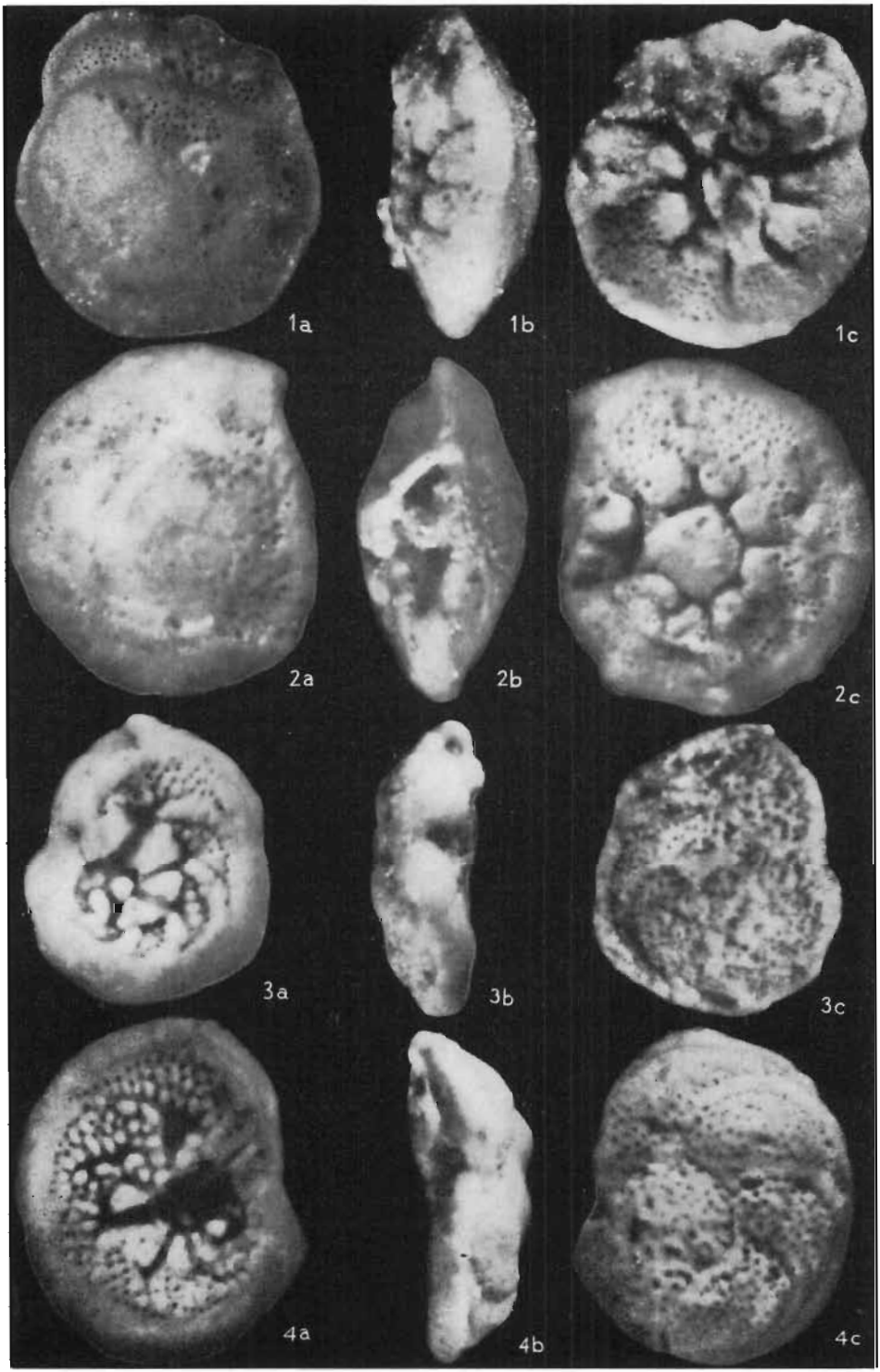
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4b
4c

Plate IV

Figs. 1,2. *Rotalia saxorum* d'Orbigny: *a* dorsal views, *b* peripheral views, *c* ventral views (F. XIII/29,30): *1* × 66, *2* × 84.

Figs. 3,4. *Rosalina parisiensis* d'Orbigny: *a* ventral views, *b* peripheral views, *c* dorsal views (F. XIII/19,20): × 60.

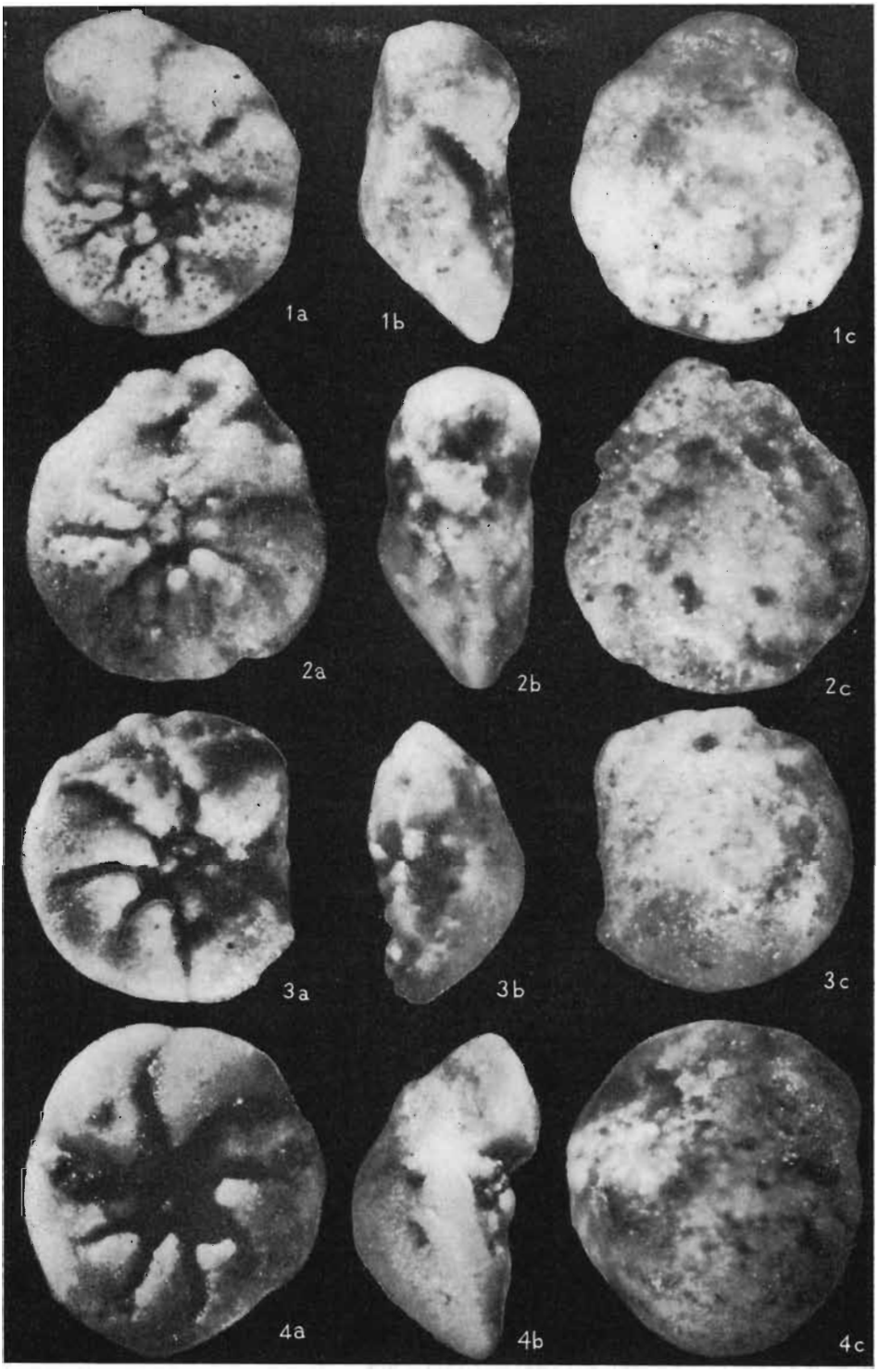
Plate V

Rotalia schutzkajae n. sp.

Fig. 1. Paratypus (F. XIII/26); × 70.

Fig. 2. Holotypus (F. XIII/25); × 84.

Figs. 3,4. Specimens tentatively included into *Rotalia schutzkajae* n. sp.: ventral views, *b* peripheral views, *c* dorsal views, (F.XIII/27,28); *3* × 70, *4* × 84.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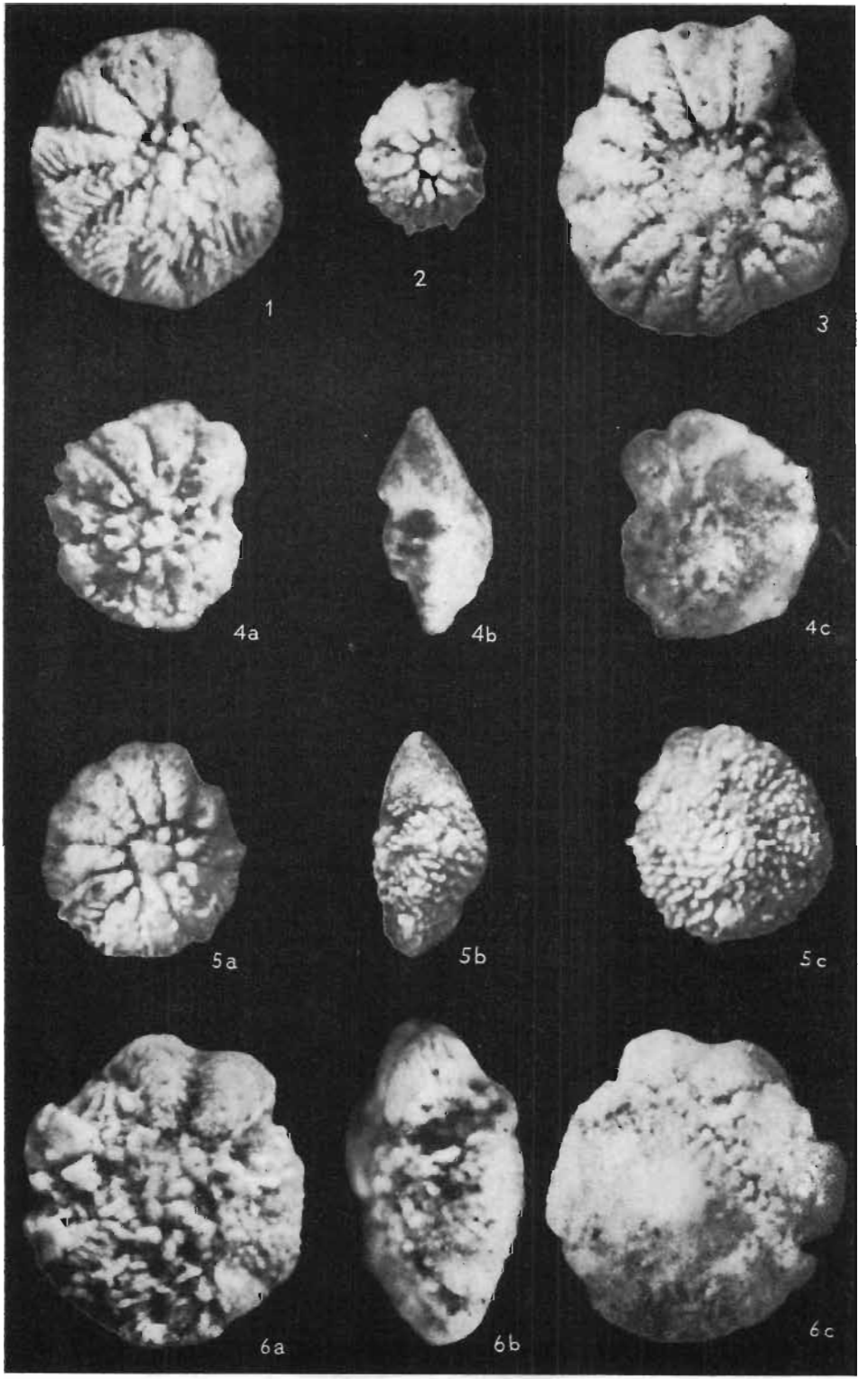
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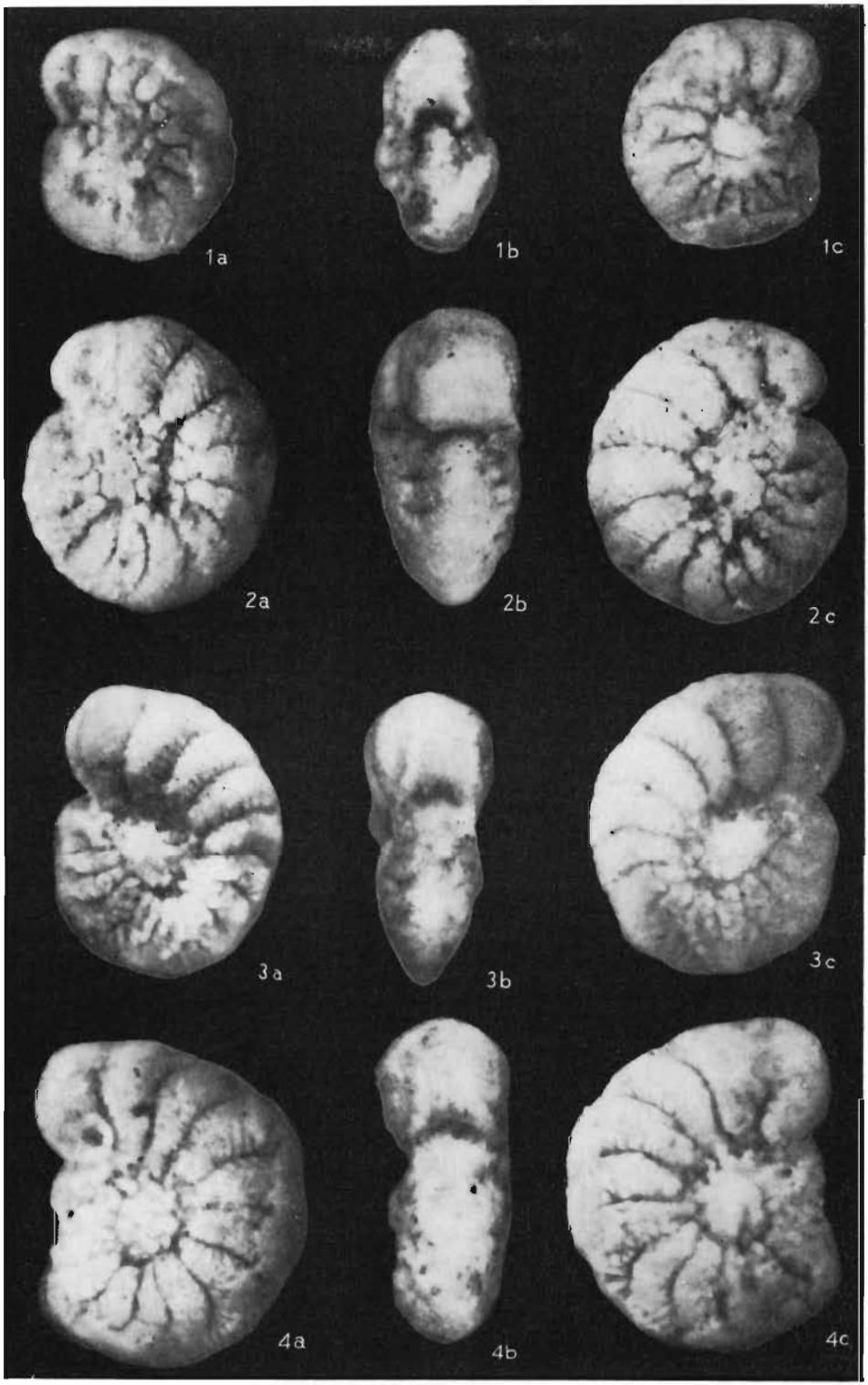
Plate VI

Figs. 1—6. *Pararotalia tuberculifera* (Reuss): 1—3, 4*a*—6*a* ventral views, 4*b*—6*b* peripheral views, 4*c*—6*c* dorsal views (F. XIII/31—36); *1*, *4*—*6* × 45; *2*, *3* × 40.

Plate VII

Fig. 1. *Storrsella crimensis* n. sp.: *a* dorsal view, *b* peripheral view, *c* ventral view (F.XIII/37); × 60.

Figs. 2—4. *Thalmannita* aff. *pomeraniana* (Pożaryska & Szczechura): *a* dorsal views, *b* peripheral views, *c* ventral views (F. XIII/43—45); × 60.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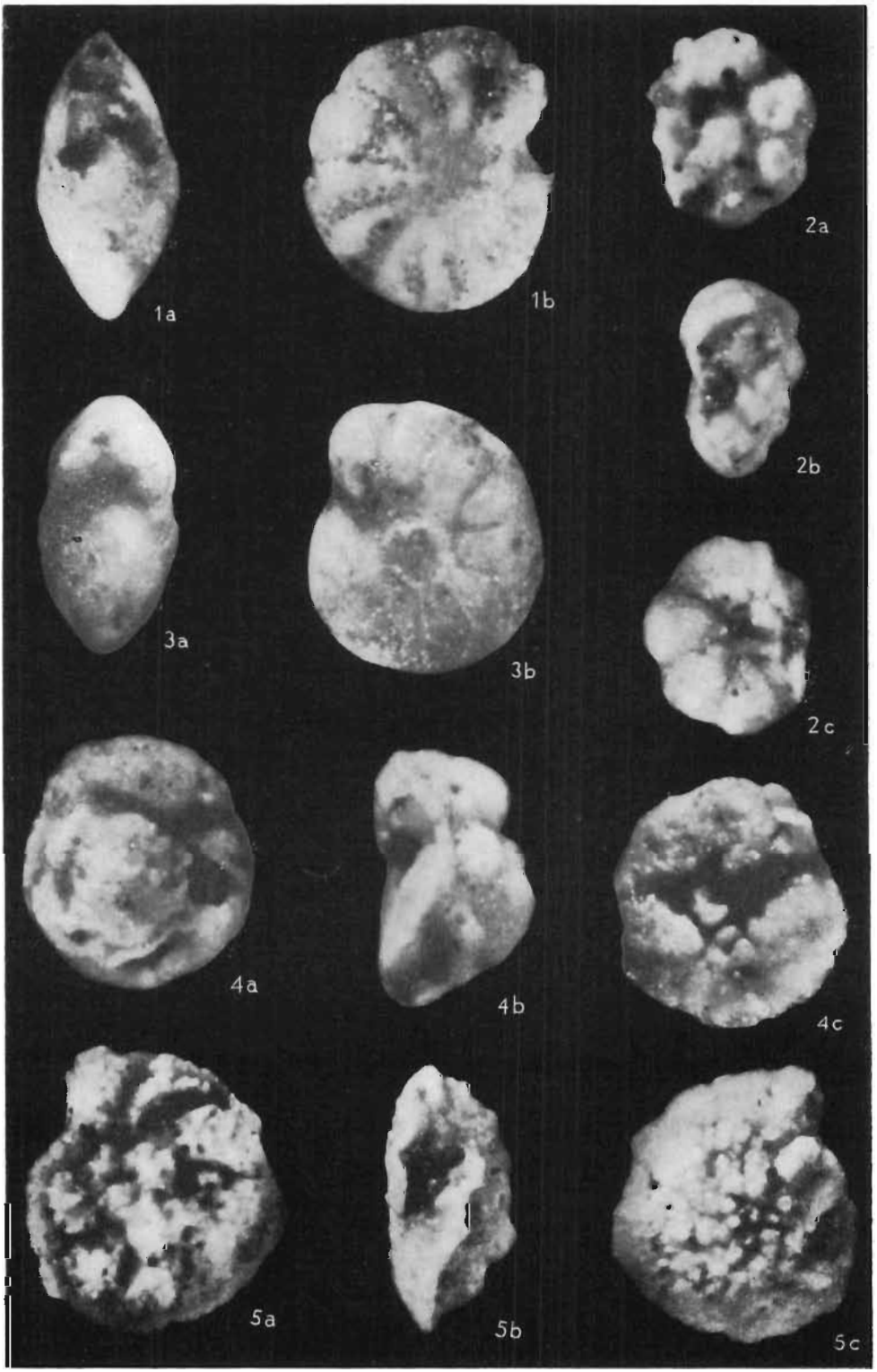
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Plate VIII

Fig. 1. *Elphidiella prima* (Ten Dam): *a* peripheral view, *b* side view (F.XIII/46); × 80.

Fig. 2. *Globorotalia globigeriniformis* van Bellen: *a* dorsal view, *b* peripheral view, *c* ventral view (F.XIII/51); × 120.

Fig. 3. *Protelphidium sublaeve* (Ten Dam): *a* peripheral view, *b* side view (F.XIII/49); × 80.

Fig. 4. Gen. and sp. indet.: *a* dorsal view, *b* peripheral view, *c* ventral view (F.XII/74); × 130.

Fig. 5. *Rotorbinella mariei* (van Bellen): *a* dorsal view, *b* peripheral view, *c* ventral view (F.XIII/21); × 90.

Plate IX

Storrsella? crimensis n. sp.

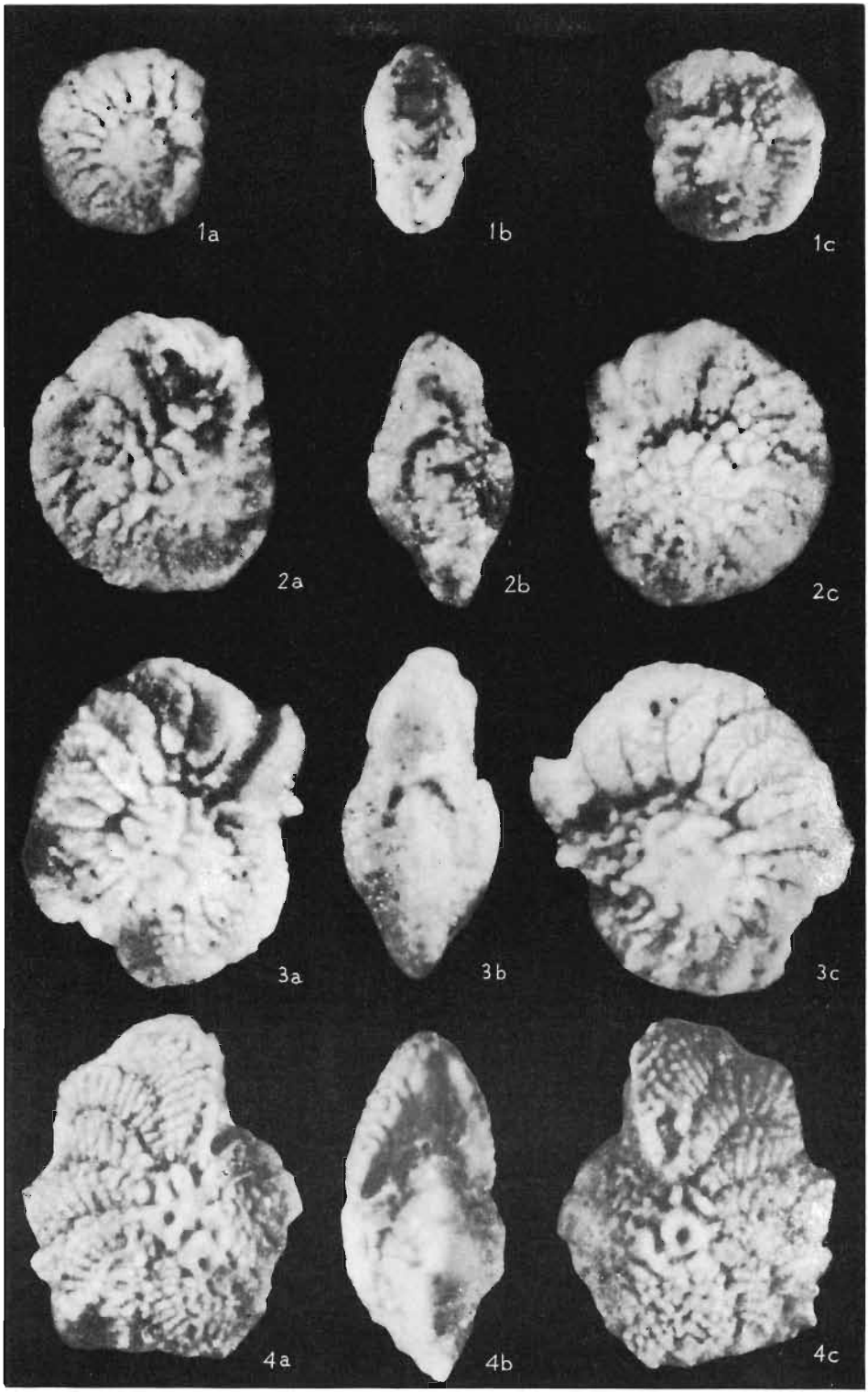
Fig. 1. Specimen (F.XIII/38).

Fig. 2. Holotypus (F.XIII/39).

Fig. 3. Paratypus (F.XIII/40).

a ventral views, *b* peripheral views, *c* dorsal views; × 58.

Fig. 4. *Elphidiella belbekensis* Schutzkaja: *a*, *c* opposite sides views, *b* peripheral view (F. XIII/48); × 50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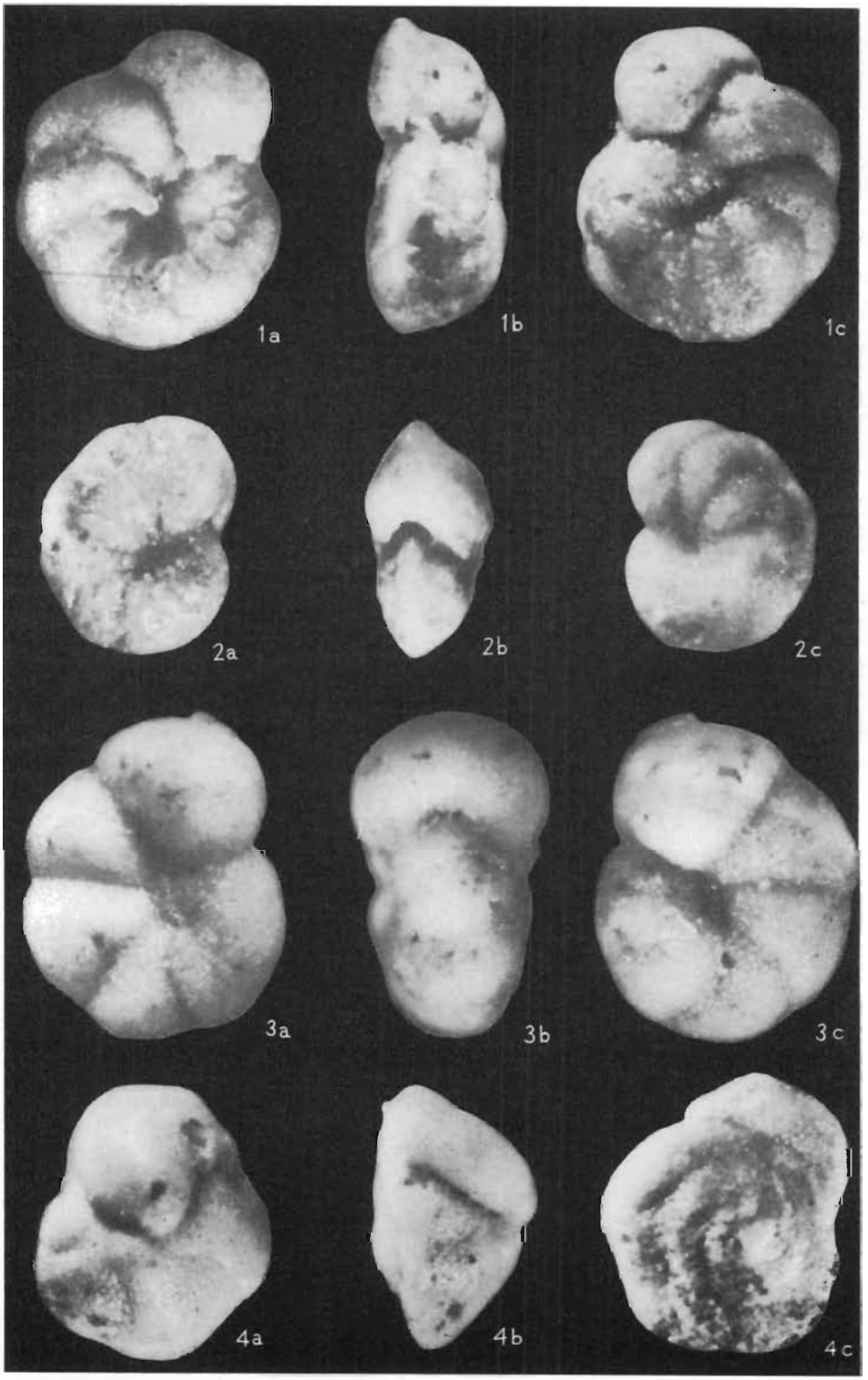
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4b
4c

Plate X

Figs. 1, 2. *Hanzawaia*? *bundensis* (van Bellen): *a* ventral views, *b* peripheral views, *c* dorsal views (F. XIII/69—70); × 62.

Fig. 3. *Anomalina danica* (Brotzen): *a* dorsal view, *b* peripheral view, *c* ventral view (F. XIII/59): × 50.

Fig. 4. *Eponides toulmini* Brotzen: *a* ventral view, *b* peripheral view, *c* dorsal view (F. XIII/53): × 58.

Plate XI

Boldia variabilis n. sp.

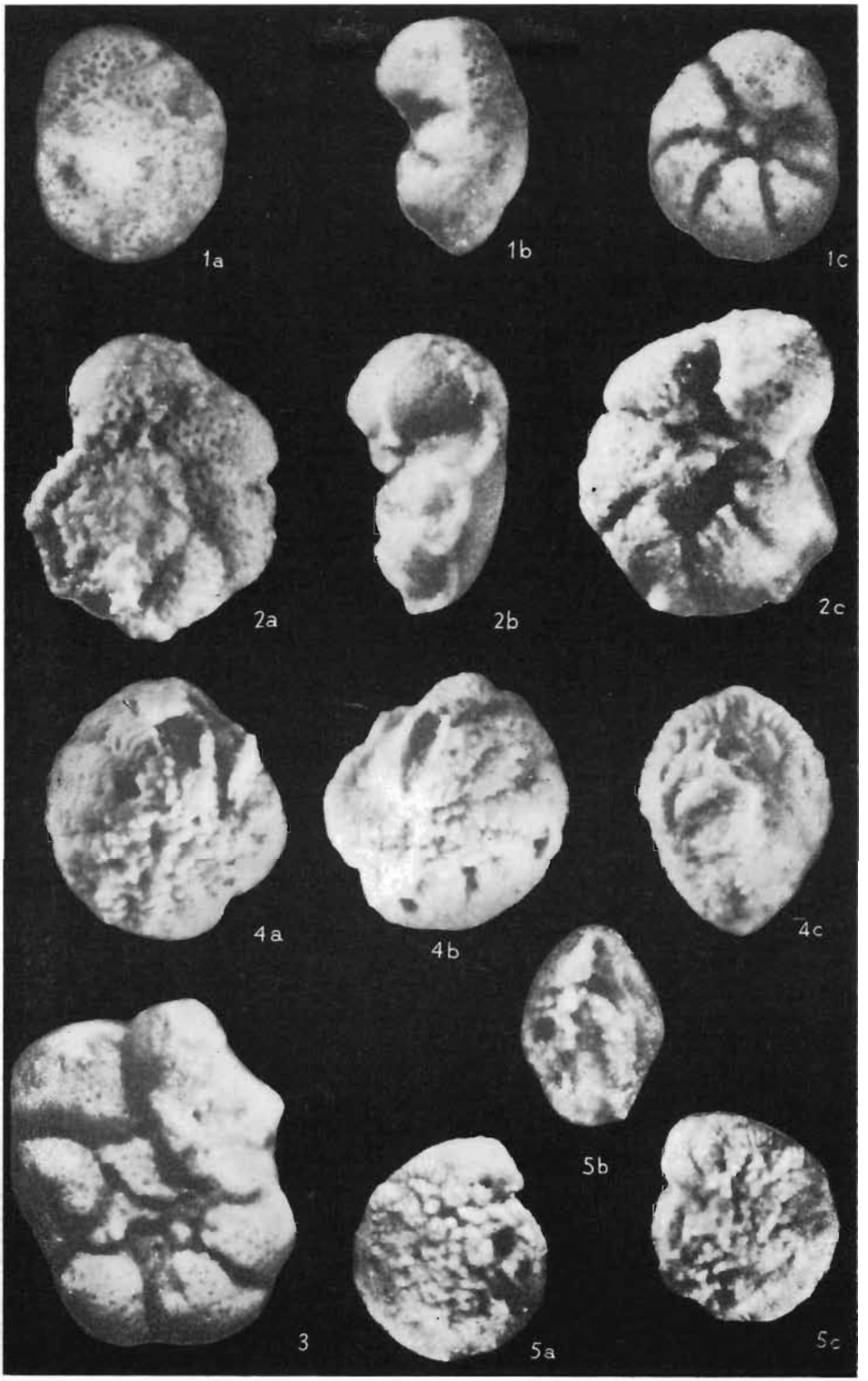
Fig. 1. Paratypus (F. XIII/65); × 70.

Fig. 2. Holotypus (F. XIII/64); × 73.

Fig. 3. Specimen (F. XIII/66); × 75.

a dorsal views, *b* peripheral views, *c* ventral views.

Figs. 4, 5. *Storrsella* sp.: *a* ventral views, *b* peripheral views. *c* dorsal views (F. XIII/41, 42); × 58.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4a
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5b
5a
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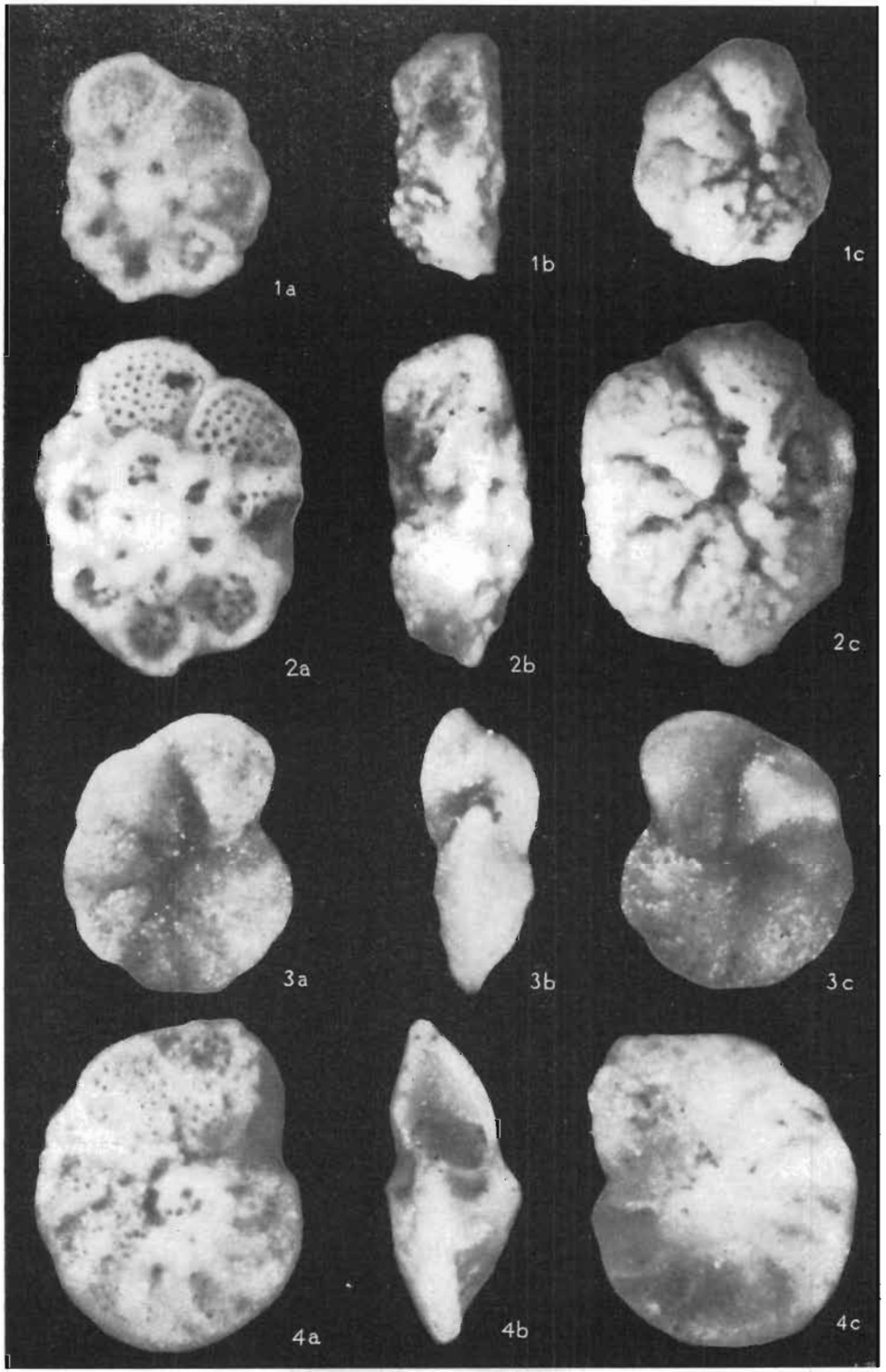
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4c

Plate XII

Figs. 1, 2. *Boldia rotundaeformis* (Schutzkaja); *a* dorsal views, *b* peripheral views, *c* ventral views (F. XIII/62, 63); × 70.

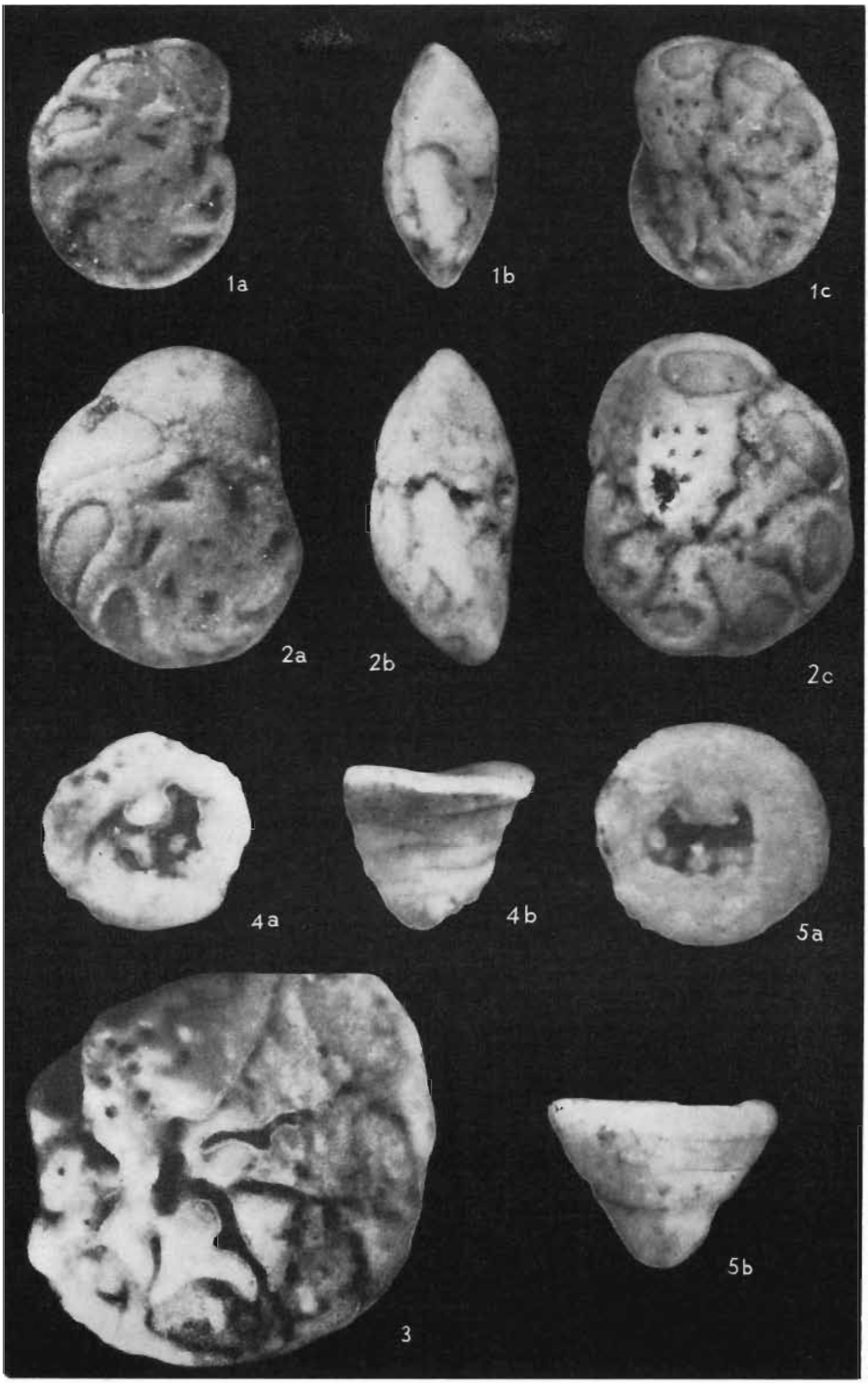
Fig. 3. *Cibicides* sp.: *a* ventral view, *b* peripheral view, *c* dorsal view (F. XIII/58); × 75.

Fig. 4. *Cibicides cuvillieri* Rouvillois: *a* ventral view, *b* peripheral view, *c* dorsal view (F. XIII/56); × 75.

Plate XIII

Figs. 1—3. *Schlosserina asterites* (Gümbel): *a* dorsal views, *b* peripheral views, *c* ventral views (F. XIII/71—73); *1* × 35, *2* × 44, *3* × 54.

Figs. 4, 5. *Vacuovalvulina keijzeri* (van Bellen): *a* apertural views, *b* side views (F. XIII/4, 5); *4* × 40, *5* × 60.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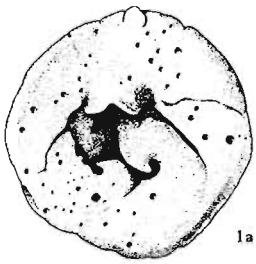
3
5b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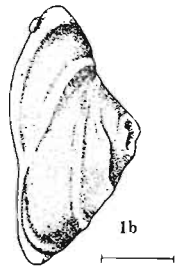
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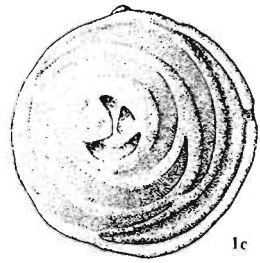
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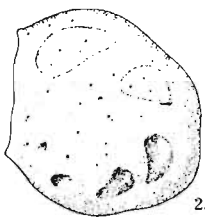
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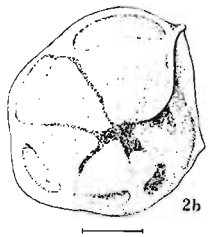
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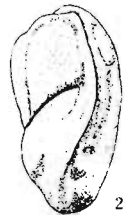
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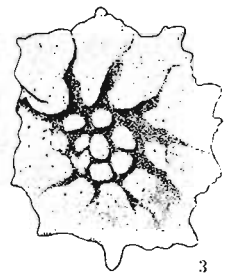
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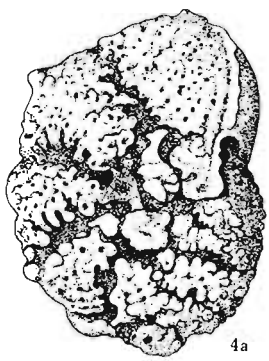
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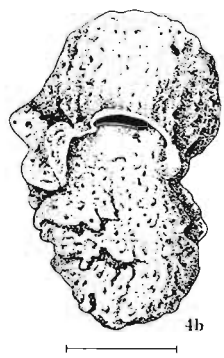
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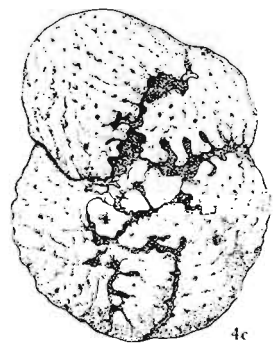
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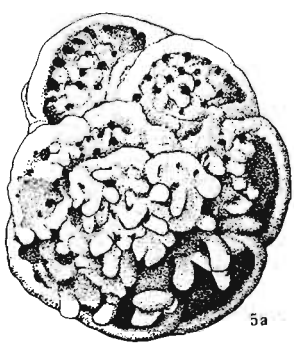
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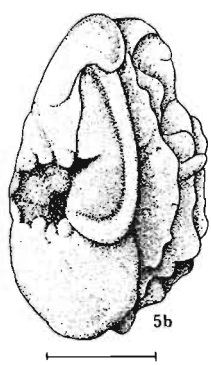
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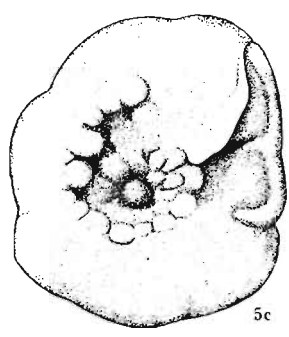

5c

Plate XIV

Fig. 1. *Vacuovalvulina keijzeri* (van Bellen): *a* ventral view, *b* peripheral view, *c* dorsal view (F. IX/15), depth 215 m.

Fig. 2. *Schlosserina* sp.: *a* dorsal view, *b* ventral view, *c* peripheral view (F. IX/254), depth 231 m.

Fig. 3. *Pararotalia tuberculifera* (Reuss), ventral view (F. IX/41), depth 215 m.

Fig. 4. *Thalmannita pomeraniana* (Pożaryska & Szczechura): *a* ventral view, *b* peripheral view, *c* dorsal view (F. IX/25), depth 210.7 m.

Fig. 5. *Rotorbinella mariei* (van Bellen): *a* dorsal view, *b* peripheral view, *c* ventral view (F. IX/47), depth 215 m.

(Scales correspond to 0.1 mm)

Plate XV

Fig.1. *Rotorbinella montiana* Pożaryska & Szczechura: *a* ventral view, *b* peripheral view, *c* dorsal view (F. IX/50), depth 210.7 m.

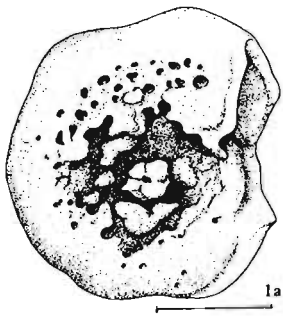
Fig. 2. *Hanzawaia? bundensis* (van Bellen): *a* ventral view, *b* dorsal view, *c* peripheral view (F. IX/103), depth 230 m.

Fig. 3. *Globorotalia globigeriniformis* (van Bellen): *a* dorsal view, *b* ventral view, *c* peripheral view (F. IX/71), depth 210.7 m.

Fig. 4. *Rotalia saxorum* d'Orbigny: *a* ventral view, *b* dorsal view, *c* peripheral view (F. IX/34), depth 273.4 m.

Fig. 5. *Discorbis marginata* (d'Orbigny): *a* ventral view, *b* dorsal view, *c* peripheral view (F. IX/33), depth 208.5 m.

(Scales correspond to 0.1 mm)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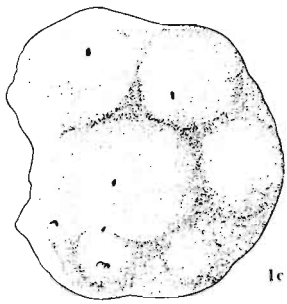
1b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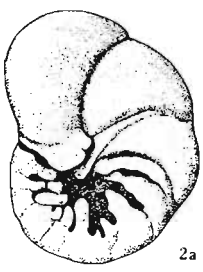
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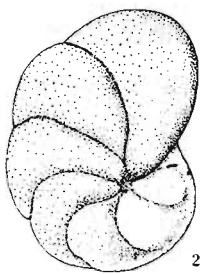
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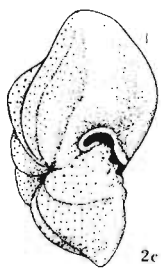
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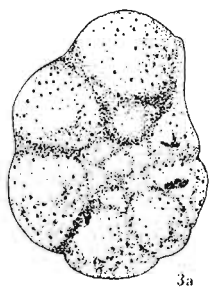
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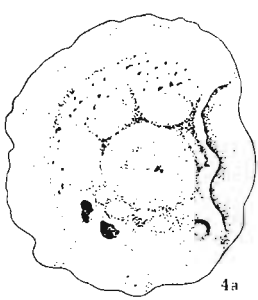
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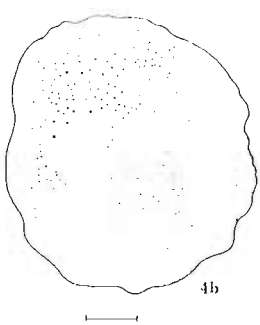
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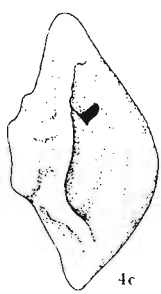
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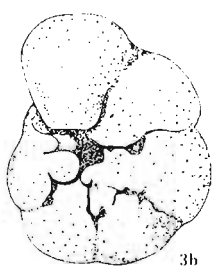
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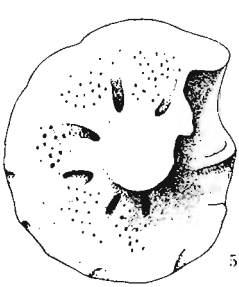
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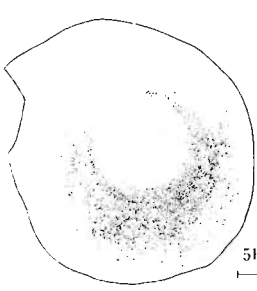
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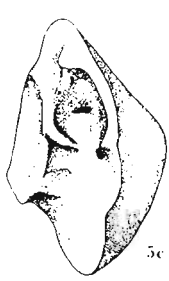
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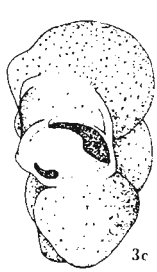
3c

Family **Cibicididae** Cushman, 1927
Genus *Cibicides* de Montfort, 1808
Cibicides cuvillieri Rouvillois, 1960
(Pl. XII, Fig. 4)

1960. *Cibicides cuvillieri* Rouvillois; A. Rouvillois, Le Thanétien du Bassin de Paris..., p. 74, Pl. 3, Fig. 51.
1968. *Cibicides cuvillieri* Rouvillois; K. Pożaryska & Szczechura, Foraminifera from the Paleocene..., p. 76, Pl. 12, Figs. 1—7 (*here additional synonymy included*).
1970. *Cibicides cuvillieri* Rouvillois; Y. Le Calvez, Contribution à l'étude..., p. 181, Pl. 41, Fig. 5.

Material. — Five specimens; last chamber damaged.

Dimensions (in mm):

	F. XIII/56	F. XIII/57
Longest diameter	0.64	0.34
Shortest diameter	0.44	0.29
Height	0.25	0.17

Variation. — Variation concerns development of the outline of test, convexity of terminal chambers and character of sutures, what was already discussed in the paper by Pożaryska and Szczechura (1968*a*). Moreover, flanges adjoining apertural slit may be developed in a form of narrow lip or wider ledges along two or more chambers.

Remarks. — Besides the problems discussed by Pożaryska and Szczechura (1968*a*) and Le Calvez (1970), one should notice a relationship between size of the individuals of this species and ecological conditions. This species is rare and represented by individuals attaining smaller size than the majority of the representatives of other species in Crimea. In boreal conditions the representatives of that species are larger and more numerous.

Occurrence. — Paleocene (Montian) of Crimea, Poland, Holland, Belgium (Mons Basin and Limbourg region); Paleocene (Thanetian) and Eocene of France.

Cibicides sp.
(Pl. XII, Fig. 3)

Material. — Two well-preserved specimens.

Dimensions (in mm):

	F. XIII/58
Longest diameter	0.56
Shortest diameter	0.44
Height	0,25

Remarks. — Specimens included here are very similar to those from the Paleocene of Poland, identified as *Cibicides* cf. *cryptomphalus her-*

cegovinensis de Witt Puyt, differing in a smaller size and not thickened sutures; thickened sutures on both sides of the tests are typical of almost all specimens from Poland.

Occurrence. — Paleocene (Montian) of Crimea.

Family **Anomalinidae** Cushman, 1927
Genus *Anomalina* d'Orbigny, 1826
Anomalina danica (Brotzen, 1940)
(Pl. X, Fig. 3)

1940. *Cibicides danica* Brotzen; F. Brotzen, Flintränanns..., p. 31, Pl. 7, Fig. 2.
?1962. *Gavelinella rubiginosa* (Cushman); A. von Hillebrandt, Das Paleozän..., p. 102, Pl. 8, Fig. 1.
1968. *Anomalina danica* (Brotzen); K. Pożaryska & J. Szczechura, Foraminifera from the Paleocene..., p. 86, Pl. 14, Figs. 6—11 (*here additional synonymy included*).
?1970. *Gavelinella rubiginosa* (Cushman); Y. von Kiesel, Die Foraminiferenfauna..., p. 287, Pl. 15, Figs. 15,17.

Material. — Approximately 60 well-preserved specimens.
Dimensions (in mm):

	F. XIII/59	F. XIII/60	F. XIII/61
Longest diameter	0.93	0.98	0.54
Shortest diameter	0.67	0.78	0.39
Height	0.56	0.49	0.34

Variation. — Variation very high, concerning mainly size of the specimens, outline and ornamentation of the test. The outline varies from entire to markedly incised. Forms lobulate in outline usually have chambers more convex and sutures incised deeper than the forms with a rounded outline; changes in ornamentation are closely connected with changes in perforation of test; forms coarsely perforated are usually covered with irregular granulation, particularly well-marked on the older parts of test.

Remarks. — *Anomalina danica* Brotzen is one of the most frequent species within the foraminiferal assemblage from Crimea. Taking into account its great variability, it does not differ from the specimens from other regions of Europe, especially those from Poland, western Europe and the U.S.S.R., included in this species. *Gavelinella rubiginosa,* described by Cushman, 1926, from the Paleocene of Mexico, seems to differ significantly from *Anomalina danica* Brotzen in ornamentation, thus Paleocene-Eocene forms from Germany, included in the former species by Kiesel (1970), similarly as Paleocene forms from Austria (Hillebrandt, 1962), are synonymized under the species *A. danica,* however, with restrictions resulting from poor illustrations and impossibility to compare the holotypes of the species compared. According to the present authors, the differences between *A. danica* (Brotzen), *A. rubiginosa* (Cushman)

and *Anomalinoides westraliensis* (Parr, 1938) conspecific to *Anomalina danica* according to McGowran (1965), are still inadequately explained.

Hofker (1957*b*) thoroughly discussed similarities between forms described under the specific names *Anomalinoides vanbelleni* Ten Dam & Sigal, 1950, *Truncatulina granosa* Hantken, 1875, *Gavelinella* (recte *Anomalina*) *danica* Brotzen, 1940, and *Anomalinoides capitatus* (Gümbel, 1868) arriving at the conclusion that in Danian and Paleocene *Gavelinella* (*Anomalina*) *danica* is a synonym of *Anomalinoides vanbelleni*, whereas *Anomalinoides capitatus* from the Eocene is a synonym of the forms included in *Truncatulina granosa Hantken*, 1875 and *Anomalina dorri* Cole, 1928. On the other hand, *Anomalinoides granosa* (van Bellen, non Hantken) from the Montian of Holland is a synonym of *Anomalina danica* Brotzen. According to the present authors, *Anomalina grosserugosa* Gümbel should be included in the above discussion. All the species mentioned above differ from one another mainly in ornamentation and further detailed studies are needed for definition of their interrelations.

Occurrence. — *Anomalina danica* Brotzen represents the species which was occurring in Europe from the Upper Cretaceous up to the Upper Eocene. It is a cosmopolitan species, characterized by a wide geographic distribution.

Genus *Boldia* van Bellen, in van den Bold, 1946

Boldia rotundaeformis (Schutzkaja, 1958)

(Pl. XII, Figs. 1,2)

1958. *Rotalia rotundaeformis* Schutzkaja; E. K. Schutzkaja, Foraminifery verchnich sloev..., p. 202, Pl. 2, Fig. 5.

Material. — Eighteen poorly-preserved specimens.

Dimensions (in mm):

	F. XIII/62	F. XIII/63
Longest diameter	0.44	0.59
Shortest diameter	0.34	0.49
Height	0.20	0.25

Description. — Test trochospiral, plano-convex or plane on both sides; peripheral outline more or less angularly lobulate, particularly in juvenile forms; peripheral margin truncate. Chambers, 6—8 in number in the last whorl, coiled into at least 2 whorls; only the last whorl is visible on the ventral side. Sutures thickened and raised spirally, incised on the umbilical side; typical star-like pattern on the dorsal side of the inner whorl is formed by raised sutures. Aperture in a form of peripheral interiomarginal arch extending onto the umbilical side beneath flap-like margin of the last chamber; earlier apertures commonly visible as sutural slits beneath imbricate flaps of the older chambers. Test covered with

pillar-like tubercles, particularly on the ventral side, occasionally on the dorsal, non-ornamented area of the dorsal side coarsely perforated.

Variation. — Variation concerns mainly size, shape, and ornamentation. As it was already mentioned, smaller specimens, presumably representing juvenile forms, are more angularly lobulate in the peripheral outline. Specimens commonly biconvex, occasionally biplane or even plano-concave, then with peripheral margin more truncated. Ornamentation more or less distinct occasionally obscures development of the umbilical area.

Remarks. — *Boldia rotundaeformis* (Schutzkaja) is similar to *B. lobata* (Terquem, 1882) known from the Paleocene and Eocene of the western Europe, differing from the latter in the angular peripheral outline and star-like pattern formed by raised sutures of the inner whorl on the dorsal side. Moreover, there are certain differences in ornamentation of the ventral side.

Occurrence. — Paleocene (Montian) of Crimea.

The species of the genus *Boldia* are typical of the Meridional Province.

Boldia variabilis n.sp.

(Pl. XI, Figs. 1—3)

1966. *Asterigerina primaria* Plummer; J. Hofker, Meastrichtian, Danian..., p. 257, Pl. 53, Fig. 73 (non *Asterigerina primaria* Plummer, 1926).

Holotypus: Specimen figured on Pl. XI, Fig. 2 (F. XIII/64).

Paratypus: Specimen figured on Pl. XI, Fig. 1 (F. XIII/65).

Stratum typicum: Montian (the uppermost layer of Dano-Montian Beds).

Locus typicus: South-western Crimea, left bank of the Katscha river. Bakchisaray region, vicinity of Simferopol.

Derivatio nominis: *variabilis* — named after its large variation.

Diagnosis. — Test plano-convex to asymmetrically biconvex; more convex on ventral side; peripheral outline lobulate, entire in smaller specimens; peripheral margin broadly rounded. Chambers coiled into $2^1/_2$—$3^1/_2$ whorls, the last of which contains 5—7 chambers. Wall coarsely perforated.

Material. — Thirty specimens; almost all partly damaged.

Dimensions (in mm):

	F. XIII/64	F. XIII/65
Longest diameter . . .	0.64	0.52
Shortest diameter . . .	0.44	0.42
Height	0.36	0.32

Description. — Test trochospiral, plano-convex to asymmetrically biconvex, with ventral side more convex; peripheral outline almost lobulate in larger specimens, entire in smaller ones; larger specimens presumably represent the adult forms; peripheral margin broadly rounded. Chambers, 5—7 in number in the last whorl, weakly inflated in smaller specimens, becoming more inflated in larger ones. Chambers coiled into $2^1/_2$—$3^1/_2$ whorls, only the outermost of which is visible on the ventral

side. Suture incised, particularly on the ventral side, whereas flushed with surface on spiral side, especially of small specimens. Wall coarsely perforated. Aperture in a form of low interiomarginal arch reaching rounded peripheral margin and extending onto umbilical side beneath flap-like margin of the last chamber; earlier apertures remain open in a form of sutural slits beneath imbricate flaps of particular chambers; imbricate flaps are especially well-developed in larger specimens.

Variation. — Variation significant, concerning mainly size and shape of the test. Smaller specimens are relatively higher, being more globulous in shape at the same time. Chambers, subtriangular in cross section in small specimens, become globularly to inflatened in larger ones. In small specimens imbricate flaps are weakly developed or absent; they are well--developed in larger specimens.

Remarks. — *Boldia variabilis* n.sp., the synonym of *Asterigerina primaria* Hofker, 1966 (not Plummer, 1926), cannot be included in the genus *Asterigerina* because of a lack of the features typical for this genus. Structural pattern of the test of *Boldia variabilis* n.sp. and particularly the development of umbilical side and type of aperture, are typical for the representatives of the genus *Boldia* (cf. Loeblich & Tappan, 1964, p. C 755). This species, and especially its large representatives, are very similar to the specimen found in the stratotype of the Montian in Belgium, Puits Goffin, vicinity of Mons and from the Montian of Holland, presumably representing the species identified as *Asterigerina primaria* Plummer by Hofker (1966). Specimens from the Montian of Crimea and western Europe, included in *Boldia variabilis* n.sp., differ from *Asterigerina primaria,* described by Plummer (1926) from the Midway Formation of the United States, in the overall shape and pattern of sutures. In contrast to European forms, the American ones are keeled and with irregularly pustulate umbilicus.

Occurrence. — Paleocene (Montian) of Crimea, Belgium and Holland (Mons Basin and Limbourg region).

Boldia sp.
(Pl. III, Fig. 4)

Material. — Three poorly-preserved specimens.
Dimensions (in mm):

	F. XIII/67	F. XIII/68
Longest diameter . . .	0.52	0.49
Shortest diameter . . .	0.47	0.42
Height	0.34	0.27

Description. — Test trochospiral, high, plano-convex, with truncated, entire margin; chambers, about 8 in number, are hardly visible on the ventral side of the last whorl. Inner whorls obscured; sutures slightly

raised on dorsal side, whereas somewhat incised on ventral. Umbilicus open or obscured with irregularly developed plug, under which, particularly on older chambers, striae typical of the genus *Boldia* can be observed. Slit-like aperture interiomarginal at the base of the last chamber, passes onto the ventral side reaching umbilical depression.

Remarks. — Poor preservation and small number of specimens made univocal identification difficult. However, it may be assumed that they represent the genus *Boldia,* because of the general structural pattern of the test, truncated periphery and the type of aperture (see Loeblich & Tappan, 1964, p. C 755).

Specimens from the Montian of Crimea are similar to specimen of *Boldia carinata* Cushman & Bermudez, 1948, figured by Voorthuysen (1969, Pl. 8, Fig. 1) from the Paleocene of Surinam (Guiana), differing in lateral outline of the test and the number of whorls distinct on the dorsal side. Analogous features of the test may be noticed in some specimens from tropical Montian of Poland (borehole Pamiętowo), described by Pożaryska and Szczechura (1970) as *B. reinholdi* Marie, 1964. However, specimens from Crimea have ornamentation on both sides less distinct.

Occurrence. — Paleocene (Montian) of Crimea.

Genus *Hanzawaia* Asano, 1944

Hanzawaia? bundensis (van Bellen, 1946)

(Pl. X, Figs. 1, 2)

1946. *Anomalina bundensis* van Bellen; R. C. van Bellen, Foraminifera from the Middle Eocene..., p. 73, Pl. 11, Figs. 1—3.
1958. *Anomalina subekblomi* Schutzkaja; E. K. Schutzkaja, Foraminifery verchnich sloev..., p. 208, Pl. 5, Figs. 1—2; Pl. 7, Fig. 4.
1966. *Gavelinopsis bundensis* (van Bellen); J. Hofker, Maestrichtian danian..., p. 57, Fig. 133 (non Pl. 56, Figs. 112, 119).
1966. *Anomalinoides bundensis* (van Bellen); J. Hofker, *Ibid.*, p. 258, Pl. 56, Figs. 106, 117.
1966. *Gavelinella bundensis* (van Bellen); J. Hofker, *Ibid.*, p. 265.
1968. *Cibicides aurouzae* Rouvillois; K. Pożaryska & J. Szczechura, Foraminifera from the Paleocene..., p. 74, Pl. 10, Figs. 8—12 (*here additional synonymy included*).
1970. *Hanzawaia aurouzae* (Rouvillois); Y. Le Calvez, Contribution à l'étude..., p. 201, Pl. 44, Fig. 1.

Material. — Twelve well-preserved specimens.

Dimensions (in mm):

	F. XIII/69	F. XIII/70
Longest diameter . . .	0.74	0.54
Shortest diameter . . .	0.59	0.39
Height	0.29	0.29

Variation. — Significant variation of specimens included in the species

Hanzawaia? bundensis concerns maily size, general shape and ornamentation of the test and development of umbilicus. The variability was well characterized by Schutzkaja (1958), Hofker (1966), Pożaryska and Szczechura (1968*a*).

Remarks. — As regards significant variability and wide geographical distribution of this species, confirmed by the analysis of the comparative material from the Paleocene and Eocene from various parts of Europe, performed by the authors, there is no doubt that all forms synonymized are conspecific. Differences among specimens recorded from various horizons of the Paleocene or Eocene of Europe, presumably related to ecological conditions, are of the same order and character as intraspecific variability of Crimean specimens identified as *Hanzawaia? bundensis*. Representatives of this species from tropical Montian are relatively large, with widely open umbilicus and with particular chambers as well as their umbilical extensions, i.e. flaps, well-developed (see specimen from Polish Montian, Pl. XV, Fig. 2). Forms inhabiting more boreal basins are smaller, weakly developed and have distinctly opened umbilicus. Presumably due to its high variability this species has been included to so distant genera.

According to the present authors, morphology of the test of this species is the most similar to that of the genus *Hanzawaia* Asano (cf. Le Calvez, 1970), differing, however, in the opened umbilicus. Therefore, the species under discussion is included in the genus *Hanzawaia* with restriction.

Occurrence. — Paleocene (Montian) of Crimea, Poland, Belgium and Holland (Mons Basin and Limbourg region); Paleocene (Thanetian) of France; Eocene of France.

Family **Ceratobuliminidae** Cushman, 1927
Genus *Schlosserina* Hagn, 1954
Schlosserina asterites (Gümbel, 1868)
(Pl. XIII, Figs. 1—3)

1868. *Rosalina asterites* Gümbel; C. W. Gümbel, Beiträge zur Foraminiferenfauna..., p. 658, Pl. 2, Fig. 101.

1958. *Epistomina inkermanica* Schutzkaja; E. K. Schutzkaja, Foraminifery verchnich sloev..., p. 205, Pl. 3, Fig. 2.

1964. *Schlosserina asterites* (Gümbel); A. R. Loeblich Jr. & H. Tappan, Treatise..., p. C 777, Fig. 640/1.

?1968. *Stomatorbina* sp.; K. Pożaryska & J. Szczechura, Foraminifera from the Paleocene..., p. 94, Pl. 10, Figs. 1, 2.

Material. — Approximately 30 specimens, rather poorly preserved.

Dimensions (in mm):

	F. XIII/71	F. XIII/72
Longest diameter . . .	1.05	1.08
Shortest diameter . . .	0.83	0.83
Height	0.49	0.49

Variation. — Variation significant, concerning mainly the shape and size of the tests. Besides the forms distinctly biconvex, there are plano-convex ones. Slit-like apertures not always observed within the umbilical region. Umbilicus commonly closed, occasionally open to a different degree, similarly as sutural slits radiating from it (cf. Pl. XIII, Fig. 3).

Remarks. — Crimean specimens identified as *Schlosserina asterites* are very similar to the neotype of this species, figured by Loeblich and Tappan (1964) from the Eocene of Bavaria, and are presumably conspecific with the specimens included in *Epistomina inkermanica* by Schutzkaja (1958). Similar forms, although devoid of the last chambers on which the multiple aperture typical of the genus *Schlosserina* and *S. asterites* occurs, were recorded by the present authors from the Montian of Poland as *Stomatorbina* sp. (see Pl. XIV, Fig. 2); the lack of diagnostic features on the specimens from Poland precludes a statement whether they are related to Crimean forms or not.

Occurrence. — Paleocene (Montian) of Crimea and (?)Poland; Eocene of Germany (Bavaria).

Gen. et sp. indet.
(Pl. VIII, Fig. 4)

Material. — One well-preserved specimen.
Dimensions (in mm):

	F. XIII/74
Longest diameter . . .	0.39
Shortest diameter . . .	0.34
Height	0.25

Description. — Test trochospiral, high-spired, with concave umbilical side. Peripheral outline lobulate; peripheral margin sharply rounded. Successive chambers rapidly increase in size, 5 in number in the last whorl; on the ventral side only the last whorl observable, whereas approximately 3 whorls may be traced on the spiral side; chambers inflated, perforated and somewhat roughened on the dorsal side, whereas smoothed and flattened on the ventral one. Sutures deeply incised on the dorsal side to nearly flush with the surface of the test on the ventral.

Umbilicus deep and open, bordered by the umbilical extensions of chambers covering the supplementary apertures. Umbilical aperture interiomarginal, almost reaching the test margin.

Remarks. — The form under discussion is most similar to the specimen from the Eocene of France, identified as *Glabratella diadematoides* (Le Calvez, 1959) by Le Calvez (1970), differing in ornamentation of the test, particularly on the ventral side, which is smooth in Crimean specimen and radially papillose in the French one; there is also some difference in the arrangement of chambers on the spiral side of the forms compared.

The development of umbilical region in both forms seems to be very similar, however, it markedly differs from that attributed to representatives of the genus *Glabratella* by Loeblich and Tappan; while the latter forms are characterized by „aperture a small rounded opening restricted to open umbilicus..." (Loeblich & Tappan, 1964, p. C 589, 1c.), the Crimean form has an interiomarginal aperture and supplementary apertures around the umbilicus. Thus the Crimean species is not assigned to the genus *Glabratella*. Nevertheless, it should be stressed that all the other features of the Crimean specimen are typical of the representatives of the genus *Glabratella*.

Occurrence. — Paleocene (Montian) of Crimea.

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CIEPŁOLUBNE OTWORNICE W POŁUDNIOWEJ PROWINCJI MONTU EUROPEJSKIEGO

Streszczenie

Praca ta jest kontynuacją rozważań autorek (Pożaryska & Szczechura, 1968, 1970) na temat rozprzestrzenienia prowincji paleogeograficznych — merydionalnej i borealnej, jakie wspomniane autorki wyróżniły w dolnym paleocenie Europy pozaalpejskiej. Rozważania na ten temat są wynikiem analizy otwornic z szeregu prób pochodzących z różnych krajów, z tych odsłonięć i wierceń, skąd sygnalizowano osady wieku monckiego. Wyróżniono w Polsce i Europie dwa zespoły otwornic monckich, związanych z różnymi warunkami klimatycznymi, tj. prowincją borealną i merydionalną. W niniejszej pracy autorki zwróciły szczególną uwagę na zespół otwornicowy, opisany z montu Krymu przez Szucką (1958), a następnie zrewidowany przez Jarcewą (1966) i dokonały szczegółowej analizy systematycznej kluczowego paleoceńskiego zespołu otwornic, zwłaszcza ciepłolubnych, wspólnych dla Europy zachodniej, Krymu i Polski. Autorki sprecyzowały też bliżej północne peryferie prowincji południowej montu, a w szczególności strefę przejściową między prowincją borealną i merydionalną, gdzie wpływy ciepło i zimnolubnych zespołów faunistycznych zazębiały się.

W zbadanym zespole otwornic z montu Krymu wyróżniono 33 gatunki (w tym 3 gatunki nowe), należące do 26 rodzajów i 10 rodzin. Większość osobników, a także większość spośród wyróżnionych gatunków reprezentuje formy ciepłolubne, które stanowią 60% wszystkich wyróżnionych w niniejszej pracy gatunków. Mikrofauna ze stratotypu montu, tj. z Puits Goffin (basen Mons) stanowi zespół bardzo zbliżony pod względem taksonomicznym do zespołu otwornicowego, stwierdzonego w moncie tropikalnym Krymu. Zawiera on 50% gatunków występujących na Krymie, z tym, że w moncie Belgii są one reprezentowane przeważnie przez formy drobniejsze i silnie obtoczone. W obu zespołach otwornic tropikalnych montu, zarówno Belgii jak i Krymu, uderza brak form planktonicznych.

Stwierdzenie obecności otwornic ciepłolubnych w osadach montu Krymu pozwala rozszerzyć przyjęty dotychczas zasięg prowincji merydionalnej (Pożaryska & Szczechura, 1968*a*) dalej na południowy wschód, na obszar Krymu. Ta prowincja merydionalna najwcześniej zaczęła się kształtować na terenie Belgii w basenie Mons, gdzie już w górnym mastrychcie zaistniały warunki sprzyjające rozwojowi faun ciepłolubnych. Ekspansja ciepłego, płytkiego morza następowała stopniowo, gdyż morze to dotarło poprzez Niemcy do Polski dopiero w wyższym moncie, zaś na teren Krymu w najwyższym moncie (Szucka, 1958, Jarcewa, 1966). Tak więc mikrofauna ciepłolubna, dzięki zaistniałym, sprzyjającym warunkom, pojawiła się znacznie wcześniej, bo w górnym mastrychcie na zachodnich peryferiach Europy, podczas gdy na jej południowo-wschodnich krańcach (Krym) występuje dopiero z końcem

montu. Przemieszczanie się faun następowało z zachodu na wschód, kolebką dolnopaleoceńskiego zespołu ciepłolubnych otwornic była zachodnia Europa. Wydaje się, że optymalne warunki dla rozwoju otwornic ciepłolubnych panowały na Krymie, gdzie mikrofauna otwornicowa rozwinęła się najpełniej, i to zarówno pod względem zróżnicowania gatunkowego, jak i stanu wykształcenia skorupek. Zalew ciepłego morza montu na Krymie musiał być nader krótkotrwały, skoro pozostawił osady nie w postaci ciągłej warstwy, lecz w charakterze soczewki.

ЯНИНА ЩЕХУРА & КРЫСТЫНА ПОЖАРЫСКА

ТЕПЛОЛЮБИВЫЕ ФОРАМИНИФЕРЫ ИЗ МЕРИДИОНАЛЬНОЙ ПРОВИНЦИИ МОНТСКОГО ЯРУСА ЕВРОПЫ

Резюме

Настоящая работа является продолжением обсуждения проблемы распространения палеогеографических провинций — меридиональной и бореальной которые были определены авторами в нижнем палеоцене внеальпийской Европы (Пожарыска & Щехура, 1968, 1970). Рассуждения на эту тему основываются на изучении фораминифер, извлеченных из пород, слагающих обнажения или вскрытых буровыми скважинами в разных странах и отнесенных к монтскому ярусу. На территории Польши и всей Европы выделены два комплекса монтских фораминифер, связанных с разными климатическими условиями, образующими меридиональную и бореальную провинции. В настоящей работе авторы обращают главное внимание на комплекс фораминифер из монтского яруса Крыма, описанный Шутской (1958), а впоследствии пересмотренный Ярцевой (1966), и проводят детальный систематический анализ основного палеоценового комплекса фораминифер, в особенности форм теплолюбивых, общих для территории Западной Европы, Крыма и Польши. Авторы уточняют также северную периферическую зону теплой монтской провинции и особенно промежуточную зону между бореальной и тропической провинциями, в которой перемежались влияния теплолюбивых и холодолюбивых фаунистических сообществ.

В исследованном комплексе фораминифер из монтского яруса Крыма определены 33 вида (в том числе 3 новых), относящиеся к 26 родам, 10 семействам. Большинство экземпляров, а также большинство определенных видов, представляет теплолюбивые формы, составляющие 60% всех видов, выделенных в настоящей работе. Микрофауна монтского стратотипа из Пюи-Гоффен (бассейн Монс) представляет комплекс, в таксономическом отношении очень сходный с комплексом фораминифер из тропического монтского яруса в Крыму. Она вклю-

чает 70% видов, распространенных в Крыму, однако формы этой микрофауны в монтских породах Бельгии мельче и сильно окатаны. В комплексах тропических фораминифер монтского яруса как Бельгии, так и Крыма отсутствуют планктонные формы.

Выявление теплолюбивых фораминифер в монтских отложениях Крыма заставляет передвинуть установленную до сих пор границу теплой монтской провинции (Пожарыска & Щехура, 1968) дальше к юго-востоку, на территорию Крыма. Эта меридиональная провинция началась формироваться раньше всего на площади бассейна Монс в Бельгии, где уже в конце маастрихта возникли благоприятные условия для развития теплолюбивых форм. Распространение теплого мелководного моря происходило медленно, так как территория Польши была охвачена этим морем через Германию только лишь в позднемонтское время, а территория Крыми в самом донце монтского века (Шутская, 1958; Ярцева, 1966). Следовательно, теплолюбивая микрофауна в связи с благоприятными условиями появилась немного раньре — в верхнем маастрихте в западной периферии Европы, а на юго-восточной окраине (Крым) только лишь в конце монтского века. Перемещение фауны происходило в направлении с запада на восток, а зарождение этого комплекса теплолюбивой фауны нижнего палеоцена произошло в западной Европе. Предполагается, что оптимальные условия развития теплолюбивых фораминифер сформировались в Крыму, где фораминиферовая микрофауна получила наиболее полное развитие как в отношении видового богатства, так и в отношении развития раковин. Трансгрессия монтского теплого моря на территории Крыма была, повидимому, кратковременная, так как осадки этого моря не образуют сплошного, даже маломощного, покрова и залегают в виде отдельных линз.