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FORAMINIFERIDA FROM THE PALEOCENE OF POLISH CARPATHIANS (BABICA CLAYS)

PALEOCEŃSKIE OTWORNICE Z IŁÓW BABICKICH, Z KARPAT POLSKICH

BY
JANINA SZCZECHURA & KRYSTYNA POŻARYSKA

(WITH 4 TEXT-FIGURES, 1 TABLE AND 38 PLATES)

WARSZAWA—KRAKÓW 1974

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CONTENTS

ABSTRACT

The authors described 132 species of Foraminifera, including 2 new species and 1 new subspecies, from Babica clays outcropping at Babica and Płosina villages, Skole and Subsilesian tectonic Units, external part of Polish eastern Carpathians. Some associated ostracodes, plant remains and nannoplankton are also determined. On the basis of comparative materials from Lower Paleocene outcropping in Polish Carpathians, Polish Lowlands and outside of Poland, revision of many species is done and proper specific names established. The foraminifers and especially the planktonic foraminifers indicate the Thanetian age of the studied samples of Babica clays.

The area on which Babica clays were deposited belonged in the Paleocene to the typical Flysch basin of the Carpathians. Sedimentary environment of Babica clays may be classified as being marine, shallow-water, near-shore and warm. Some ideas concerning the palaeoecology and palaeogeography of the area in question are presented.

In foraminiferal assemblages of the Babica clays there occur elements known both from Tethyan Ocean deposits, stretching almost equatorially from Mexico to New Zealand, and from deposits of European epicontinental seas. This result from the fact that the place of deposition of these clays was situated at the contact of two contrasting areas of sedimentation — Carpathian geosyncline and Polish epicontinental marine basin.

INTRODUCTION

The Babica clays have been the subject of stratigraphic and faunal studies hence 1917, when they were distinguished by KROPACZEK. The interest they are attracting is mainly due to the fact that Babica clays — compared with other Carpathian Paleocene deposits — contain rich macro- and microfaunas. They contain molluscan shell debris, bryozoans, corals, echinoderm spines, ostracodes, nannoplankton, etc. So far, molluscans are the best known faunal elements of these clays. They were described mainly by ROGALA (1927) and KRACH (1963, 1969). Foraminiferal microfauna of these clays was described by BIEDA (1946), MORGIEL (1959, 1969 MS), GEROCH and KOTLARCZYK (1963), and others.

The present authors took interest in foraminiferal microfauna of Babica clays because it represents microfauna of Upper Paleocene, i.e. of the deposits not occurring in the Polish Lowlands, which has been the subject of the authors' earlier studies. The authors have studied Paleocene foraminifers from the Babica clays, compared the results with previously studied Paleocene foraminifers from the Polish Lowlands, and then they determined regional distribution of all the studied foraminiferal assemblages. On the basis of those studies the authors have drawn conclusions on the relationships between geographical distribution of foraminifers and their environmental conditions, strictly speaking sedimentary conditions of the marine basin which these microfaunal assemblages inhabited.

In the present paper, 132 species and subspecies, including 2 new species and 1 sub-

species, representing 30 families and 66 genera, are described. This wealth of Paleocene foraminiferal fauna makes Babica and Płosina localities, from where the here examined samples are taken, some of the most important in studies of Paleocene foraminiferal faunas of the Polish Carpathians.

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The participation of authors in the preparation of this paper is as follows: K. POŻARYSKA described arenaceous Foraminifera (20 species), whereas J. SZCZECHURA described calcareous, both benthic and planctonic Foraminifera (112 species) as well as identified the ostracodes and plants remains discussed in the paper. J. SZCZECHURA is the author of all the palaeoecological and palaeogeographical conclusions, while both authors are responsible for other ones.

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GENERAL PART

MATERIAL

The material studied was collected mostly from Babica clays outcrops at Babica and Płosina villages, south of Rzeszów (Text-fig. 1).

The Babica locality is situated about 2 km south of Babica village. Here, on the left bank of Kosina stream, 8 meter profile of Babica clays is exposed. Four samples were taken at 2.5, 4, 5, and 6 m above stream bottom. Dark-gray to black, unstratified, sometimes slaty-like clays, with thin, up to 0.1 m, coarse sandstone intercalations rich in shell detritus, are outcropping in the profile. The sandstone intercalations yield the same macrofauna as the surrounding clays (W. KRACH, personal inf.). Dip 30° to the north. A detailed description of this profile was given by KRACH (1969). A similar profile of Babica clays, also exposed in Kosina stream bank in the vicinity of Babica village, was described by MORGIEL (1959).

The Płosina outcrop is situated about 0.5 km west of Płosina village. Similarly as in the Babica locality, Babica clays outcrop in about 6 m high stream bank. Unstratified clays with admixture of coarse, unsegregated material, lithologically resembling the so-called fossil loam, are exposed there. The clays are in places somewhat slaty-like and reach 8 to 10 m in thickness. They are overlayed by sandstone layers. From this profile, four clay samples were taken at 1 m intervals and a few supplementary samples along the profile. Detailed description of this profile was given by KRACH (1969).

At the authors' disposal there were also some additional samples from Babica and Płosina localities, samples of Babica clays and marls outcropping at Bircza (GEROCH & KOTLARCZYK, 1963), and samples of Babica clays and clay slates outcropping in Sufczyna near Bircza, in the bank of a stream flowing from Korzenica hill in Dobromil Carpathians.

Babica clay samples collected in Babica and Płosina localities yielded fragments of bryozoans, gastropod and pelecypod shell detritus, ostracod tests, plant remains, and numerous foraminifers. Both benthonic (agglutinated and calcareous) and planktonic foraminifers were found. Microfaunal elements are generally poorly preserved, crushed or fragmentated. Foraminifers are usually represented by dwarfish forms.

The study also comprised comparative materials previously gathered by the second author from several countries, where Paleocene strata are well-developed. The samples were, in part, used in previous studies of the present authors (POŻARYSKA, 1965; POŻARYSKA & SZCZECHURA, 1970; SZCZECHURA & POŻARYSKA, 1971). The comparative materials primarily represent the Paleocene developed in epicontinental facies and were gathered from the stratotypes of the Thanetian (Kent, England) and Montian (Puits Goffin and Puits d'Obourg, Belgium), Montian and Thanetian strata of Paris Basin (France), Paleocene strata of Holland (Bunde) and Sweden (Klagshamn, Limhamn), Paleocene and Eocene strata of Denmark

(Stevns Klint, Hvalloese, Roesnes), Paleocene of Germany (Krefeld), Paleocene and Eocene of Ukraine (Luzanovka), and Paleocene of Crimea (USSR).

The present paper deals with the Paleocene of the Carpathians which belonged to the Tethyan region. That is why the authors also gathered further comparative materials of

Fig. 1
Sketch map of Paleocene deposits containing sites in Poland, studied by the present authors.

Paleocene deposits developed in geosynclinal, mostly flysch-like facies from various parts of the Tethyan region. These materials included samples from Paleocene (Velasco Fm.) and Eocene (Aragon Fm.) of Mexico, Cretaceous and Paleocene (Frydek Fm.) of Slovak Carpathians, Paleocene of Austria (Kroisbach, Graben, Reichenhall), Paleocene of Italy (Vieste Cape Gargano), Paleocene of France (Atlantic coasts of Aquitanian Basin — Bidart near Biarritz), Paleocene of Germany (Kressenberg) and Oligocene of Hungary (*Clavulina szaboi* beds from Budapest region).

GEOLOGICAL SETTING AND ORIGIN OF BABICA CLAYS

Babica clays sensu stricto, also known as Babica beds (ŚWIDZIŃSKI, 1947), occur in flysch series of Skole and Subsilesian nappes. They are best represented in marginal parts of the nappe (Text-fig. 2), south of Przemyśl and Rzeszów, disappearing at the distance of 15-35 km south of the northern margin of the Carpathians. Babica clays represent volumetrically subordinate, but nevertheless lithologically and facially very characteristic element of the flysch complex. Babica clays were deposited in peripheric, northernmost parts of the geosyncline of the outer Carpathians. In this geosyncline, deposition of mainly flysch deposits continued from the Tithonian to Oligocene. In Miocene, they were folded into forms resembling tectonic slices close to the northern margins of the Carpathians, and passing to the south into folds with steep and narrow anticlinal and wide synclinal elements. These tectonic forms thrusted over one another and also translocated Miocene deposits of Carpathian Foredeep at least 12 km to the north (KSIĄŻKIEWICZ, 1972).

Paleocene deposits, somewhat older than Babica clays, occur about 150 km to the north of the Carpathians, south-east of Lublin.

Babica clays are mostly represented by discontinuous beds or lense-like intercalations varying from a few to about a dozen meters in thickness. They overlay *Inoceramus* beds, commonly represented by sandstones and conglomerates, or Paleocene slates and sandstones, passing upward into gray marls, which are developed in the top part of the *Inoceramus* beds. The Babica clays, together with overlying black to black-gray slate-like sandy clays with pebbles and sandstone intercalations form the series of Babica clays up to 50 m thick (WATYCHA, 1949 MS). Babica clays series is found only in some tectonic slices situated close to the margin of the Carpathians. Babica clays, as a rule, are overlayed by mottled Lower Eocene slates.

It should be noted that dark clays with pebbles, facially close to Babica clays, are known to occur in the same tectonic slices and folds. They are known to occur in Jamno type sandstones of the upper parts of *Inoceramus* beds, where they are of the Upper Cretaceous age, and in Oligocene series; the latter, Oligocene clays, are known as Popielno clays. It follows from the literature (PAZDRO, 1931; WATYCHA, 1949 MS; BIEDA *et al.*, 1963, a.o.) that deposits facially close to the above are quite common in the Carpathian Flysch.

Babica clays were described for the first time and named after Babica village by KROPACZEK (1917). Babica clays proper are built of slate-like, weakly consolidated, sandy clays yielding numerous pebbles and boulders of sandstones, Stramberg limestones, crystalline rocks and other exotics (KROPACZEK, 1917) up to 2.5 m in diameter. Moreover, the clays yield fragments of coals and pebbles of Devonian and Carboniferous dolomites and limestones, and Jurassic limestones. These exotics are generally well rounded (presumably in surf zone) and some of them bear traces of intense weathering. Generally, pebbles are more numerous in lower parts of Babica clays than in upper parts where sandy laminations appear. This may indicate some sedimentary gradation in these deposits (BUKOWY, 1956).

Unfragmentated material derived from older flysch strata and occasionally occurring in substantial amounts in Babica clays is of remarkable importance for interpretation of the origin of these clays. Occurrence of this material implies that Babica clays underwent post-depositional translocation by slumping. WATYCHA (1949 MS) and BUKOWY (1956) regard Babica clays as mostly fossil loam resulting from subaqueous slumpings. This point of view is supported by GEROCH and KOTLARCZYK (1963), who carried out detailed studies on exotics horizons of Skole unit. In Babica clays outcropping at Bircza, the latter authors found large blocks of older rocks derived from the substrata. The blocks are formed of *Baculites* marls

of the Upper Senonian age and of sandstone-slaty packets of *Inoceramus* beds. Babica clays from Bircza also contain lumps of marls coated with quartz grains. Microfaunistic studies carried out by GEROCH and KOTLARCZYK (1963) showed that microfauna yielded by these marl lumps is of the same age as that found in the matrix, i.e. of the Middle Paleocene age (Upper Paleocene according to the present authors). Remarkable size and concentration of exotics of the whole packets of flysch rocks as well as the lack of gradation of Babica clays outcropping at Bircza implicate that the front of a subaqueous slump is exposed here. Deposits outcropping here correspond to wildflysch of Austrian and Swiss geologists (which was already noted by SUJKOWSKI, 1957). Occurrence of wildflysch in the Upper Paleocene of the Car-

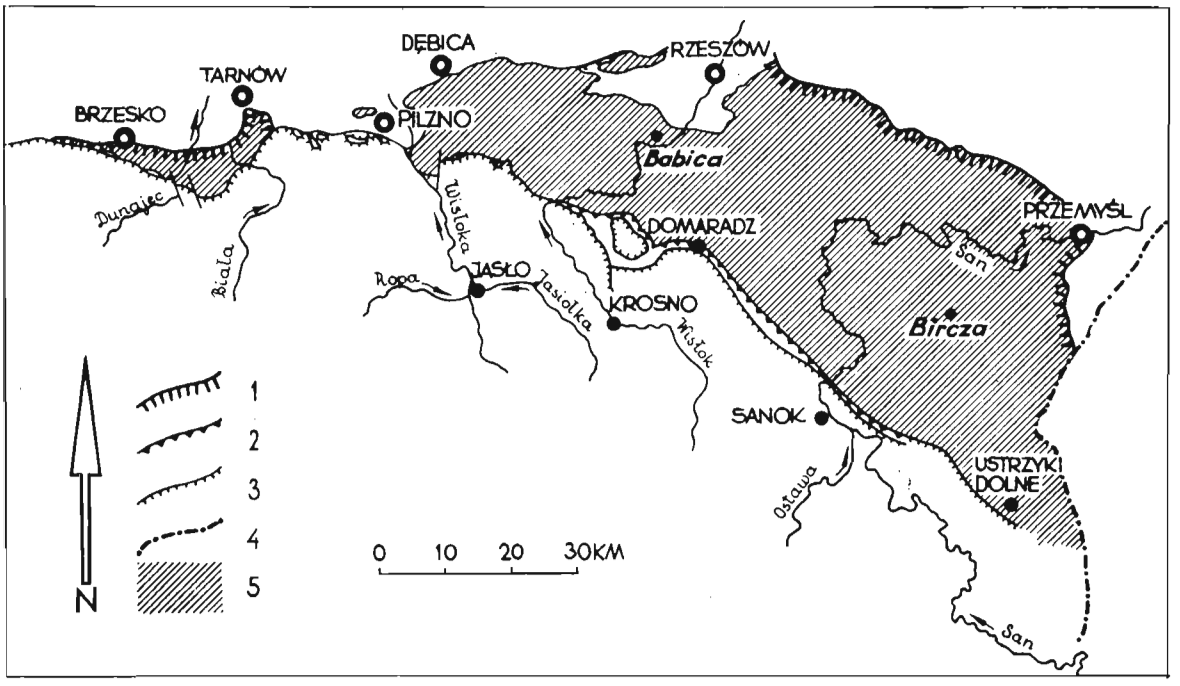

Fig. 2

Position of Babica clays outcrops within the Skole Unit of the Carpathians (after WDOWIARZ, 1949); *1* Northern margin of the Carpathians, *2* Overthrust of the Subsilesian Unit, *3* Overthrust of the Silesian Unit, *4* State boundary, *5* Skole Unit

pathians indicate high mobility of the bottom of flysch basin. This mobility appears synchronous with the final phase of Laramie rebuilding of Polish Lowlands. This period of increased mobility of flysch basin bottom also corresponds to the times of emergence of the forefield of the outer Carpathians, where it is indicated by the lack of marine Thanetian deposits in the latter areas.

The situation observed at Bircza is not typical of the Babica clays, as they not always represent deposits of the front of subaqueous slump. For example, exotics material content is very low at Babica and Płosina. Lithology and sedimentary structure of Babica clays appear specific for a given rock series, varying from one locality to another. However, middle parts of the slump, where turbidites should prevail, are generally lacking in the Babica clays series. The studies on Babica clays exposed at Bircza (GEROCH & KOTLARCZYK, 1963) indicate a rapid deposition, as dense suspension moving in the form of water-saturated mud could not be separated into size grades. The deposited mass could also be represented by partly lithified

rock, as besides exotics and grained material it contained whole rock series, somewhat disturbed and most probably rather rapidly buried by other deposits. In other places deposition of Babica clays presumably proceeded in the way typical of small depression of low water energy. This is indicated by much smaller contribution of exotics and partial gradation of the deposit observed at Babica and Płosina (KROPACZEK, 1917; ŚWIDZIŃSKI, 1947, a.o.), and at Olszany (WATYCHA, 1949 MS). The laminate mudstone found in top parts of Babica clays presumably represents a lighter fraction which underwent strong dispersion and was accompanying the slump in the form of suspension cloud (BUKOWY, 1956). This would indicate a period of sedimentary rest during the last phase of translocation of the subaqueous slump.

Thus the variable facies development and the structure of Babica clays, differences between microfaunal, and particularly between foraminiferal assemblages described below, support the point of view of earlier authors that the Babica clays undoubtedly represent subaqueous slump deposits. Various outcrops of these clays represent sections of different slump deposits rather than deposits of the same slump.

Accurate estimation of the depth at which these clays were deposited appears difficult. The fossils found in these clays may only indicate the depth at which the fauna lived and from which the materials building Babica clays were transported by slumpings.

Babica clays yield pelecypod and gastropod shell detritus, fragments of bryozoans, ostracods, foraminifers, coccoliths, plant remains, and other bioclasts. According to KRACH (1963, 1969), the molluscan fauna lived at the depth not greater than 75 m. Earlier analyses of foraminiferal fauna implied rather shallow-water conditions. Foraminifers from Babica clays represent two markedly different assemblaged, namely: (1) an assemblage of agglutinated foraminifers, and (2) an assemblage of benthic, agglutinated-calcareous foraminifers with varying contribution of planktonic ones (BUKOWY, 1956, 1957; MORGIEL, 1959; BIEDA *et al.*, 1963). Environmental requirements of agglutinated foraminifers are still the subject of controversy. BIEDA'S (1969) holding that these foraminifers inhabited shallow water, or even partly brackish environment, remains rather isolated. According to that author (BIEDA, 1969), the assemblage of exclusively agglutinated foraminifers was related to shallow-marine, or even lacustrine environment of enclosed bays and river mouths. Shallow-water deposition of Babica clays was previously suggested by WATYCHA (1949 MS). WATYCHA (1949 MS, and personal inf.) considers these clays as slump deposits transported at the distance not greater than a few to about a dozen kilometers from basin shores. WATYCHA also admits that both structure and lithology of these clays suggest deltaic or estuarine environment of the primary deposition. Deposition of this Babica-clay-building material took place in areas of abundant supply of terrigenous material. Near-shore localization of these areas of initial deposition is implied by very good rounding of exotic blocks, resulting from surf action, and by lack of sorting.

The present authors found only calcareous-agglutinated foraminiferal assemblages, accompanied by ostracodes and plant remains. Analysis of this foraminiferal assemblage, described below, confirms an environment of shallow shelf sea connected with open ocean basins. Also ostracodes from Babica, identified by J. SZCZECHURA as: *Kingmaina* cf. *opima* SZCZECHURA, 1965, ?*Cytheromorpha* sp., *Aulocytheridea* sp., *Bairdia* sp., *Cytherella* sp., *Quadracythere* sp., *Amphicytherura limburgensis* HOWE & LAURENCICH, 1958 and *Schizocythere solida* SZCZECHURA, 1965, and from Bircza: ?*Uroleberis mazoviensis* SZCZECHURA, 1965, *Cytherura* sp., *Pulaviella* cf. *ovata* (BONNEMA, 1941), *Hermanites* sp., ?*Paracytheretta* sp. and *Krithe* sp., indicate marine, rather shallow-water environment of normal salinity; however, ?*Cytheromorpha* sp. would be an exception here as it represents rather littoral, mesohaline

form. Restriction concerning the generic assignment of the latter form is made as it is based on the closed carapaces only.

Among plant remains found in Babica clays, J. SZCZECHURA identified seeds *Eurya stigmosa* (LUDWIG, 1860) of the family Theaceae. This species is known to occur since the Cretaceous to Miocene, and was previously reported from the Paleocene flysch of Slovak Carpathians (KNOBLOCH, 1971) and found by SZCZECHURA in comparative material from the Paleocene of Kroisbach (Austria). According to MAI (1967) and KNOBLOCH (1971), occurrence of this form indicates warm climatic conditions, and according to the latter author, it proves proximity of shores, as it cannot be transported on any greater distances.

It follows from the above discussion that Babica clays presumably represent shallow marine shelf deposits, redeposited to various distances, and only locally occurring in situ.

CHARACTERISTICS OF FORAMINIFERAL ASSEMBLAGE OF BABICA CLAYS

The foregoing discussion concerns foraminiferal assemblage from Babica clays outcropping at Babica and Płosina villages. For comparative purposes, foraminiferal assemblages from other localities of Babica clays proper were studied. The Babica clays proper are regarded to be of the Paleocene age (MORGIEL, 1959; KRACH, 1969; GEROCH & KOTLARCZYK, 1963). However, lower part of Babica clays may be of the Maastrichtian age (MORGIEL *in* SZYMAKOWSKA, 1961), whereas top parts of Babica clays exposed in other localities may represent the Lower Eocene (BIEDA, 1946).

The foraminiferal assemblage studied comprises about 200 species, 132 of which are analysed in the systematic part of this monograph. Species, represented by not numerous or badly preserved specimens and thus not described in the systematic part are as follows: *Allomorphina halli* BROTZEN, *Bulimina minuta* (MARSSON), *B. (Desinobulimina) suteri* CUSH. & RENZ, *Ellipsopleurostomella* sp., *Mississippina* sp., *Patellina* sp., *Glabratella* sp., *Baggatella* sp., *Triloculina* sp., *Islandiella* sp., *Cyclammina* sp. and *Rectobulimina* sp. These species were discarded from the analysis of quantitative and qualitative composition of the assemblage. The analysis did not comprise almost all the common forms of the families Polymorphinidae and Lagenidae either, as these forms are neither stratigraphically sensitive in the Lower Tertiary, nor equivocally interpreted. Moreover, single Cretaceous foraminifers, mostly globotruncanas and neoflabellinas, were neglected in the analysis as undoubtedly redeposited forms.

The foraminiferal spectrum obtained may be characterized as follows: agglutinated foraminifers contribute ca. 15% of the species to the assemblage, calcareous planktonic foraminifers — ca. 10%, and calcareous benthic foraminifers — ca. 75%. The calcareous benthic foraminifers prevail in both the number of species and the number of representatives of a species. Moreover, it should be noted that the contribution of planktonic foraminifers was overestimated as sample enrichment was performed by CCl_4 method utilizing differences in specific weight of rock particles and microfauna.

The list of species described and their stratigraphic ranges are given in Table I. The tables show that about 25% of the species are characterized by long stratigraphic ranges, as they are known at least from the Upper Cretaceous up to the Eocene. Some of them persisted to the Oligocene or even to a later period. About 20% of the species appeared not before the

Paleocene and persisted at least to the Early Eocene. About 25% of the species occur from the Cretaceous to the end of Paleocene, and about 30% are known from the Paleocene only. Two species only were not reported from strata older than Eocene. The above analysis comprised both the species whose palaeontological interpretation and stratigraphic ranges are doubtless, and those which remain controversial.

It is left to planktonic forms to determine the age of the foraminiferal assemblage in question more exactly. These forms are indicative of the Upper Paleocene (Thanetian) age. The age determination is based on the following species: *Globorotalia velascoensis* (CUSHMAN), *G.* cf. *laevigata* BOLLI, *G. whitei* WEISS, *Globigerina velascoensis* CUSHMAN and *G.* cf. *yeguaensis* WEINZIERL & APPLIN. However, the above species are represented by a few specimens. Among angulate *Globorotalia*, representatives of *G. angulata* WHITE and *G. chapmani* PARR predominate.

The Late Paleocene age of the assemblage seems to be confirmed by some benthic forms, such as *Cribrononion subnodosum* ROEMER, *Pararotalia* cf. *minuta* (COLOM), *Rotalia lithothamnica* UHLIG and *Eponides umbonatus* (REUSS). However, the last two species were not reported from strata older than Eocene and had most probably been redeposited.

The Paleocene age of the Babica clays series was formerly suggested by KROPACZEK (1917), ROGALA (1927), BIEDA (1946), MORGIEL (1959) and KRACH (1969). The last author (KRACH, 1969) assumed rather the Mid-Paleocene age of molluscans occurring in Babica clays from Babica and Płosina localities.

Dr A. S. GRIGOROWICZ (Inst. Geol. USSR, Kiev) studied nannoplankton occurring in Babica clays samples from Płosina, collected by Prof. W. KRACH. The analysis showed that the following Lower Paleocene nannoplankton zones, proposed by MARTINI (1970), may be distinguished:

NP2 *Cruciplacolithus tenuis*,

NP3 *Chiasmolithus danicus*,

NP4 *Ellipsolithus macellus?*

In turn, an analysis of foraminifers occurring in Babica clays from Bircza carried out by GEROCH and KOTLARCZYK (1963) showed that these clays are not older than the Paleocene (GEROCH & KOTLARCZYK, 1963, p. 286). These authors reported the following planktonic foraminiferal species: *Globorotalia mckannai* (WHITE), *G. aequa* (CUSHMAN & RENZ) and *G. pseudomenardii* BOLLI. The above assemblage equivocally indicates that Babica clays from Bircza are of the Late Paleocene age, and are somewhat younger that the clays from Babica and Płosina.

Apart from the differences between planktonic forms occurring in Babica and Bircza foraminiferal assemblages, there are also some differences in the composition of benthic foraminifers. Moreover, some differentiation in composition of foraminiferal faunas of particular beds in Bircza and Sufczyna sections was found. A number of forms were found in various combinations in Babica clays as well as in accompanying gray marls and clay slates. A detailed analysis of foraminiferal assemblages of Bircza and Sufczyna sections is out of scope of this monograph and will be published later.

Analysis of Babica clays foraminiferal assemblage indicates a rather shallow, warm, shelf zone of water basin with good connection with the open ocean basin. Suggested conditions are evidenced by occurrence of foraminiferal genera such as *Asterigerina, Ceratobulimina, Lamarckina, Epistomina, Bolivina, Aragonia*, keeled *Globorotalia, Rotalia, Pararotalia, Thalmannita, Glabratella, Baggatella*, and others. The last 5 have even the same species as typical of warm-water foraminiferal assemblage occurring in the Paleocene strata of Meridional

province (see POŻARYSKA & SZCZECHURA, 1968, 1970; SZCZECHURA & POŻARYSKA, 1971). This Meridional foraminiferal assemblage is known from zoogenic Paleocene strata deposited in shallow, even lagoonal parts of epicontinental marine basins in Belgium, Netherlands, France (Paris Basin), Crimea, and in the Polish Lowlands; but in the last case it is represented by less typical forms.

Seeds of *Eurya stigmosa* (LUDWIG) found in the residuum imply warm subtropical climatic conditions (MAI, 1967) as well as shallow water origin of these strata (KNOBLOCH, 1971).

Warm-water character of the faunas occurring in Babica clays was already suggested by KROPACZEK (1917). This point of view found support in the studies on co-occurring algae (BUKOWY, 1957). Subsequently, KRACH (1969) arrived at the same conclusion in his studies on molluscan fauna of Babica clays. According to KRACH (1969), the molluscan fauna lived in shallow waters, not deeper than 75 m and of the temperature at least 20°C, i.e. in shallow warm waters under subtropical conditions. According to KRACH (1969), this molluscan fauna is of the Mediterranean character.

BLAICHER and SIKORA (1967) distinguished two principal types of foraminiferal assemblages from Carpathian flysch series on the basis of species composition and their dependance on facies, namely: (1) foraminiferal assemblage typical of flysch facies from deeper parts of sedimentary flysch series, and (2) foraminiferal assemblage typical of non-flysch facies from shallower parts of this series. The foraminiferal assemblage studied by the present authors represents the latter, i.e. non-flysch proper, shallow-water type. This is confirmed by macrofauna mostly preserved in the form of shell debris (KRACH, 1963, 1969), with "traces of wearing out in a turbulent environment" (KRACH, 1963, p. 152).

Among ostracodes recovered from Babica clays, there are shallow-water, rather epineritic species, and, occasionally, mesohaline (brackish-water) species.

DISTRIBUTION OF BABICA CLAYS FORAMINIFERS ON THE AREA OF POLAND

Analysis of distribution of the foraminiferal species known from Babica clays in uppermost Cretaceous and lowermost Paleocene strata of Poland shows certain regularities. Various elements occurring in the assemblage of Babica clays appear typical of the one of two separate palaeogeographical regions, i.e. the Carpathians or the Polish Lowlands.

The distribution of Babica clays species in the Polish Carpathians is still poorly known because of the lack of more extensive and more complete palaeontological studies of Paleocene foraminifers of this region. Previous works were usually of the type of fragmentary contributions to the knowledge of that group. This is related to the fact that Paleocene strata of Polish Carpathians are, however, facially differentiated, in places they are developed in the same facies as underlaying Cretaceous strata. Moreover, these Paleocene strata yield two foraminiferal assemblages, namely: (1) agglutinated foraminiferal assemblage, and (2) calcareous, benthic and planktonic foraminiferal assemblage. The former assemblage is markedly better known, as it is more common and it was recorded from all the tectonic units of the Carpathians, whereas the latter assemblage was usually recorded from the Skole and Subsilesian units and only partly described.

Paleocene foraminifers of Polish Flysch Carpathians were previously described by GRZYBOWSKI (1896, 1898, 1901), DYLĄŻANKA (1923), BIEDA (1946-1969), BIEDA *et al.* (1963,

TABLE I

STRATIGRAPHICAL RANGE OF FORAMINIFERA OCCURRING IN THE CARPATHIAN PALEOCENE, BABICA CLAYS

SPECIES		PALAEOCENE L	M	U
Ammodiscus siliceus (Terquem)		←		
Anomalina danica (Brotzen)	L	←		
Anomalina velascoensis Cushman		←		
Bolivinoides paleocenicus (Brotzen)	L	←		
Cibicides sahlstroemi Brotzen	L	←		
Citharina plumoides (Plummer)	L	←		
?*Clavulina aspera aspera* Cushman		←		
?*C. aspera whitei* Cushman & Jarvis		←		
Conorbina transuralicus (Morozova)	L	←		
Dorothia crassa (Marsson)		←		
D. oxycona (Reuss)	L	←		
Epistominella cf. *limburgensis* (Visser)		←		
Eponides megastomus (Rzehak) emend. Grzybowski		←		
Frondicularia biformis Marsson	L	←		
Gavelinella umbilicatula Mjatliuk	L	←		
Goesella rugosa (Hanzlikova)		←		
Gyroidinoides pontoni Brotzen	L	←		
Pulsiphonina prima (Plummer)	L	←		
Rzehakina fissistomata (Grzybowski)		←		
Stensioeina beccariiformis (White)	L	←		
Tappanina selmensis (Cushman)	L	←		
Tritaxia pyramidata Reuss	L	←		
T. tricarinata (Reuss)	L	←		
?*Cibicides commatus* Morozova	L	←		→
C. mariae (Jones)	L	←		→
Globigerina pseudobulloides Plummer	L	←		→
Matanzia varians (Glaessner)		←		→
Pararotalia tuberculifera (Reuss)	L	←		→
Anomalina acuta Plummer	L	←		→
Anomalinoides affinis (Hantken)	L	←		→
Aragonia velascoensis (Cushman)		←		→
Bulimina midwayensis Cushman & Parker		←		→
B. ovata d'Orbigny	L	←		→
Carpathiella ovulum (Grzybowski)		←		→
Coleites reticulosus (Plummer)	L	←		→
Dorothia retusa (Cushman)		←		→
Epistomina scalaris (Franke)	L	←		→
Eponides subcandidulus (Grzybowski)		←		→
Globimorphina trochoides (Reuss)		←		→
Glomospira charoides (Jones & Parker)		←		→
Gyroidinoides cf. *globosa* (Hagenow)		←		→
Karreria fallax Rzehak	L	←		→
Lenticulina velascoensis (White)		←		→
Nodellum velascoense (Cushman)		←		→

SPECIES		PALAEOCENE L	M	U
Nuttalides truempyi (Nuttall)		←		→
Paralabamina toulmini (Brotzen)	L	←		→
Pseudonodosaria manifesta (Reuss)	L	←		→
Pullenia coryelli White		←		→
P. quinqueloba (Reuss)		←		→
Rotalia saxorum d'Orbigny	L	←		→
Rzehakina epigona (Rzehak)		←		→
Spiroplectammina dentata (Alth)		←		→
S. spectabilis (Grzybowski)		←		→
S. subhaeringensis (Grzybowski)		←		→
Stomatorbina cf. *torrei* (Cushman & Bermudez)		←		→
Vaginulina cf. *plummerae* (Cushman)		←		→
Cibicides succedens Brotzen	L	←		
C. proprius (Brotzen)	L	←		
Globigerina trivialis Subbotina	L	←		
Loxostomoides applinae (Plummer)	L	←		
Osangularia cordieriana navarroana (Cushman)	L	←		
Angulogerina cuneata Brotzen	L			
Bulimina karpatica sp. n.				
Cibicides cuvillieri Rouvillois	L			
C. cf. *tezhevaensis* Morozova & Kurilova				
Dorothia longa (Morozova)				
Eponides lunata Brotzen	L			
?*Globigerina inconstans* Subbotina				
G. triloculinoides Plummer	L			
Globorotalites granulatus Pożaryska & Szczechura	L			
Gyroidina babicensis sp. n.				
?*Heterostomella gigantica turkmenica* Morozova				
Osangularia plummerae Brotzen	L			
Pseudopolymorphina geijeri Brotzen	L			
Pyramidina crassa Brotzen	L			
Rosalina koeneni Brotzen	L			
Stensioeina anninelechi Reiss				
Thalmannita sp.				
Valvulineria alpina Hillebrandt				→
Globorotalia perclara Loeblich & Tappan				→
?*Angulogerina europaea* Cushman & Edwards				→
Anomalina mantaensis Galloway & Morrey				→
Aragonia aragonensis (Nuttall)				→
Bulimina velascoensis White				→
Bolivina crenulata Cushman				→
Cibicides asteroides Pożaryska & Szczechura	L			→
C. carinatus (Terquem)				→
Epistominella vitrea Parker				→

SPECIES		PALAEOCENE L	M	U
Gyroidinoides girardana (Reuss)				→
Hanzawaia bundensis bundensis (van Bellen)	L			→
Nonion graniferum (Terquem)	L			→
Pararotalia minimalis Hofker	L			→
Planispirillina striatogranulosa (Terquem)	L			→
Pseudouvigerina wilcoxensis Cushman & Ponton	L			→
Rosalina parisiensis d'Orbigny	L			→
Anomalina minor Pożaryska & Szczechura	L		→	→
A. umbilicata umbilicata (Brotzen)	L		→	→
Ceratobulimina perplexa (Plummer)	L		→	→
Globorotalia chapmani Parr			→	→
Pararotalia globigeriniformis (van Bellen)	L		→	→
Lamarckina haeolensis Cushman & Todd	L		→	→
Globorotalia angulata White			→	→
Vulvulina sp.			→	→
Alabamina cf. *wilcoxensis* Toulmin				→
?*Anomalina* cf. *sola* (Mjatliuk)				→
Anomalinoides cf. *hyphalus* Fischer				→
Asterigerina sp.				→
A. cf. *noervangi* Brotzen				→
Bolivina cf. *paula* Cushman & Cahill				→
Caucasina cf. *schischkinskayae oligocaenica* Chalilov				→
Epistomina cf. *juliae* Mjatliuk				→
Globigerina velascoensis Cushman				→
Globorotalia cf. *convexa* Subbotina				→
G. cf. *laevigata* Bolli				→
G. cf. *occlusa* Loeblich & Tappan				→
G. sp.				→
Hanzawaia bundensis karpatica subsp. n.				→
Lamarckina sp.				→
Lenticulina sp.				→
L. cf. *arminensis* (d'Orbigny)				→
L. cf. *obtusimargo* (Sigalova)				→
L. cf. *revolutus* (Israelsky)				→
?*Neoeponides* cf. *acria* (Loeblich & Tappan)				→
Osangularia cf. *crassaformis* (Cushman & Siegus)				→
Vaginulina sp.				→
Globorotalia velascoensis (Cushman)				→
Pararotalia cf. *minuta* (Colom)				→
Cibicononion subnodosum (Roemer)				→
Eponides umbonatus (Reuss)				→
Globigerina cf. *yeguaensis* Weinzierl & Applin				→
Globorotalia whitei Weiss				→
Rotalia lithothamnica Uhlig				→

L – occurrence in the Polish Lowlands Paleocene; ⟶⟵ – range of taxon exceeds limits of chart

1967), GEROCH (1960), GEROCH and GRADZIŃSKI (1955), GEROCH and KOTLARCZYK (1963), GEROCH *et al.* (1967), HUSS (1957, 1966), JEDNOROWSKA (1968), LISZKOWA (1959), LISZKOWA and NOWAK (1964), JURKIEWICZ (1959, 1960, 1967), MORGIEL (1959), and others.

The analysis of geographical distribution of Carpathian Paleocene foraminiferal assemblage from the areas of Polish Lowlands was possible due to relatively complete knowledge of foraminiferal faunas from contemporaneous strata of extra-Carpathian Poland. The Paleocene foraminifers from Polish Lowlands, previously studied by POŻARYSKA (1957, 1964, 1965), BROTZEN and POŻARYSKA (1957, 1961), POŻARYSKA and SZCZECHURA (1968, 1970), and SZCZECHURA and POŻARYSKA (1971), represent rather uniform, mostly calcareous, benthic-planktonic assemblage.

The comparison of foraminiferal assemblages from the Paleocene of the Carpathians with those from contemporaneous strata of Polish Lowlands showed a remarkable contribution of common forms in both these assemblages, and a number of forms known only from the Carpathians. In foraminiferal assemblage recovered from Babica clays samples from Babica and Płosina localities, the contribution of species common with Polish Lowlands assemblage equals about 40 per cent. The remaining species, unknown from Polish Lowlands, are in part the species of uncertain taxonomic position and some planktonic forms unknown from Polish Lowlands. The lack of the latter forms in Polish Lowlands may result from differences in age of Paleocene strata of the Carpathians and Polish Lowlands. Babica clays of the Carpathians are of the Late Paleocene (Thanetian) age, so they are somewhat younger than the Paleocene strata from Polish Lowlands, which are of Dano-Montian age (there, the Late Paleocene — Thanetian strata are lacking). The lack of typical Tethyan elements in the Paleocene of Polish Lowlands also results from the fact that the influence of Tethyan ocean was generally weak in the areas to the north of the Carpathians. That is why the planktonic species, particularly the case of keeled planktonic forms, had not reached areas of Central Poland.

Comparison of benthic forms known from the Paleocene of the Carpathians and Polish Lowlands is facilitated by their wide stratigraphic range: from the Cretaceous to Paleocene or even Eocene. Thus, space distribution of these forms may not be time dependant. However, a number of these long-living forms seems to be restricted in their distribution to the Carpathians; they were not recorded from the remaining areas of Poland. These Carpathian forms make a rather large foraminiferal population, also known from other Tethyan regions, but almost always from geosynclinal and not epicontinental basin strata. The most characteristic representatives of this population are as follows: *Glomospira charoides* (JONES & PARKER), *Pullenia coryelli* (JONES & PARKER), *Anomalina velascoensis* CUSHMAN, *Eponides megastomus* (RZEHAK), *Spiroplectammina spectabilis* (GRZYBOWSKI), *S. dentata* (ALTH), *S. subhaeringensis* (GRZYBOWSKI), *Dorothia crassa* (MARSSON), *D. retusa* (CUSHMAN), *?D. longa* (MOROZOVA), *Goesella rugosa* (HANZLIKOVA), *Matanzia varians* (GLAESSNER), *?Heterostomella gigantica turkmenica* MOROZOVA, *Eponides subcandidulus* (GRZYBOWSKI), *Rzehakina fissistomata* (GRZYBOWSKI), *Rz. epigona* (RZEHAK), *Aragonia velascoensis* (CUSHMAN), *Vulvulina* sp., *Nodellum velascoense* (CUSHMAN), *Ammodiscus siliceus* (TERQUEM), *Carpathiella ovulum* (GRZYBOWSKI), *Stensioeina beccariiformis* (WHITE), *S. avnimelechi* REISS, *Nuttalides truempyi* (NUTTALL), *Globimorphina trochoides* (REUSS), *Bulimina velascoensis* WHITE, *Anomalina rubiginosa* (CUSHMAN), and *Lenticulina velascoensis* (WHITE).

It may be stated that the foraminiferal assemblage of Babica clays represents a mixture of foraminiferal species typical of epicontinental, rather shallow seas, and of foraminiferal fauna of deeper, geosynclinal basins, which implies the deposition at the contact of the two

environments. However, this conclusion was based on the analysis of foraminiferal spectrum of Babica clays outcropping at Babica and Płosina, and may not be valid for Babica clays outcropping elsewhere. For example, in foraminiferal assemblages recovered from various horizons of Babica clays outcropping at Bircza, the contribution of foraminifers typical of epicontinental seas of Polish Lowlands and neighbouring areas is varying but generally markedly lower than in the samples from Babica and Płosina. This, together with markedly higher contribution of planktonic forms in foraminiferal spectrum for Babica clays samples from Bircza, implies that these clays were presumably deposited at a greater distance from the shores than the clays from Babica and Płosina.

In foraminiferal spectrum from Babica and Płosina, among the forms common to the Paleocene of Polish Lowlands, there occur forms typical of Boreal Paleocene province, as well as forms typical of Paleocene Meridional province (so-called Transitional province of SCHEIBNEROVA, 1971), (POŻARYSKA & SZCZECHURA, 1968; SZCZECHURA & POŻARYSKA, 1971). The latter confirm shallow- and warm-water character of the Carpathian foraminiferal assemblage in question.

The mutual influence within the Paleocene Carpathians microfaunas from the Polish Lowlands and Carpathians was possible thanks to seaway connecting these basins as early as in the earliest Tertiary. Such seaway continued through at least south-eastern part of Polish Carpathians, on the extension of the Polish marginal synclinorium (POŻARYSKA, 1965, 1967).

DISTRIBUTION OF PALEOCENE CARPATHIAN FORAMINIFERAL ASSEMBLAGE OUTSIDE POLAND

As it already has been stated, two assemblages can be distinguished within Carpathians Paleocene foraminifers: one related only to the Carpathians, i.e. to geosynclinal strata, and another one, characteristic of the Polish Lowlands, i.e. epicontinental basin strata. Such relationships between foraminiferal assemblages and types of marine reservoirs, or rather their facies, can also be found outside Poland.

Analysis of geographical distribution of the foraminiferal assemblage known from Babica clays as well as from other contemporaneous strata in the Carpathians outside Poland shows space differentiation comparable to that found in Poland. Some elements, here termed Carpathian elements, are similarly confined to geosynclinal facies, whereas the remaining ones are more or less pandemic in distribution or are known solely from epicontinental marine deposits.

Foraminifers of Paleocene epicontinental seas are typical of Boreal and Meridional provinces (POŻARYSKA & SZCZECHURA, 1968), this latter also known as Transitional biogeoprovince (SCHEIBNEROVA, 1972). Foraminiferal assemblages from Gulf Coastal Plain (Midway Fm.) in the USA, Thanet sands, and the so-called Selandian beds from North and Central Europe (see POŻARYSKA & SZCZECHURA, 1968) and from Australia, may be regarded as typical of that province.

Foraminifers known from Paleocene geosynclinal strata yielding typical Carpathian microfauna, are related to tropical, Tethyan province. The range of distribution of these elements almost closely corresponds to the area of Alpine mountain belts (see Text-fig. 4). It should be noted that the distribution of exclusively agglutinated foraminiferal assemblage, typical

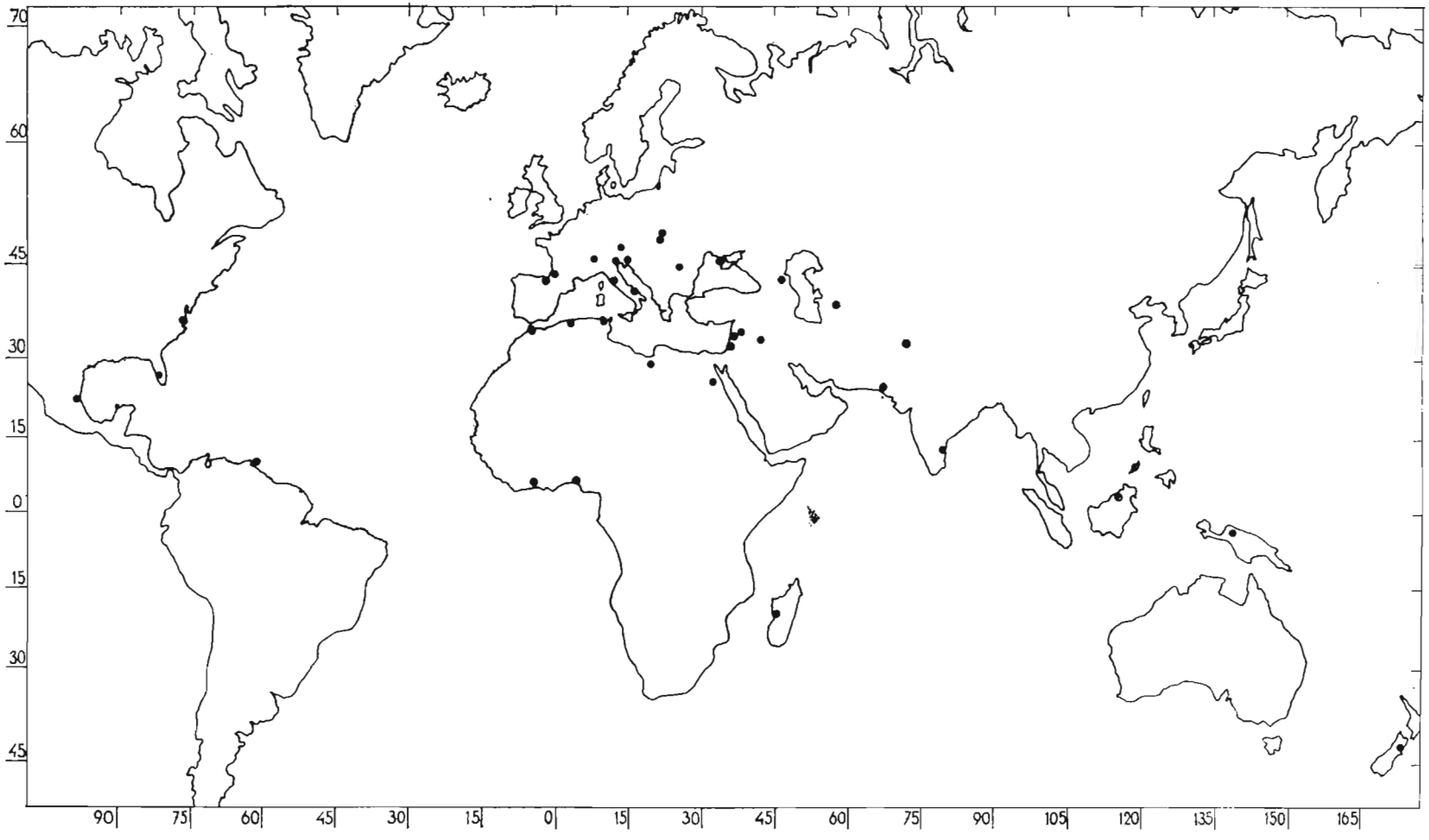

Fig. 3
World map to show the distribution of *Globorotalia velascoensis* (CUSHMAN).

of the Carpathians and named "*Rhabdammina*" fauna by BROUWER (1965), was regarded by that author as confined to Alpine belts. BROUWER (1965) showed that this assemblage, occurring from the Late Cretaceous to Neogene times, appears to be related to pelite deposits of some turbidite activities.

In the area of "*Rhabdammina*" fauna, also occurs Paleocene microfauna of small Carpathian foraminifers. The latter are classically developed, i.e. represented by forms typical of rather deeper sea basin, which is the case of the assemblage from the Paleocene (Velasco Fm.) of Mexico. It may also accompany microfaunal population of epicontinental type, presumably inhabitating shelf zones of geosyncline. The microfauna described in the present monograph represent the latter type.

However, a detailed analysis of space and time distribution of Carpathian foraminiferal species appears difficult, if ever possible. This results from incompleteness of Paleocene foraminiferal records, particularly in the case of circum-Pacific regions, from nonuniform taxonomic nomenclature of the same species combined with often improper illustrations precluding identifications of particular species, as well as from local variability of a given species. Nevertheless, worldwide distribution of at least some Tethyan species, both planktonic and benthic, appears doubtless. This worldwide distribution indicates that in the Paleocene there existed seaways connecting Caribbean and Indo-Pacific regions. These seaways were opened during the Late Paleocene, but may have been active since the Late Cretaceous up to Early Eocene times. The seaways presumably run through the Mediterranean region and through the seas occupying south-European areas — Spain, Aquitanian Basin in France, Italy, Austria, Slovak-, Polish-, and Roumanian Carpathians, Crimea, North Africa, Caucasus, and the Near East areas, Himalaya, Indonesia, New Guinea, northern Madagascar, to New Zealand. Similar corridor, making possible the exchange of ostracode faunas during the early Cenozoic times, was suggested by MCKENZIE (1971).

Such distribution of Paleocene foraminiferal microfauna typical of Tethyan ocean and delineating its margins confirms reconstruction of continental masses in the Eocene, as presented by SMITH *et al.* (1973; see Text-figs. 3, 4 herein). Geophysical data, on which this reconstruction was based, imply remarkable separation of North and South American Continents from Europe and Africa, respectively, Madagascar from Africa, and suggest that New Zealand and Australia were at that time still situated within Tethyan regions. Such location of New Zealand and Australia explains occurrence of keeled planktonic foraminifers typical of tropical seas, without necessary influence of currents. When Carpathian microfauna localities are plotted on the reconstruction given by SMITH *et al.* (1973), it may be noted that these microfaunas are almost exclusively recorded in areas affected by Alpine mountain-building movements.

ADAMS (1967), MCGOWRAN (1968) and other authors suggested certain influence of currents on distribution of foraminifers. Some planktonic and agglutinated benthic foraminifers dispersed by currents are found outside their main areas of occurrence, which makes defining of their proper environment difficult. However, the "obscuring" effect of currents is not so great as it might be supposed and these "dragged away" elements are usually confined to peripheral areas of their distribution.

Paleocene foraminiferal microfauna typical of geosynclinal deposits — not always flysch but also of shelf type — representing Carpathian foraminiferal assemblages plus certain admixtures of planktonic and epicontinental marine elements, has been recorded from areas of contact of geosynclinal and epicontinental sea basins. In Europe, microfaunas of such contact zone are known, besides Polish Carpathians, from Austrian Alps (Kroisbach micro-

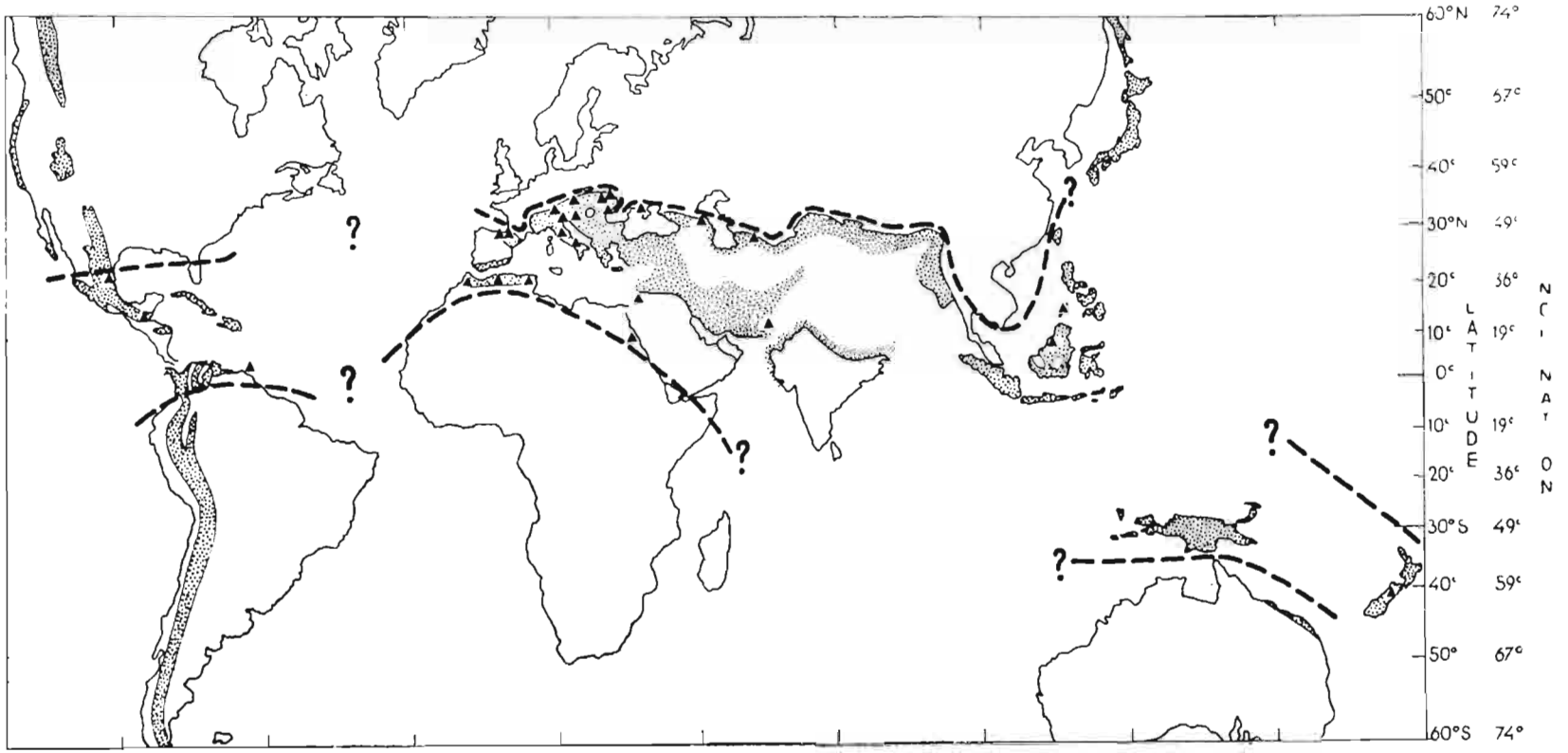

Fig. 4

Distribution of the Paleocene Carpathian foraminiferal assemblage plotted on the palaeogeographical map for the Eocene (the map compiled by SMITH *et al.*, 1973); dots — areas of Tertiary orogenies; solid triangles — occurring of the Paleocene Carpathian foraminiferal assemblage; dashed line indicate approximate limits of the Tethys. On the right there are given lattitude and inclination scale.

fauna; reinterpreted by the present authors), Aquitanian basin (south of Pau, described by GUBLER and POMEYROL, 1946), from Israel (see REISS, 1962), and from other localities.

Stricte geosynclinal and stricte epicontinental foraminiferal microfaunas markedly differ, particularly in the composition of benthic elements. Thus, identification of any Paleocene foraminiferal assemblage with either Midway Fm. or Velasco Fm. assemblage, made by some authors, seems unsubstantiated.

Similarity between Paleocene foraminifers, and particularly small foraminiferal faunas of North and South Americas, Europe, Africa, and Australia, was noted by a number of authors. However, only a few authors have seen a possibility of free communication between Caribbean and Indo-Pacific regions through the Tethyan corridor. Generally, microfaunas of Indo-Pacific region were compared with those of Mediterranean region, and the Mediterranean ones with those of Caribbean region. However, the newly obtained data do not support differentiation of Paleocene small-foraminiferal faunas into a number of zoogeographical provinces, but rather their worldwide distribution. However, distribution of these foraminiferal faunas appears markedly dependant on certain facies and climatic conditions. This latter is especially the case with planktonic foraminifers.

CONCLUSIONS

(1) Small benthic foraminifers appear to be excellent indices for reconstructing environmental, and particularly sedimentary conditions prevailing in a given basin, and may give a basis for long-distance, interregional correlations (see also KURESHY, 1968).

Contrary to benthic forms, planktonic and particularly keeled planktonic foraminifers have markedly latitudinally limited distribution, which partly reduces their correlational importance. At the same time, large foraminifers seem to be more sensitive to local facies-climatic conditions and thus are less significant for interregional correlations.

(2) Two assemblages of small benthic foraminifers of early Tertiary age may be distinguished, namely: (a) assemblage of epicontinental seas, and (b) assemblage typical of geosynclinal seas. The former assemblage is known from both Boreal and Meridional provinces sensu POŻARYSKA and SZCZECHURA (1968). In the areas of Boreal province, there prevail detrital, sandy-glauconitic deposits, foraminiferal microfauna of which was described by PLUMMER (1926), BROTZEN (1948) and MCGOWRAN (1965). Meridional province, or Transitional province of SCHEIBNEROVA (1971) comprises areas of deposition of zoogenic, calcareous-detrital deposits of shallower seas. Microfauna of these deposits was described by VAN BELLEN (1946) and SCHUTZKAJA (1958). The above provinces, or rather biogeoprovinces, were distinguished on the basis of certain foraminiferal microfaunas, and their geographical extent does not agree with that inferred by SCHEIBNEROVA (1971). The biogeoprovinces distinguished by that author appear not to be actual zoogeographic ones, i.e. defined by their faunas, but rather climatic belts of Cretaceous and early Paleocene times.

Foraminiferal assemblage of geosynclinal seas, which comprises Carpathian microfauna, appears to be related to deposits primarily of the flysch type and confined to Tethyan areas, i.e. to tropical Tethyan province occupying seaway almost equatorially stretching from Caribbean region to New Zealand during early Tertiary times. Microfauna typical of this assemblage was described by WHITE (1928, 1929), CUSHMAN (1926), CUSHMAN and JARVIS (1928).

(3) Foraminiferal assemblage, in which the elements typical of both above provinces are represented, is found in strata deposited at the contact of epicontinental and geosynclinal seas. Examples of such assemblage are given by foraminiferal assemblage from the Paleocene of Polish Carpathians, deposited in northernmost, marginal part of this Tethyan geosyncline.

SYSTEMATIC PART

Family ALLOGROMIIDAE RHUMBLER, 1904

Genus **NODELLUM** RHUMBLER, 1913

Nodellum velascoense (CUSHMAN, 1926)

(Pl. I, Fig. 5)

1926. *Nodosinella velascoensis* CUSHMAN; J. A. CUSHMAN, p. 583, Pl. 20, Fig. 9.
1937. *Nodosinella velascoensis* (CUSHMAN); M. F. GLAESSNER, p. 358, Pl. 1, Fig. 6.
1946. *Nodosinella velascoensis* (CUSHMAN); J. A. CUSHMAN, p. 17, Pl. 1, Figs 28-31.
1946. *Nodosinella velascoensis* (CUSHMAN); J. A. CUSHMAN & H. H. RENZ, p. 14, Pl. 7, Figs 20-24.
1948. *Nodosinella velascoensis* (CUSHMAN); D. M. CHALILOV, p. 31.
1950. *Nodosinella velascoensis* (CUSHMAN); N. N. SUBBOTINA, p. 73, Pl. 2, Fig. 3.
1955. *Nodosinella velascoensis* (CUSHMAN); N. I. MASLAKOVA, p. 42, Pl. 1, Fig. 8.
1959. *Nodosinella velascoensis* (CUSHMAN); J. MORGIEL, p. 122, Pl. 12, Fig. 4.
1962. *Nodosinella velascoensis* (CUSHMAN); A. HILLEBRANDT, p. 24.
1968. *Nodellum velascoense* (CUSHMAN); A. JEDNOROWSKA, p. 38, Pl. 1, Figs 1-2.
1969. *Nodellum velascoense* (CUSHMAN); E. J. KRAEVA & B. F. ZERNETZKIJ, p. 15, Pl. 3, Fig. 6.
1970. *Nodellum velascoense* (CUSHMAN); E. BRATU & G. ALEXANDRESCU, p. 464, Pl. 1, Figs 1-9.

Material. — Four specimens not well preserved, damaged.
Dimensions of one specimen (in mm):

	F. XIV/1
Length	0.70
Width	0.19
Thickness . . .	0.15

Description. — Test elongate, slender, uniserial. Chambers flattened, weakly overlapping one another. Sutures incised. Aperture terminal, circular. Wall finely arenaceous.

Variation insignificant, concerning the general shape, length/width ratio, number of chambers, and degree of chambers compression.

Remarks. — The specimens from the Paleocene of the Carpathians are undoubtedly conspecific with the representatives of that species reported from the Velasco Fm. of Mexico and from other countries. That species appears to be one of the most equivocally determined.

Occurrence. — The species is reported from Tethyan regions: Mexico, Trinidad, Morocco, Austrian Alps, Polish, Rumanian, Slovak and Soviet Carpathians, Caucasus and Crimea; Cretaceous — Eocene.

Family AMMODISCIDAE Reuss, 1862

Genus **AMMODISCUS** Reuss, 1862

Ammodiscus siliceus (Terquem, 1862)

(Pl. III, Figs 10-12)

1862. *Involutina silicea* Terquem; O. Terquem, p. 450, Pl. 6, Fig. 11.
1962. *Ammodiscus glabratus* Cushman & Jarvis; A. Hillebrandt, p. 25, Pl. 1, Fig. 3 (*non Ammodiscus glabratus* Cushman & Jarvis, 1928).
1969. *Ammodiscus silicea* (Terquem); W. Grün, p. 311, Pl. 65, Figs 2, 3.
1969. *Ammodiscus silicea* (Terquem); F. Bieda, Pl. 94, Fig. 5.

Material. — Five specimens well preserved.
Dimensions of three specimens (in mm):

	F. XIV/2	F. XIV/3	F. XIV/4
Largest diameter . . .	1.13	0.74	0.69
Shortest diameter . . .	0.93	0.59	0.54
Thickness	0.25	0.20	0.15

Description. — Test siliceous, planispiral, slightly concave on both sides, markedly compressed. Periphery broadly rounded. Chambers tubular, gradually increasing in size in successive coils, 8-10 in number. Aperture semicircular, at the end of the tubular chamber. Wall smooth or somewhat wrinkled.

Variation primarily concerning general shape, size and coiling of chambers.

Remarks. — The Polish specimens differ from the holotype of that species, figured and described by Terquem (1862) from the Jurassic of France, only in a more smooth test surface, without any traces of possible internal dividing walls, inferred by Terquem (1862) in his description. Specimens from the comparative materials from the Paleocene of Reichenhall near Salzburg, identified by Hillebrandt (1962) as *Ammodiscus glabratus* Cushman & Jarvis, differ from typical American representatives of that species in tests insoluble in HCl, i.e. not built of calcium carbonate, and presumably belong to *A. siliceus* (Terquem).

Occurrence. — The species is reported from Tethyan regions: France (Aquitanian Basin), Yugoslavia, Austrian Alps, Polish Carpathians, and Caucasus; Jurassic — Paleocene.

Ammodiscus incertus (d'Orbigny), a species morphologically similar to *A. siliceus* (Terquem), is known from the Maastrichtian of the Carpathians and from the Lower Eocene of the Caucasus.

Genus **GLOMOSPIRA** Rzehak, 1885

Glomospira charoides (Jones & Parker, 1860)

(Pl. II, Figs 9, 10)

1860. *Trochammina squamata* var. *charoides* Jones & Parker; T. R. Jones & W. K. Parker, p. 304 (illustration not given).
1928. *Glomospira charoides* (Jones & Parker); M. P. White, p. 187, Pl. 27, Fig. 8.
?1937. *Glomospira irregularis* (Grzybowski); M. F. Glaessner, p. 359, Pl. 1, Fig. 7.
1944. *Glomospira charoides* (Jones & Parker); E. S. Franklin, p. 304, Pl. 44, Fig. 3.
1946. *Glomospira charoides* var. *corona* Cushman & Jarvis; J. A. Cushman & H. H. Renz, p. 15, Pl. 1, Fig. 31.
1948. *Glomospira charoides* (Jones & Parker); D. M. Chalilov, p. 72, Pl. 5, Fig. 2.
1950. *Glomospira charoides* (Parker & Jones); N. N. Subbotina, p. 74, Pl. 2, Fig. 5.

1953. *Glomospira charoides* (PARKER & JONES); L. W. LE ROY, p. 33, Pl. 1, Figs 23, 24.
1959. *Glomospira charoides* (PARKER & JONES); J. LISZKOWA, p. 53, Pl. 8, Figs 1-3.
1960. *Glomospira charoides* (JONES & PARKER); V. POKORNÝ, p. 1134, Pl. 11, Fig. 1.
1961. *Glomospira charoides* (JONES & PARKER); V. SCHEIBNEROVA, p. 30, Pl. 1, Fig. 3.
1962. *Glomospira charoides corona* CUSHMAN & JARVIS; A. HILLEBRANDT, p. 25, Pl. 2, Fig. 24.
?1963. *Glomospira iranensis* KAVARY; E. KAVARY & DON L. FRIZZELL, p. 10, Pl. 1, Fig. 4 (Figs 2, 3, 5-7?).
1970. *Glomospira charoides* JONES & PARKER; Y. KIESEL, p. 180, Pl. 1, Fig. 18.

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

	F. XIV/5	F. XIV/6
Largest diameter . . .	0.18	0.24
Shortest diameter . . .	0.16	0.24

Description. — Test siliceous, ball-like in general shape, composed of undivided tubular chamber, which is regularly, horizontally coiled; last volution more or less irregular. Aperture represented by an opening at the end of the chamber; test surface smooth.

Variation primarily concerning the general test size, number of volutions, and the degree of irregularity of the last formed chamber.

Remarks. — The specimens from the Paleocene of the Carpathians are more regularly coiled in comparison with some specimens allocated in that species by other authors. According to the present authors, the species appears to be highly variable (see also BRATU & ALEXANDRESCU, 1970); thus, separation of its numerous subspecies seems invalid.

The Mediterranean species, *Trochammina* (recte *Glomospira*) *charoides* JONES & PARKER (1860), was described rather schematically and was not illustrated; thus its full comparison with the material from the Paleocene of the Polish Carpathians is precluded.

The species *Glomospira irregularis* (GRZYBOWSKI, 1898), described from the Polish Carpathians, and Iran tests fragments, assigned by KAVARY and FRIZZELL (1963) to the species *G. iranensis*, are very similar and may be even conspecific with those described herein as *G. charoides* (JONES & PARKER).

Occurrence. — The species occurring in Tethyan regions: Trinidad, Mexico, Morocco, Egypt, Austrian Alps, Rumanian, Slovak, Polish and Soviet Carpathians, Crimea, Caucasus, south-western Asia (USSR, Iran), and New Zealand; Cretaceous — Eocene.

Family HORMOSINIDAE HAECKEL, 1894

Genus **CARPATHIELLA** MJATLIUK, 1966

Carpathiella ovulum (GRZYBOWSKI, 1896)

(Pl. III, Fig. 19)

1896. *Reophax ovulum* GRZYBOWSKI; J. GRZYBOWSKI, p. 276, Pl. 8, Figs 19-21.
1937. *Hormosina ovulum* (GRZYBOWSKI); M. F. GLAESSNER, p. 357, Pl. 1, Fig. 5.
1948. *Hormosina ovulum* (GRZYBOWSKI); D. M. CHALILOV, p. 32, Pl. 7, Fig. 1.
1959. *Hormosina ovulum* (GRZYBOWSKI); J. MORGIEL, p. 122, Pl. 12, Figs 2, 3.
1962. *Hormosina ovulum* (GRZYBOWSKI); A. HILLEBRANDT, p. 24.
1969. *Hormosina ovulum* (GRZYBOWSKI); E. J. KRAEVA & B. F. ZERNETZKIJ, p. 15, Pl. 3, Fig. 5.
1970. *Carpathiella ovulum ovulum* (GRZYBOWSKI); E. V. MJATLIUK, p. 52, Pl. 8, Fig. 12; Pl. 9, Figs 8-13.

Material. — A single specimen well preserved.
Dimensions of the specimen (in mm):

	F. XIV/7
Height	0.36
Width	0.29
Thickness . . .	0.24

Description. — Test consisting of a single chamber, globulous, somewhat laterally compressed, with slightly elongated apertural end. Aperture simple, circular, small. Similar aperture is developed in the initial, basal test part. Test surface smooth.

Remarks. — The specimen from the Paleocene of the Carpathians is very similar to one of the forms, figured by GRZYBOWSKI (1896) as *Reophax* (recte *Carpathiella*) ovulum from the (?) Lower Oligocene of the Carpathians, somewhat differing, however, from the latter, in being more laterally compressed. It has no depression in its central part.

Carpathiella ovulum (GRZYBOWSKI) is a generotype of the genus *Carpathiella* erected by MJATLIUK in 1966.

Occurrence. — The species is reported from Tethyan regions: Austrian Alps, Slovak, Rumanian, Polish and Soviet Carpathians, Crimea, Caucasus, south-western Asia (Turkmenia) and New Zealand; Cretaceous — Eocene.

Family RZEHAKINIDAE CUSHMAN, 1933

Genus **RZEHAKINA** CUSHMAN, 1927

Rzehakina epigona (RZEHAK, 1895)

(Pl. II, Fig. 1)

1895. *Silicina epigona* RZEHAK; A. RZEHAK, p. 214, Pl. 6, Fig. 1 (see Catalogue of Foraminifera).
1928. *Rzehakina epigona* (RZEHAK); M. P. WHITE, p. 186, Pl. 27, Fig. 6.
1937. *Rzehakina epigona* (RZEHAK); M. F. GLAESSNER, p. 367, Pl. 2, Fig. 16.
1946. *Rzehakina epigona* var. *lata* CUSHMAN & RENZ; J. A. CUSHMAN & H. H. RENZ, p. 23, Pl. 3, Fig. 6.
1950. *Rzehakina epigona* (RZEHAK); N. N. SUBBOTINA, p. 89, Pl. 4, Figs 2, 3.
1955. *Rzehakina epigona* (RZEHAK); N. I. MASLAKOVA, p. 52, Pl. 4, Fig. 8.
1959. *Rzehakina epigona* (RZEHAK); J. LISZKOWA, Pl. 6, Figs 2-5.
1960. *Rzehakina epigona* (RZEHAK); S. GEROCH, p. 133, Pl. 4, Figs 11-16; Pl. 10, Fig. 1.
1960. *Rzehakina epigona* (RZEHAK); V. POKORNÝ, p. 1121, Pl. 2, Fig. 5.
1962. *Rzehakina epigona* (RZEHAK); A. HILLEBRANDT, p. 26, Pl. 2, Fig. 21.
1966. *Rzehakina epigona* (RZEHAK); M. J. SEROVA, p. 280, Pl. 3, Figs 1, 2.
1969. *Rzehakina epigona* (RZEHAK); E. J. KRAEVA & B. F. ZERNETZKIJ, p. 23, Pl. 7, Fig. 7.
1970. *Rzehakina epigona epigona* (RZEHAK); E. V. MJATLIUK, p. 96, Pl. 32, Fig. 1.
1970. *Rzehakina epigona lata* CUSHMAN & JARVIS; E. V. MJATLIUK, p. 96, Pl. 32, Fig. 3.
1970. *Rzehakina epigona* (RZEHAK); E. BRATU & G. ALEXANDRESCU, p. 464, Pl. 2, Figs 12, 13.

Material. — Three specimens well preserved.
Dimensions of one specimen (in mm):

	F. XIV/8
Longest diameter . . .	0.64
Shortest diameter . . .	0.39
Thickness	0.10

Description. — Test siliceous, flat, elliptical in general outline, with ends more or less elongated. Test margin ledge-like. A few coils observable in the central, somewhat depressed part of the test. Last whorl chambers markedly wider than those of the inner whorl. Whorls consisting of two arcuate chambers connected at elongated test ends. Aperture slit-like. Test surface smooth.

Remarks. — The Polish specimens do not differ from the figured holotype of this species, described by RZEHAK (1895) from the Early Tertiary of Czechoslovakia. *Rzehakina epigona* (RZEHAK) appears to be quite equivocally interpreted by previous authors. The subspecies *Rzehakina epigona lata*, erected by CUSHMAN and RENZ (1946), most probably falls within the limits of variability of the nominal subspecies and it is abandoned here.

Occurrence. — Besides the Tethyan regions, including Trinidad, Mexico, Morocco, Swiss and Austrian Alps, Polish, Rumanian, Slovak and Soviet Carpathians, Crimea, Caucasus, and New Zealand, the species is reported from California (USA), Siberia and Japan; Cretaceous — Eocene.

Rzehakina fissistomata (GRZYBOWSKI, 1901)

(Pl. II, Fig. 5)

1901. *Spiroloculina fissistomata* GRZYBOWSKI; J. GRZYBOWSKI, p. 260, Pl. 7, Fig. 20.
1960. *Rzehakina fissistomata* (GRZYBOWSKI); S. GEROCH, p. 63, Pl. 4, Fig. 12.
1966. *Rzehakina fissistomata* (GRZYBOWSKI); M. J. SEROVA, p. 273, Pl. 1, Fig. 1; Text-fig. 3.
1968. *Psamminopelta fissistomata* (GRZYBOWSKI); A. JEDNOROWSKA, p. 46, Pl. 4, Fig. 4.
1970. *Rzehakina fissistomata* (GRZYBOWSKI); E. BRATU & G. ALEXANDRESCU, p. 464, Pl. 2, Figs 14-17.
1970. *Rzehakina fissistomata* (GRZYBOWSKI); E. V. MJATLIUK, p. 97, Pl. 10, Figs 10, 11; Pl. 32, Fig. 2.

Material. — Four specimens well preserved.
Dimensions of one specimen (in mm):

	F. XIV/9
Longest diameter . . .	0.54
Shortest diameter . . .	0.40
Thickness	0.10

Description. — Test siliceous, elliptical and more or less elongated in general outline, compressed, planispiral, with ledge-like margins; test consisting of 7-8 whorls; every whorl composed of two chambers similar in size. Both test sides bearing shallow umbilical depressions. Aperture represented by an opened end of the last chamber. Surface smooth, glossy.

Variation insignificant, primarily concerning the general shape of test, varying from oval to elliptical.

Occurrence. — The species is reported from Slovak, Polish, Rumanian and Soviet Carpathians, and Caucasus; outside Europe known from Sakhalin (USSR); Cretaceous — Paleocene.

Family TEXTULARIIDAE EHRENBERG, 1838

Genus **SPIROPLECTAMMINA** CUSHMAN, 1927

Spiroplectammina dentata (ALTH, 1850)

(Pl. I, Figs 6, 7)

1850. *Textularia dentata* ALTH; A. ALTH, p. 262, Pl. 13, Fig. 13.
1932. *Spiroplectammina dentata* (ALTH); J. A. CUSHMAN & P. W. JARVIS, p. 14, Pl. 3, Fig. 7.
1946. *Spiroplectammina dentata* (ALTH); J. A. CUSHMAN, p. 27, Pl. 5, Fig. 11.

1949. *Textularia dentata* ALTH; J. CUVILLIER & V. SZAKALL, p. 12, Pl. 5, Fig. 2.
1959. *Spiroplectammina dentata* (ALTH); J. LISZKOWA, p. 58, Pl. 3, Fig. 11.
1962. *Spiroplectammina dentata* (ALTH); A. HILLEBRANDT, p. 28, Pl. 1, Figs 9-11; Text-fig. 1.
1963. *Spiroplectammina dentata* (ALTH); E. KAVARY & L. FRIZZELL, p. 12, Pl. 1, Fig. 16.
1966. *Spiroplectammina dentata* (ALTH); F. HUSS, p. 34, Pl. 5, Figs 13-15.
1966. *Spiroplectammina dentata* (ALTH); J. HOFKER, p. 49, Pl. 8, Fig. 18; Pl. 76, Fig. 4.
1970. *Spiroplectammina dentata* (ALTH); T. NEAGU, p. 40, Pl. 4, Fig. 21.
1970. *Spiroplectammina dentata* (ALTH); Y. KIESEL, p. 194, Pl. 3, Fig. 17.

Material. — A dozen or so specimens well preserved.
Dimensions of two specimens (in mm):

	F. XIV/10	F. XIV/11
Length	0.69	0.88
Maximal width . . .	0.44	0.44
Thickness	0.15	0.20

Description. — Test compressed, consisting of small spiral part and more or less long biserial part, slowly enlarging in size towards the apertural end. Periphery acute, sometimes with sharp, ragged keel. Axial test part elevated, resulting in a rhomboidal section. Chambers numerous, low, slowly increasing in size as added. Chambers ends projecting in the form of short spinose processes. Sutures distinct, depressed very slightly if ever. Aperture — a narrow opening at the inner margin of the last formed chamber. Wall smooth, finely arenaceous.

Variation considerable, primarily concerning the spiral/biserial portions ratio; spiral part is sometimes very weakly developed, whereas the length of biserial part varies over a wide range. Keel present or not; when present, it is usually more or less ragged.

Remarks. — Some specimens assigned herein to *Spiroplectammina dentata* (ALTH) differ from the holotype figured by ALTH (1950) in well-developed spiral part and keel; whereas the specimens without a keel are strikingly similar to the holotype.

It is disputable whether or not the population discussed herein should be separated into two species. A detailed discussion of a species very similar to *S. dentata* (ALTH) is given by HILLEBRANDT (1962).

Occurrence. — The species is common in Tethyan regions: Trinidad, USA (Gulf Coast), France (Aquitanian Basin), Spain, Italy, Yugoslavia, Swiss and Austrian Alps, Slovak, Polish and Rumanian Carpathians, Egypt, Crimea, Caucasus, south-western Asia (USSR), reported also from the epicontinental facies of north-western Europe, i.e. Holland, Germany, Denmark and Sweden; Cretaceous — Eocene.

Spiroplectammina spectabilis (GRZYBOWSKI, 1898)

(Pl. I, Figs 1-4)

1898. *Spiroplecta spectabilis* GRZYBOWSKI; J. GRZYBOWSKI, p. 293, Pl. 12, Fig. 12.
1928. *Spiroplecta clotho* (GRZYBOWSKI); M. P. WHITE, p. 32, Pl. 4, Fig. 5.
1928. *Spiroplectoides clotho* (GRZYBOWSKI); J. A. CUSHMAN & P. W. JARVIS, p. 101, Pl. 14, Figs 13, 14.
1937. *Bolivinopsis spectabilis* (GRZYBOWSKI); M. F. GLAESSNER, p. 364, Pl. 2, Figs 13, 14.
1944. *Spiroplecta spectabilis* (GRZYBOWSKI); A. TEN DAM, p. 81, Pl. 2, Figs 6, 7.
1946. *Bolivinopsis? clotho* (GRZYBOWSKI); J. A. CUSHMAN, p. 103, Pl. 44, Figs 10-13.
1950. *Spiroplecta clotho* (GRZYBOWSKI); N. N. SUBBOTINA, p. 83, Pl. 3, Fig. 8.
1953. *Spiroplectammina spectabilis* (GRZYBOWSKI); N. K. BYKOVA, p. 61, Pl. 1, Fig. 5 *(here included additional synonymy)*.

1955. *Spiroplectammina spectabilis* (GRZYBOWSKI); N. I. MASLAKOVA, p. 50, Pl. 5, Figs 7, 8.
1960. *Spiroplectammina spectabilis* (GRZYBOWSKI); S. GEROCH, p. 63, Pl. 4, Fig. 12.
1962. *Spiroplectammina spectabilis* (GRZYBOWSKI); A. HILLEBRANDT, p. 32, Pl. 2, Figs 26, 27.
1966. *Spiroplectammina spectabilis* (GRZYBOWSKI); F. HUSS, p. 39, Pl. 6, Figs 13, 14.
1969. *Bolivinopsis spectabilis* (GRZYBOWSKI); E. J. KRAEVA & B. F. ZERNETZKIJ, p. 29, Pl. 9, Fig. 4.
1970. *Spiroplectammina spectabilis* (GRZYBOWSKI); Y. KIESEL, p. 191, Pl. 3, Fig. 22.
1972. *Spiroplectammina spectabilis* (GRZYBOWSKI); H. HILTERMANN, pp. 43-55, Pl. 1, Figs 1-17; Pl. 2, Figs 1-53.

Material. — Twenty specimens well preserved.
Dimensions of four specimens (in mm):

	F. XIV/12	F. XIV/13	F. XIV/14	F. XIV/15
Length	0.83	0.44	0.52	0.64
Maximal width . . .	0.25	0.25	0.25	0.25
Thickness	0.15	0.10	0.10	0.15

Description. — Test siliceous, compressed; initially spiral, later biserial; biserial part more or less long, uniform in width to somewhat widen towards the aperture; periphery acute. Chambers numerous, low, very slowly increasing in size as added. Axial test part distinctly elevated, which results in rhomboidal test section. Wall finely arenaceous, smooth. Aperture, a narrow opening at the inner margin of the last chamber.

Variation. — The species *Spiroplectammina spectabilis* (GRZYBOWSKI) comprises microspheric and megalospheric forms. The microspheric forms differ from the megalospheric ones in much smaller spiral part; moreover, their spiral part usually does not exceed the width of the biserial part. The microspheric and megalospheric forms differ in length which depends on the number of chambers, as well as in width and general shape. Initial part is occasionally somewhat curved.

Remarks. — Specimens representing macrospheric form, assigned to *S. spectabilis*, do not differ from the holotype of this species figured and described by GRZYBOWSKI (1898) from the Upper Eocene of the Polish Carpathians. They are undoubtedly conspecific with *Spiroplecta* (recte *Spiroplectammina*) clotho described by GRZYBOWSKI (1901) from the Upper Cretaceous and Eocene of the Polish Carpathians, which appears to be a microspheric form of the former species, and is placed in its synonymy. According to HUSS (1966) and MORGIEL (1969 MS), *Spiroplecta* (recte *Spiroplectammina*) *foliacea* GRZYBOWSKI and *Spiroplecta* (recte *Spiroplectammina*) *brevis* GRZYBOWSKI, described by GRZYBOWSKI (1898) from the Eocene of Polish Carpathians, should be placed in the synonymy of *S. spectabilis*.

Recently, a detailed revision of *Spiroplectammina spectabilis* (GRZYBOWSKI) was performed by HILTERMANN (1972) mainly on the basis of the material from the Polish Carpathians. According to HILTERMANN (1972), *Spiroplectammina mexiaensis* LALICKER, 1953 from the Paleocene of Wills Point Fm., Gulf Coast of North America, is an American equivalent of this species.

Occurrence. — The species is common in Tethyan regions: Trinidad, Venezuela, Mexico, France (Aquitanian Basin), Morocco, Egypt, Austrian Alps, Slovak, Polish and Soviet Carpathians, Caucasus, western Siberia and Tadjikistan (USSR), and New Zealand. It occurs also in California (USA); occasionally found in epicontinental facies of Holland and Germany; Cretaceous — ?Miocene.

Spiroplectammina subhaeringensis (GRZYBOWSKI, 1896)

(Pl. III, Figs 16, 17)

1896. *Textularia subhaeringensis* GRZYBOWSKI; J. GRZYBOWSKI, p. 285, Pl. 9, Figs 13, 16.
1929. *Textularia excolata* CUSHMAN; M. P. WHITE, p. 30, Pl. 4, Fig. 1.

1946. *Spiroplectammina excolata* (CUSHMAN); J. A. CUSHMAN, p. 27, Pl. 5, Figs 9, 10.
?1953. *Spiroplectammina knebeli* LE ROY; L. W. LE ROY, p. 19, Pl. 2, Figs 10, 11.
1959. *Vulvulina* sp.; J. MORGIEL, p. 111, Pl. 13, Fig. 6.
1960. *Spiroplectammina* sp.; S. GEROCH, p. 57, Pl. 8, Fig. 1.
1962. *Spiroplectammina excolata* (CUSHMAN); A. HILLEBRANDT, p. 29, Pl. 1, Figs 12, 13; Text-fig. 2.
1966. *Spiroplectammina subhaeringensis* (GRZYBOWSKI); F. HUSS, p. 39, Pl. 6, Figs 15-17.
1966. *Spiroplectammina excolata* (CUSHMAN); J. HOFKER, p. 306, Pl. 66, Figs 7, 8.
1970. *Spiroplectammina excolata* (CUSHMAN); Y. KIESEL, p. 194, Pl. 3, Fig. 24; Pl. 16, Fig. 1.

Material. — Twelve specimens well preserved.
Dimensions of three specimens (in mm):

	F. XIV/16	F. XIV/17	F. XIV/18
Length	0.74	0.54	0.29
Maximal width . . .	0.74	0.44	0.25
Thickness	0.40	0.25	0.15

Description. — Test generally as long as broad, very rapidly enlarging in width and thickness towards the apertural end. Periphery subacute, sometimes slightly serrate. Spiral part markedly smaller than biserial. Chambers low, up to 6 in one row, strongly overlapping each other, bent downwards. Sutures more or less distinct, raised. Apertural face broad, bordered by thickened margin of the test. Aperture basal, short, slit-like.

Variation rather significant, concerning size of tests and degree of overlapping of chambers. Spiral part of the test is sometimes overlapped by younger, biserial part, or it sticks out.

Remarks. — The Polish specimens are very similar to the holotype of the species *Textularia* (recte *Spiroplectammina*) *excolata*, described by CUSHMAN (1926) from the Upper Cretaceous of Mexico. At the same time, they do not differ from those described previously by GRZYBOWSKI (1896) from the Cretaceous of the Polish Carpathians as *T. subhaeringensis*. They are identical with the specimens from the Paleocene of Austria, figured by HILLEBRANDT (1962) as *Spiroplectammina excolata*, and are close to those described as *S. knebeli* by LE ROY (1953) from the Upper Cretaceous of Egypt.

Occurrence. — The species is common in Tethyan regions: Trinidad, Mexico, Morocco, Egypt?, Austrian Alps, Polish Carpathians, Yugoslavia, Crimea, Caucasus and south-western Asia (USSR). Occasionally found in epicontinental facies of Germany and Denmark; Cretaceous — Eocene.

Genus **VULVULINA** D'ORBIGNY, 1826

Vulvulina sp.

(Pl. III, Figs 13, 14)

?1949. *Vulvulina flabelliformis* (GÜMBEL); V. POKORNÝ, Pl. 1, Figs 15, 16.
?1957. *Vulvulina flabelliformis* (GÜMBEL); S. LISZKA, p. 167, Pl. 8, Fig. 2.
?1959. *Vulvulina* sp.; J. MORGIEL, p. 128, Pl. 13, Fig. 6.
?1962. *Vulvulina* cf. *colei* CUSHMAN; A. HILLEBRANDT, p. 32, Pl. 1, Fig. 18.
?1967. *Vulvulina flabelliformis* (GÜMBEL); F. BIEDA *et al.*, Pl. 5, Fig. 2.

Material. — Three specimens damaged.
Dimensions of two specimens (in mm):

	F. XIV/19	F. XIV/20
Length	0.69	0.49
Width	0.41	0.39
Thickness . . .	0.25	0.20

Description. — Test compressed, lenticular in transverse section, composed of fairly large biserial portion, tapering in initial part, and of shorter uniserial, younger portion. Initial spiral test portion, which is of diagnostic importance for the genus *Vulvulina*, is poorly differentiated. Periphery acute, slightly serrate. Chambers distinct, numerous, low, obliquely arranged in the biserial portion, and horizontally arranged in the uniserial portion. Sutures distinct, curved, raised, particularly in the biserial test part. Axial test part elevated. Aperture damaged. Test surface finely grained, arenaceous, almost smooth.

Remarks. — The specimens determined as *Vulvulina* sp. are presumably conspecific with those described as *Vulvulina* sp. by MORGIEL (1959) from the Babica clays of the Polish Carpathians; however, MORGIEL (1959) figured her species rather schematically and regarded it as close to *Vulvulina jarvisi* CUSHMAN (1932) — species described from the Eocene of America; the latter species differs from the specimens described herein in distinctly "spinous" margin. Thus, the species described by MORGIEL (1959) is here placed in the synonymy with reservation. From the Eocene of the Carpathians, POKORNÝ (1949), LISZKA (1957) and BIEDA *et al.* (1967) described *Vulvulina flabelliformis* (GÜMBEL) — the species which differs from the *Vulvulina* sp. from the Paleocene of Babica in spiral and biserial test parts markedly differing in width. The Babica specimens are characterized by quite regular, entire outline of the initial test part, thus they are tentatively regarded as conspecific with *Vulvulina flabelliformis* (GÜMBEL). The holotype of *Textularia* (recte *Vulvulina*) *flabelliformis* GÜMBEL, 1868, described from the Eocene of the Alps (Bavaria), as it follows from its rather schematical drawing, is more similar to the specimens from the Paleocene than from the Eocene of the Carpathians; however, it has no uniserial part and that is why the full comparison is at present impossible. *Vulvulina* cf. *colei* CUSHMAN, described by HILLEBRANDT (1962) from the Paleocene of Austria, closely resembles the specimens from the Paleocene of the Carpathians in its general outline; however, it is difficult to state whether or not it is conspecific with the forms in question, as morphology of its test is hardly visible on the photo. *Vulvulina* cf. *jarvisi* CUSHMAN, as figured and described by HOFKER (1966) from the Danian of Denmark, as well as *Vulvulina furssenkoi* described by MOROZOVA *et al.* (1967) from the Cretaceous and Paleocene of Crimea, Caucasus and Turkmenia, somewhat resemble the forms described herein. All the above cited species are most probably closely related.

Occurrence. — In Poland in Carpathians exclusively; Paleocene — ?Eocene. Similar forms are reported from Tethyan regions; Cretaceous — Eocene.

Family ATAXOPHRAGMIIDAE SCHWAGER, 1877

Genus **HETEROSTOMELLA** CUSHMAN, 1911

?**Heterostomella gigantica turkmenica** MOROZOVA, 1967

(Pl. I, Figs 9, 10)

1948. *Heterostomella gigantica* SUBBOTINA; D. M. CHALILOV, p. 37, Pl. 3, Fig. 4.

1967. *Heterostomella gigantica turkmenica* MOROZOVA; V. G. MOROZOVA, G. E. KOJEWNIKOVA & A. M. KURILEVA, p. 183, Pl. 3, Fig. 7.

Material. — Six specimens well preserved.

Dimensions of two specimens (in mm):

	F. XIV/21	F. XIV/22
Length	1.52	1.18
Maximal width . . .	0.78	0.74
Thickness	0.59	0.59

Description. — Test solid, elongated, subtriangular in general outline. Triserial part high, with rounded margins and chambers closely adjoining one another; biserial part ovate to subquadrate in axial section; chambers of the biserial part better differentiated and more inflated than those of the triserial part, and markedly overlapping one another. Sutures flush with the surface along the triserial part, straight or gently curved, incised along the biserial test part. Aperture — a short horizontal slit continuing along or just above the suture at the base of the last chamber. Test surface rough, coarsely arenaceous.

Variation not significant, concerning the size of test and biserial/triserial part lengths ratio. Chambers of the biserial part may be more or less angulated and to a different degree overlapping one another.

Remarks. — The specimens from the Polish Carpathians, assigned to *?Heterostomella gigantica turkmenica* MOROZOVA, are very close to that figured and described from the Paleocene of USSR. The differences primarily concern the development of aperture, which is always basal and slit-like in Polish forms, and circular and situated distant from the base in the Turkmenian forms. The identifications of Polish specimens was kindly verified by MOROZOVA. According to LOEBLICH and TAPPAN (1964), terminal aperture is a diagnostic feature of the genus *Heterostomella*, and basal aperture, such as that of the Polish specimens, is typical of the genus *Gaudryina*. Thus, the Polish specimens are assigned to the genus *Heterostomella* with reservation.

A very close species was described by HILLEBRANDT (1962) from the Paleocene of Austria as *Gaudryina aissana* TEN DAM & SIGAL (1950).

Occurrence. — The species is described from USSR (Caucasus and Turkmenia), in Poland in Carpathians only; Paleocene.

Genus **TRITAXIA** REUSS, 1860

Tritaxia pyramidata REUSS, 1863

(Pl. III, Fig. 15)

1863. *Tritaxia pyramidata* REUSS; A. E. REUSS, p. 32, Pl. 1, Fig. 9.

1937. *Tritaxia pyramidata* REUSS; J. A. CUSHMAN, p. 22, Pl. 2, Figs 21-24; Pl. 3, Figs 1, 5, 7 *(earlier synonymy included here)*.

1949. *Tritaxia pyramidata* REUSS; J. CUVILLIER & V. SZAKALL, p. 20, Pl. 7, Fig. 11.

Material. — Two specimens well preserved.

Dimensions of two specimens (in mm):

	F. XIV/23	F. XIV/24
Length	0.59	0.54
Maximal width . . .	0.38	0.34

Description. — Test short, triserial, triangular in cross-section, broadest close to apertural end, tapering towards the initial end, with flattened sides and subacute margins; sutures slightly depressed. Aperture terminal, rounded, rather large. Wall moderately rough.

Remarks. — The Polish specimens fall within the limits of variability of the specimens figured by CUSHMAN (1937), differing from the holotype drawn by REUSS (1863, see Catalogue of Foraminifera) in less slender outline and in not so sharply tapered initial parts.

Tritaxia pyramidata differs from *T. tricarinata* primarily in its more pyramidal shape.

Occurrence. — The species in reported only from the Upper Cretaceous of Europe (France, Germany, England, Czechoslovakia), in Poland — in studied samples from the Paleocene of Carpathians and in Cretaceous of Pomerania (CUSHMAN, 1937).

Tritaxia tricarinata (REUSS, 1844)

(Pl. I, Fig. 8)

1844. *Textularia tricarinata* REUSS; A. E. REUSS, p. 215.
1845. *Textularia tricarinata* REUSS; A. E. REUSS, Pl. 8, Fig. 60.
1895. *Tritaxia tricarinata?* RSS.; J. GRZYBOWSKI, p. 188, Pl. 1, Fig. 20.
1937. *Tritaxia tricarinata* (REUSS); J. A. CUSHMAN, p. 25, Pl. 3, Figs 16-25 *(earlier synonymy included here)*.

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

	F. XIV/25	F. XIV/26
Length	0.88	0.98
Maximal width . . .	0.49	0.54

Description. — Test large, triserial elongated, somewhat fusiform, triangular in cross-section, with slightly rounded angles and concave sides; terminal chamber of adult forms projected. Chambers low, indistinct, slowly increasing in size; sutures gently curved, flush with the surface. Aperture terminal, represented by a circular opening at the top of the last chamber. Wall vitreous, almost smooth.

Variation not large, primarily concerning the size and general shape. Particular specimens more or less slender and elongated.

Remarks. — The specimens of the Paleocene of the Polish Carpathians differ from the holotype illustrated by REUSS (1844) in less fusiform general shape and more parallel test margins; however, they fall within the limits of variability of this species, if its interpretation by CUSHMAN (1937) is accepted.

Occurrence. — The species is reported from Egypt, France (Aquitanian Basin), England, Slovak Carpathians, Germany; Cretaceous — Paleocene. In Poland — in studied samples from the Paleocene of Carpathians and in Cretaceous of Pomerania (CUSHMAN, 1937).

Genus **DOROTHIA** PLUMMER, 1931

Dorothia crassa (MARSSON, 1878)

(Pl. I, Fig. 15, 16)

1878. *Gaudryina crassa* MARSSON; T. MARSSON, p. 158, Pl. 3, Fig. 27.
1878. *Gaudryina crassa* var. *trochoides* MARSSON; T. MARSSON, p. 159, Pl. 3, Fig. 27.
1937. *Dorothia trochoides* (MARSSON); J. CUSHMAN, p. 79, Pl. 8, Figs 25-27.
1957. *Marssonella crassa* (MARSSON); S. BUKOWY & S. GEROCH, p. 315, Pl. 30, Figs 1-4.
1966. *Dorothia crassa* (MARSSON); F. HUSS, p. 45, Pl. 8, Figs 8, 9.
1972. *Dorothia trochoides* (MARSSON); E. HANZLIKOVA, p. 58, Pl. 13, Fig. 9.

Material. — Eight specimens well preserved.
Dimensions of four specimens (in mm):

	F. XIV/27	F. XIV/28	F. XIV/29	F. XIV/30
Length	0.98	0.74	0.59	0.49
Maximal width . . .	0.69	0.54	0.54	0.39
Thickness	0.69	0.54	0.54	0.39

Description. — Test solid, with early portion trochospiral and later biserial. Chambers somewhat inflated and rather rapidly enlarging in size as added, which results in distinct enlarging of test towards the apertural end. Sutures slightly oblique, incised. Apertural face margins rounded. Aperture in the form of an arched slit, situated at the base of the last chamber. Test surface coarsely roughened.

Variation significant, primarily concerning the size and general shape of tests. Juvenile forms short, distinctly conical in lateral outline, and with three chambers in the last formed whorl, differing from the adult ones in arrangement and degree of inflation of chambers.

Remarks. — The Polish specimens attributed to *Dorothia crassa* are very similar to its figured holotype, described by MARSSON (1878) from the Upper Cretaceous of Germany. The subspecies *Gaudryina* (recte *Dorothia*) *crassa trochoides*, erected by the same author (MARSSON, 1878), falls within the range of variability of the nominal species, and thus it is usually identified with the latter subspecies. HANZLIKOVA (1972) is the only exception here, as she allocates *Dorothia trochoides* (MARSSON) in the synonymy of the species *Dorothia crassa* (MARSSON), following CUSHMAN (1937), who elevated the subspecies *Gaudryina crassa trochoides* to the species rank, because according to him, *G. crassa* MARSSON (1878) was homonymous with *G. crassa* KARRER (1870).

Occurrence. — The species is reported from Tethyan region: France (Aquitanian Basin), Swiss Alps, Slovak, Polish and Rumanian Carpathians. Occasionally found in epicontinental facies of northern Germany; Cretaceous — Paleocene.

Dorothia longa (MOROZOVA, 1967)

(Pl. III, Fig. 1)

1967. *Marssonella longa* MOROZOVA; V. G. MOROZOVA, G. E. KOJEWNIKOVA & A. M. KURILEVA, p. 184, Pl. 3, Figs 1, 2.

Material. — Two specimens well preserved.

Dimensions of one specimen (in mm):

	F. XIV/31
Length	0.93
Maximal width . . .	0.44
Thickness	0.39

Description. — Test slender, long, moderately tapering in the lower part, ovate in transversal section, composed of triserial, older part, and biserial, younger part, almost equal in length. Chambers numerous, not inflated. Sutures straight, horizontal, flush with the surface to slightly depressed in biserial test part, attaining zigzag course in place where two chambers meet. Aperture formed by an arched slit situated at the base of the last formed chamber. Wall more coarsely arenaceous in triserial than in biserial test part. Apertural test face with sharply angulated margin.

Remarks. — The species *Dorothia longa* (MOROZOVA, 1967) is very similar to *D. oxycona* (REUSS), differing in more conical than cylindrical shape.

Occurrence. — The species is reported from the Paleocene of USSR (Turkmenia), present also in studied samples from the Paleocene of Polish Carpathians.

Dorothia oxycona (REUSS, 1860)

(Pl. I, Figs 13, 14)

1860. *Gaudryina oxycona* REUSS; A. REUSS, p. 229, Pl. 12, Fig. 3.
1953. *Marssonella oxycona* (REUSS); L. W. LE ROY, p. 39, Pl. 1, Figs 3, 4.
1957. *Marssonella oxycona* (REUSS); J. HOFKER, p. 85, Text-figs 86-90.
1959. *Marssonella oxycona* (REUSS); J. LISZKOWA, p. 46, Pl. 6, Figs 2, 3.
1959. *Marssonella oxycona* (REUSS); J. MORGIEL, p. 115, Pl. 11, Fig. 3.
1962. *Marssonella oxycona* (REUSS); A. HILLEBRANDT, p. 45, Pl. 2, Figs 6, 7.
1963. *Marssonella oxycona* (REUSS); J. P. BERMUDEZ, p. 42, Pl. 1, Figs 14, 15.
1965. *Marssonella oxycona* (REUSS); K. POŻARYSKA, p. 55, Pl. 2, Figs 2, 3.
1966. *Marssonella oxycona* (REUSS); J. SALAJ & O. SAMUEL, Pl. 38, Fig. 2.
1966. *Marssonella oxycona* (REUSS); J. HOFKER, p. 35, Pls 51, 87, 117, 135, 144, 278; Pl. 4, Fig. 8; Pl. 8, Fig. 16; Pl. 15, Fig. 6; Pl. 18, Fig. 33; Pl. 20, Fig. 20; Pl. 22, Fig. 70; Pl. 64, Fig. 118; Pl. 65, Fig. 133.
1967. *Marssonella oxycona* (REUSS); M. NEUMANN, p. 246, Text-figs 164, 165.

Material. — Eight specimens well preserved.
Dimensions of three specimens (in mm):

	F. XIV/32	F. XIV/33	F. XIV/34
Length	0.88	0.69	0.49
Maximal width . . .	0.67	0.67	0.44
Thickness	0.59	0.59	0.34

Description as given by POŻARYSKA (1965).

Variation considerable, primarily concerning the general size and length/width ratio, as well as the shape of the initial part of test, which varies from rounded to tapering.

Remarks. — The species requires revision comprising comparisons with some other similar species as *Marssonella crassa* (MARSSON, 1878), *M. indentata* (CUSHMAN & JARVIS, 1928), *M. nacataensis* (WHITE, 1929), *M. oxycona* var. *trinitatensis* CUSHMAN & RENZ (1946) and *Dorothia trochus* (D'ORBIGNY, 1840). The above species mostly differ in general size and mode of development of the initial part of test. The species in question, *D. oxycona* (REUSS) is assigned to the genus *Dorothia* in accordance with foraminiferal systematics of LOEBLICH and TAPPAN (1964). However, the congeneric status of *Dorothia* and *Marssonella*, suggested by those authors, needs further confirmation.

Occurrence. — A cosmopolitan form distributed in Tethyan regions all over the world, from Trinidad up to New Zealand. Well known also in epicontinental facies; Cretaceous — Paleocene.

Dorothia retusa (CUSHMAN, 1926)

(Pl. I, Figs 11)

1926. *Gaudryina retusa* CUSHMAN; J. A. CUSHMAN, p. 17, Pl. 4, Figs 7-10.
1928. *Gaudryina retusa* CUSHMAN; M. P. WHITE, p. 313, Pl. 42, Figs 8, 9.
1932. *Gaudryina retusa* CUSHMAN; J. A. CUSHMAN & P. W. JARVIS, p. 17, Pl. 4, Figs 7-10.
1946. *Textulariella trinitatensis* CUSHMAN & RENZ; J. A. CUSHMAN & H. H. RENZ, p. 23, Pl. 3, Figs 1-3.
1949. *Dorothia retusa* CUSHMAN; J. CUVILLIER & V. SZAKALL, p. 31, Pl. 14, Fig. 5.
1959. *Dorothia retusa* (CUSHMAN); J. MORGIEL, p. 115, Pl. 11, Fig. 4.
1959. *Dorothia retusa* CUSHMAN; J. LISZKOWA, p. 108, Pl. 3, Fig. 10.
1962. *Dorothia retusa* (CUSHMAN); A. HILLEBRANDT, p. 41, Pl. 1, Fig. 31.
1963. *Dorothia retusa* (CUSHMAN); E. KAVARY & DON L. FRIZZELL, p. 18, Pl. 2, Fig. 9.
1963. *Dorothia retusa* CUSHMAN; P. J. BERMUDEZ, p. 27, Pl. 2, Figs 14, 15.

Material. — Eleven specimens well preserved.
Dimensions of three specimens (in mm):

	F. XIV/44	F. XIV/45	F. XIV/46
Length	0.88	0.98	0.64
Maximal width . . .	0.69	0.64	0.39

Description. — Test fairly large, stout, elongated, subcircular to ovate in transversal section. Early portion trochospiral, relatively short, gradually passing into biserial, larger test portion. Chambers numerous, distinct, somewhat inflated. Sutures weakly marked, depressed in the younger test portion. Aperture — an arched, short slit at the base of the last chamber. Wall coarsely roughened.

Variation not significant, primarily concerning the test outline in transversal section, which is more or less circular. Sutures more or less depressed. Degree of convexity of chambers is also variable.

Remarks. — The specimens from the Paleocene of the Polish Carpathians, assigned to *Dorothia retusa* (CUSHMAN), do not differ from the figured North American and Mexican representatives of this species. Forms almost identical as those from the Polish Carpathians are found in the comparative material from the Paleocene (Velasco Fm.) of Mexico.

On the basis of drawing of the holotype, *Textulariella trinitatensis* CUSHMAN & RENZ (1946) described from the Upper Cretaceous of Trinidad, cannot be separated from the species *Dorothia retusa* (CUSHMAN) and is placed in the synonymy of the latter species only tentatively.

Occurrence. — The species is reported from the Tethyan region only: Trinidad, Mexico, France (Aquitanian Basin), Morocco, Yugoslavia, Swiss and Austrian Alps, Polish Carpathians, Crimea, Caucasus, south-western Asia (USSR and Iran); Cretaceous — Eocene.

Genus **CLAVULINA** D'ORBIGNY, 1826

?**Clavulina aspera aspera** CUSHMAN, 1926

(Pl. III, Fig. 7)

1926. *Clavulina trilatera* var. *aspera* CUSHMAN; J. A. CUSHMAN, p. 589, Pl. 17, Fig. 3.
1928. *Clavulina trilatera* CUSHMAN; M. P. WHITE, p. 315, Pl. 42, Fig. 13 (non *Clavulina trilatera* CUSHMAN, 1926).
1928. *Clavulina trilatera* var. *aspera* CUSHMAN; M. P. WHITE, p. 315, Pl. 42, Fig. 14.
1932. *Clavulina aspera* CUSHMAN; J. A. CUSHMAN & P. W. JARVIS, p. 19, Pl. 5, Fig. 4.
1946. *Clavulinoides aspera* (CUSHMAN); J. A. CUSHMAN & H. H. RENZ, p. 22, Pl. 2, Fig. 25.
1946. *Clavulinoides aspera* (CUSHMAN); J. A. CUSHMAN, p. 38, Pl. 9, Figs 24-30.
?1953. *Clavulinoides asper* (CUSHMAN); L. W. LE ROY, p. 26, Pl. 1, Figs 5, 6.
?1953. *Clavulinoides trilaterus* (CUSHMAN); L. W. LE ROY, p. 26, Pl. 1, Figs 9, 10.

Material. — Five specimens damaged.
Dimensions of two specimens (in mm):

	F. XIV/38	F. XIV/39
Length	1.81	1.22
Maximal width . . .	0.49	0.34

Description. — Test large, stout, triangular in axial section. Uniserial and triserial parts almost uniform in width; the latter more or less long. Chambers numerous, low; sutures hardly distinguishable, slightly depressed. Aperture — a rounded opening at the top of the last chamber. Wall thick, coarsely arenaceous, roughly finished.

Variation not significant, primarily concerning the size of mineral test-building particles and triserial to uniserial parts length ratio.

Remarks. — The specimens from the Polish Carpathians are very similar to the figured holotype of this species by CUSHMAN (1926) from the Upper Cretaceous (Velasco shale) of Mexico. Upper Cretaceous specimen of Egypt assigned by LE ROY (1953) to *Clavulinoides asper* (CUSHMAN), and Paleocene specimen from Egypt assigned by this author to *C. trilaterus* (CUSHMAN) seem to be conspecific with the Polish representative of ?*Clavulina aspera aspera* CUSHMAN, differing however in more distinct sutures, more numerous chambers and in less coarsely arenaceous walls.

The species is tentatively placed in the genus *Clavulina*, as the Polish representatives do not have ventral tooth, characteristic of this genus. *Clavulina trilatera* (CUSHMAN), regarded as a variety of *Clavulina aspera* by CUSHMAN (1923), was placed by LOEBLICH and TAPPAN (1964) in the genus *Tritaxia*.

Occurrence. — The species occurs in Tethyan regions: Mexico, USA (Gulf Coast), Trinidad, Egypt, Polish Carpathians; Cretaceous — Paleocene.

?**Clavulina aspera whitei** CUSHMAN & JARVIS, 1932

(Pl. III, Figs 8, 9)

1932. *Clavulina aspera* Cushman *whitei*, new var.; J. A. CUSHMAN & P. W. JARVIS, p. 19, Pl. 5, Fig. 6 (non Figs 7, 8).
1946. *Clavulinoides aspera* (CUSHMAN) var. *whitei* (CUSHMAN & JARVIS); J. A. CUSHMAN, p. 39, Pl. 9, Fig. 31.
1948. *Clavulina aspera* WHITE & JON.; D. M. CHALILOV, p. 32, Pl. 3, Fig. 5.
1959. *Clavulinoides aspera* (CUSHMAN) var. *whitei* (CUSHMAN & JARVIS); J. MORGIEL, p. 129, Pl. 13, Fig. 8.
1963. *Clavulinoides asper whitei* (CUSHMAN & JARVIS); P. J. BERMUDEZ, p. 23, Pl. 2, Figs 3-5

Material. — Eight specimens, almost all damaged.
Dimensions of two specimens (in mm):

	F. XIV/40	F. XIV/41
Length	1.22	1.57
Maximal width . . .	0.34	0.39

Description. — This subspecies differs from the nominal subspecies (here also described) in the shape of the younger part of the test. Triangular section confined to early triserial test part; uniserial test part somewhat smaller in cross-section than the triserial one, and composed of 4 to 8 rounded, slightly inflated chambers, almost equal in size. Sutures depressed. Wall arenaceous, rough.

Variation small, primarily concerning the size of specimens and number and degree of inflation of chambers. Larger specimens are generally more coarsely arenaceous.

Remarks. — The specimens from the Paleocene of the Polish Carpathians closely resemble the figured holotype of *Clavulina aspera whitei* CUSHMAN & JARVIS, 1923, described from the Upper Cretaceous of Trinidad (but not the topotypes, which were interpreted by CUSHMAN and JARVIS (1932) as microspheric forms), differing in more differentiated test-building grains and in the lack of valvular tooth.

Remarks concerning the generic assignment of this species — as at the species ?*Clavulina aspera aspera* (p. 38).

Occurrence. — The species occurs in Tethyan regions: Trinidad, Mexico, USA (Gulf Coast), France (Aquitanian Basin), Polish Carpathians, Morocco, Caucasus and south-western Asia (USSR); Cretaceous — Paleocene.

Genus **GOESELLA** Cushman, 1933

Goesella rugosa (Hanzlikova, 1953)

(Pl. III, Figs 2, 3)

1953. *Marssonella rugosa* Hanzlikova; E. Hanzlikova, p. 493, Pl. 2, Figs 5, 7.
?1959. *Goesella carpathica* Liszkowa; J. Liszkowa, p. 60, Pl. 3, Fig. 9.
1962. *Dorothia beloides* Hillebrandt; A. Hillebrandt, p. 39, Pl. 2, Figs 8-14.
?1966. *Goesella carpathica* Liszkowa; F. Huss, p. 51, Pl. 8, Figs 10-17.
1972. *Goesella rugosa* (Hanzlikova); E. Hanzlikova, p. 59, Pl. 12, Fig. 5.

Material. — Thirteen specimens well preserved.
Dimensions of two specimens (in mm):

	F. XIV/42	F. XIV/43
Length	0.74	0.54
Maximal width . . .	0.34	0.34

Description. — Test stout, elongated, with early portion trochospiral, short and tapering, later portion biserial, long, and subparallel margins. Chambers numerous, not inflated; sutures horizontal, almost flush with the surface. Aperture interiomarginal. Wall coarsely arenaceous.

Variation primarily concerning the length and general shape of test. Tests are almost cylindrical to rather conical; in the latter case they resemble *Dorothia crassa* (Marsson).

Remarks. — The specimens from the Paleocene of the Polish Carpathians are very similar to those referred to *Marssonella* (recte *Goesella*) *rugosa* Hanzlikova (1953) from the Upper Cretaceous of the Slovak Carpathians, as well as to those described as *Dorothia beloides* Hillebrandt (1962) from the Paleocene of Austria. Both these species are treated by Hanzlikova (1972) as conspecific. Hanzlikova (1972) also places here the species *Goesella carpathica* described by Liszkowa (1959) from the Upper Cretaceous of the Polish Carpathians; however, it is disputable as the representatives of *G. carpathica* reach uniserial test form in the course of their ontogenetic development, which do occur neither in the specimens described by Hanzlikova (1953, 1972), nor by Hillebrandt (1962).

Occurrence. — The species is reported from Tethyan regions: Trinidad, Spain, Austrian Alps, Slovak and Polish Carpathians; Cretaceous — Paleocene.

Genus **MATANZIA** Palmer, 1936

Matanzia varians (Glaessner, 1937)

(Pl. I, Fig. 12)

1937. *Textulariella? varians* Glaessner; M. F. Glaessner, p. 366, Pl. 2, Fig. 15.
1947. *Remesella mariae* Vašiček; M. Vašiček, p. 246, Text-fig. 2, Pl. 2, Fig. 14.
1962. *Textulariella varians* Glaessner; A. Hillebrandt, p. 45, Pl. 1, Fig. 27, Text-fig. 4.
?1966. *Hagenowella paleocenica* Hofker; J. Hofker, p. 334, Pl. 77, Figs 16, 17.
1968. *Matanzia varians* (Glaessner); O. Samuel & J. Salaj, p. 68, Text-fig. 11.
1969. *Matanzia varians* (Glaessner); E. Hanzlikova, p. 25, Pl. 2, Fig. 19.

Material. — A dozen or so specimens well preserved.
Dimensions of three specimens (in mm):

	F. XIV/35	F. XIV/36	F. XIV/37
Length	0.83	0.70	0.59
Maximal width . . .	0.56	0.39	0.32

Description. — Test fairly large, stout, subovate in lateral outline, and circular to subcircular in transverse section; early test portion trochospiral, later one — biserial. Chambers internally divided by vertical partitions, sometimes observable on outer test surface. Chambers numerous, distinct, fairly inflated; sutures depressed, especially on the biserial test part. Aperture interiomarginal, situated at the base of the last formed chamber. Wall rather coarsely arenaceous.

Variation primarily concerning the size of general shape of tests. Some specimens are bulbous, whereas other are elongated and more slender.

Remarks. — The Polish specimens are very similar and certainly conspecific with the illustrated specimens of *Matanzia varians* (GLAESSNER, 1937). The latter are very similar to the representatives of *Dorothia retusa* (CUSHMAN, 1926), primarily differing in meander inner test structure, usually poorly marked on test surface. The comparison of both these species was given by GLAESSNER (1937). *Hagenowella paleocenica* HOFKER (1966), described from the Paleocene of Denmark, presumably falls within the variability of the species *Matanzia varians*.

Occurrence. — The species is common in Tethyan regions: Swiss and Austrian Alps, Slovak, Polish and Rumanian Carpathians, Crimea and Caucasus; Cretaceous — ?Eocene. Probably occurs in epicontinental facies of Denmark, from where it is described as *Hagenowella paleocenica* by HOFKER (1966).

Family NODOSARIIDAE EHRENBERG, 1838

Genus **CITHARINA** D'ORBIGNY, *in* DE LA SAGRA, 1839

Citharina plumoides (PLUMMER, 1926)

(Pl. IV, Fig. 5)

1926. *Vaginulina plumoides* PLUMMER; J. H. PLUMMER, p. 113, Pl. 6, Fig. 6.
1951. *Vaginulina plumoides* PLUMMER; J. A. CUSHMAN, p. 28, Pl. 8, Figs 16-18.
1960. *Citharina plumoides* (PLUMMER); R. K. OLSSON, p. 19.
1965. *Citharina plumoides* (PLUMMER); K. POŻARYSKA, p. 81, Pl. 11, Fig. 10.
1966. *Citharina plumoides* (PLUMMER); J. HOFKER, p. 309, Pl. 68, Fig. 48.
1970. *Citharina plumoides* (PLUMMER); Y. KIESEL, p. 238, Pl. 10, Fig. 3.

Material. — Two specimens somewhat damaged at the apertural end.

Dimensions of one specimen (in mm):

	F. XIV/47
Length	0.88
Maximal width . . .	0.27
Thickness	0.10

Description as given by POŻARYSKA (1965).

Remarks. — Polish specimens differ from the types found in the comparative material from the Paleocene (Midway Fm.) of Texas, bearing fine striae parallel to the growth direction, visible on test surface close to apertural end, in being completely covered by weakly marked striae. In turn, the representatives of this species from Sweden have better developed striae, visible also on the whole test surface, and particularly accentuated when they are crossing sutures. PLUMMER (1926) allocated in this species both specimens covered with striae and devoid of them.

Occurrence. — The species is reported from North America, New Zealand, Sweden, Germany, Polish Lowlands and Carpathians, and Denmark; Upper Cretaceous — Paleocene.

Genus **FRONDICULARIA** DEFRANCE, *in* D'ORBIGNY, 1826

Frondicularia biformis MARSSON, 1878

(Pl. IV, Figs 10-12)

1878. *Frondicularia biformis* MARSSON; T. MARSSON, p. 137, Pl. 2, Fig. 17c, d.
1928. *Frondicularia biformis* MARSSON; A. FRANKE, p. 72, Pl. 6, Figs 19, 20.
1946. *Frondicularia* sp. A; J. A. CUSHMAN & R. TOOD, p. 2, Pl. 9, Fig. 24.
1957. *Frondicularia biformis* MARSSON; K. POŻARYSKA, p. 139, Pl. 20, Fig. 7.
1960. *Frondicularia* sp.; R. K. OLSSON, p. 22, Pl. 3, Fig. 19.
1965. *Frondicularia biformis* MARSSON; K. POŻARYSKA, p. 82, Pl. 11, Fig. 1.
1966. *Frondicularia biformis* MARSSON; J. HOFKER, p. 105, Pl. 69, Fig. 75; Pl. 70, Fig. 102.

Material. — Eight specimens well preserved.
Dimensions of three specimens (in mm):

	F. XIV/48	F. XIV/49	F. XIV/50
Length	0.59	0.49	0.47
Maximal width . . .	0.42	0.32	0.29
Thickness	0.15	0.12	0.10

Description as given by POŻARYSKA (1957, 1965).

Variation significant, primarily concerning the size of tests, as well as number, height and mode of overlapping of chambers, i.e. different general outline.

Remarks. — The specimens in question represent the form B of FRANKE (1925, 1928) of the species *Frondicularia biformis* distinguished by MARSSON (1878). Carpathian representatives of this species, when their remarkable variation is taken into account, do not differ from those described from the Cretaceous and Paleocene of the Polish Lowlands (POŻARYSKA, 1957, 1965). Specimens from the Paleocene of Poland as well as those from the Cretaceous and Paleocene of America, described as *Frondicularia* sp. and subsequently included into the synonymy of the species *Frondicularia biformis*, are very similar to each other; however, they differ from the representatives of this species from the Cretaceous of Rügen, i.e. its type locality, and from western Pomerania, in smaller number of chamber.

Occurrence. — The species is known from Germany, Denmark, Polish Lowlands and Carpathians, present in Austrian Alps (Kroisbach), and North America; Upper Cretaceous — Paleocene.

Genus **LENTICULINA** LAMARCK, 1804

Lenticulina velascoensis (WHITE, 1928)

(Pl. IV, Fig. 20)

1928. *Lenticulina velascoensis* WHITE; M. P. WHITE, p. 199, Pl. 28, Fig. 8.
1946. *Lenticulina velascoensis* WHITE; J. A. CUSHMAN, p. 57, Pl. 19, Fig. 8.
1959. *Lenticulina velascoensis* WHITE; J. LISZKOWA, p. 62, Pl. 4, Fig. 4.
1962. *Robulus velascoensis* WHITE; A. HILLEBRANDT, p. 55, Pl. 3, Fig. 19.
1969. *Lenticulina velascoensis* WHITE; E. HANZLIKOVA, p. 29, Pl. 4, Fig. 5.

Material. — Two specimens with slightly damaged last chamber.
Dimensions of two specimens (in mm):

	F. XIV/51	F. XIV/52
Longest diameter . . .	0.29	0.27
Shortest diameter . . .	0.25	0.22
Thickness	0.17	0.12

Description. — Test flattened, lenticular, biumbonate; peripheral margin sharply angulate, keeled; chambers coiled in two and a half whorls, very slowly increasing in size; the last whorl consisting of 11 chambers. Sutures slightly curved, weakly raised. Umbos well developed, depressed on both sides. Aperture damaged. Wall finely perforated.

Remarks. — The Polish specimens differ from the topotype of this species from the Paleocene (Velasco Fm.) of Mexico in markedly smaller size and somewhat elevated sutures.

Occurrence. — The species is common in Tethyan regions: Mexico and Gulf Coastal region of USA, Trinidad, France (Aquitanian Basin), Austrian Alps, Italy, Slovak and Polish Carpathians, and Bulgaria; Upper Cretaceous — Eocene.

Lenticulina cf. **ariminensis** (D'ORBIGNY, 1846)

(Pl. IV, Fig. 17)

Material. — A single specimen well preserved.

Dimensions of one specimen (in mm):

	F. XIV/53
Longest diameter . . .	0.98
Shortest diameter . . .	0.74
Thickness	0.47

Description. — Test thick, oval in general outline, somewhat evolute, composed of 6 chambers growing in size and becoming progressively more inflated as added. Test surface covered by numerous longitudinal, distinct, discontinuous and irregularly spaced ribs. Keel well developed, continuing along almost the whole length of the test margin. Aperture prominent, terminal, radial. Aperture area wide, truncated, smooth, laterally bordered by distinct ribs.

Remarks. — The Polish specimen is most similar to the specimen described by D'ORBIGNY (1846) from the Miocene of Austria as *Robulina* (recte *Lenticulina*) *ariminensis*, differing from it in somewhat more ovate general outline (i.e. in being more elongated), in less regular ribs, and in being less compressed laterally.

Occurrence. — Polish Carpathians; Upper Paleocene.

Lenticulina cf. **obtusimargo** (SEGUENZA, 1880)

(Pl. II, Fig. 8)

Material. — Two specimens well preserved.

Dimensions of two specimens (in mm):

	F. XIV/54	F. XIV/55
Longest diameter . . .	0.37	0.34
Shortest diameter . . .	0.33	0.33
Thickness	0.20	0.19

Description. — Test biumbonate, angularly rounded and gently lobulate in peripheral outline, lenticular in edge view, keeled, consisting of five chambers in outer, the only distinguishable whorl. Sutures flush with test surface, rather oblique than sickled, with a tendency to overlap each other at the large, not elevated central umbo. Test surface smooth. Apertural area narrow, with ridges situated close to keel. Aperture radial, with distinct radial apertural slit.

Remarks. — The Polish specimens are very similar to the form figured and described by SEGUENZA, 1880, from the Upper Miocene of Italy as *Robulina* (recte *Lenticulina*) *obtusimargo*. However, inaccurate description and unsatisfactory figure of the holotype of the latter species preclude more precise comparisons with the Polish material.

Occurrence. — Polish Carpathians; Upper Paleocene.

Lenticulina cf. **revolutus** (ISRAELSKY, 1955)

(Pl. II, Figs 6, 7)

Material. — Three specimens well preserved.

Dimensions of two specimens (in mm):

	F. XIV/56	F. XIV/57
Longest diameter . . .	0.74	0.49
Shortest diameter . . .	0.69	0.46
Thickness	0.44	0.29

Description. — Test almost circular in general outline, lenticular in edge view, biumbonate, sharply keeled, consisting of about eight chambers in outer, the only observable whorl. Sutures flush with the test surface, limbate, distinctly sickled near the large umbo. Aperture damaged.

Variation small, primarily concerning general shape of tests in edge view; in that view, umbonal part of tests is elevated to a different degree. Some differences in details of apertural faces, morphology and in size of the specimens were also noted.

Remarks. — The specimens from the Paleocene of the Polish Carpathians attributed to *Lenticulina* cf. *revolutus* only slightly differ from typical representatives of *Robulus* (recte *Lenticulina*) *revolutus* described by ISRAELSKY (1955) from the Upper Paleocene — Lower Eocene (Lodo Fm.) of California (USA) in more strongly bent sutures. Differences in development of apertural faces are also inferred, but apertural ends of the Carpathian forms are damaged, so full comparison is precluded.

Occurrence. — Polish Carpathians; Upper Paleocene.

Lenticulina sp.

(Pl. IV, Fig. 18)

1928. *Lenticulina gaultina* (BERTHELIN); M. P. WHITE, p. 198, Pl. 28, Fig. 6 (non *Cristellaria gaultina* BERTHELIN, 1880).
1931. *Robulus curvisepta* (SEGUENZA); J. J. GALLOWAY & M. MORREY, p. 340, Pl. 38, Fig. 7 (non *Robulina curvisepta* SEGUENZA).

Material. — Two specimens somewhat damaged.

Dimensions of one specimen (in mm):

	F. XIV/58
Longest diameter . . .	0.32
Shortest diameter . . .	0.27
Thickness	0.17

Description. — Test almost entire in peripheral outline, circular, thick, closely coiled; peripheral margin acute, keeled. Chambers 5-6 in the only visible whorl, low and strongly overlapping each other; the overlap more distinct in umbilical region than close to peripheral

margin where chambers rapidly enlarge. Sutures oblique at the periphery, becoming strongly sickled in test center, flush with the test surface. Aperture damaged. Apertural face rather large, with weakly angulate margins. Surface smooth.

Remarks. — The specimens from the Paleocene of the Polish Carpathians, here described as *Lenticulina* sp., are almost identical with those attributed by White (1928) to *Lenticulina gaultina* (BERTHELIN) from the Paleocene (Velasco Fm.) of Mexico, markedly differing, however, from the figured holotype of *Cristellaria* (recte *Lenticulina*) *gaultina* described from the Lower Cretaceous of France.

The Polish specimens similarly resemble the forms described as *Robulus curvisepta* (SEGUENZA) by GALLOWAY and MORREY (1931) from the Upper Cretaceous of Mexico, markedly differing from the holotype of *Robulus* (recte *Lenticulina*) *curvisepta*, known from the Miocene of Italy. Some authors (HILLEBRANDT, 1962; WHITE, 1928; CUVILLIER & SZAKALL, 1949) compare specimens more or less similar to those, reported from the Paleocene of the Polish Carpathians, with *Nautilus* (recte *Lenticulina*) *vortex* FICHTEL & MOLL. However, *Lenticulina* sp. described herein differs from *L. vortex* in much less numerous and differently arranged chambers.

Occurrence. — Polish Carpathians; Upper Paleocene.

Genus **PSEUDONODOSARIA** BOOMGAART, 1949

Pseudonodosaria manifesta (REUSS, 1851)

(Pl. IV, Figs 1-4; Pl. XXXVIII, Figs 4-8)

1851. *Glandulina manifesta* REUSS; A. E. REUSS, p. 22, Pl. 2, Fig. 4.
1946. *Pseudoglandulina manifesta* (REUSS); J. A. CUSHMAN, p. 76, Pl. 27, Figs 20-26.
1953. *Pseudonodosaria manifesta* (REUSS); N. K. BYKOVA, p. 67, Pl. 2, Fig. 3.
1957. *Pseudoglandulina manifesta* (REUSS); K. POŻARYSKA, p. 93, Pl. 9, Fig. 7.
1959. *Pseudoglandulina manifesta* (REUSS); J. MORGIEL, p. 134, Pl. 14, Figs 4, 5.
1965. *Pseudonodosaria manifesta* (REUSS); B. MCGOWRAN, p. 36, Text-fig. 6 (1, 2).

Material. — Twenty eight specimens; some of them damaged.
Dimensions of four specimens (in mm):

	F. XIV/59	F. XIV/60	F. XIV/61	F. XIV/62
Length	0.72	0.47	0.44	0.34
Maximal width . . .	0.34	0.25	0.29	0.26

Description as given by POŻARYSKA (1957).

Variation significant, concerning size, number of chambers, and general outline of tests.

Remarks. — Some specimens from the Paleocene of the Polish Carpathians are identical with the figured holotype of this species described by REUSS (1851) from the Upper Cretaceous of south-eastern Poland. If the significant variation of the studied population is taken into account, it seems that the population may comprise forms A and B of *P. manifesta* and even representatives of a separate species.

Occurrence. — The species is known from North America, Europe, Africa, New Zealand and Australia; Cretaceous — Lower Paleogene.

Genus **VAGINULINA** D'ORBIGNY, 1826

Vaginulina cf. **plummerae** (CUSHMAN, 1937)

(Pl. IV, Figs 13-15; Pl. XXXVI, Figs 8-10)

Material. — Twenty eight specimens, in most cases well preserved.
Dimensions of three specimens (in mm):

	F. XIV/63	F. XIV/64	F. XIV/65
Length	1.10	0.83	0.64
Maximal width . . .	0.47	0.40	0.34
Thickness	0.34	0.29	0.24

Description. — Test large, stout, elongated, subovate in transverse section; peripheral margin more or less acute. Chambers initially weakly coiled or erected, later almost horizontally arranged, moderately increasing in size as added. Sutures somewhat oblique and elevated to a different degree. Aperture terminal, protruding, radial. There exist micro- and macrospheric forms.

Variation considerable, concerning the general shape, size, and ornamentation of tests. Tests uniform in width or widening towards the top. Initial part of tests erect, occasionally bent. Thickness of elevated sutures differing from one specimen to other; sutures sometimes with distinct, translucent, elongated protuberances, becoming markedly narrower towards the margins of tests.

Remarks. — Some specimens from the Paleocene of the Polish Carpathians are very similar to the forms described as *Marginulina plummerae* by CUSHMAN (1946) from the Upper Cretaceous of Texas (USA). When the remarkable variability of specimens assigned to *Vaginulina* cf. *plummerae* is taken into account, it may be assumed that this species is related to other species, and particularly to *Vaginulina robusta*, *Cristellaria* (recte *Vaginulina*) *longiforma* and *Cristellaria* (recte *Vaginulina*) *earlandi* — the three species described from the Paleocene (Midway Fm.) of America by Plummer (1926). These is also a close similarity between the specimens described herein and the representatives of *Cristellaria* (recte *Vaginulina*) *trilobata*, the species described by D'ORBIGNY (1840) from the Upper Cretaceous of France. All the above mentioned species are differently interpreted by particular authors.

Occurrence. — Polish Carpathians; Upper Paleocene. Related species are common in Upper Cretaceous — Eocene beds of Europe and North America.

Vaginulina sp.

(Pl. IV, Fig. 19)

Material. — Four specimens, of which three damaged.
Dimensions of one specimen (in mm):

	F. XIV/66
Height	0.98
Width	0.24
Thickness . . .	0.20

Description. — Test stout, elongated, uniserial, slightly compressed, except for its initial part, and composed of 7 low chambers. Test margin roughly parallel. Chambers uninflatted; sutures somewhat oblique, thickened, particularly in the mid-length. Surface smooth. Aperture radial, situated on protruding end of the last chamber.

Remarks. — Polish specimens are very similar to the forms from the Paleocene of Austria described by HILLEBRANDT (1962) as *Vaginulina* cf. *legumen* (LINNÉ), markedly differing, however, from the original form of LINNÉ (1758). They are also close to the specimen from the Paleocene of Jutland, referred by FRANKE (1928) to *Cristellaria ensis* REUSS. However, original figure and description of *Marginulina* (recte *Vaginulina*) *ensis* of REUSS (1845) are unfortunately insufficient for making any comparisons with the specimens of the present authors.

Occurrence. — Polish Carpathians; Upper Paleocene.

Family POLYMORPHINIDAE D'ORBIGNY, 1839

Genus **PSEUDOPOLYMORPHINA** CUSHMAN & OZAWA, 1928

Pseudopolymorphina geijeri BROTZEN, 1948

(Pl. IV, Fig. 16)

1948. *Pseudopolymorphina geijeri* BROTZEN; F. BROTZEN, p. 52, Text-fig. 10/15; Text-fig. 12.
1969. *Pseudopolymorphina geijeri* BROTZEN; E. J. KRAEVA & B. F. ZERNETZKIJ, p. 67, Pl. 24, Fig. 5.

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

	F. XIV/67
Length	0.44
Width	0.18
Thickness . . .	0.12

Description. — Test elongated, lenticular in peripheral outline, somewhat laterally compressed, widest just below the mid-height, slightly tapering towards apertural end. Chambers four in number, alternating, elongated; each of them overlapping the former one in its upper part. Sutures depressed. Test surface covered with fine longitudinal striae. Aperture terminal, damaged.

Rermarks. — The specimen determined here as *Pseudopolymorphina geijeri* easily falls within the limits of variability of that species, as interpreted by BROTZEN (1948). Additional remarks as given by BROTZEN (1948).

Occurrence. — Sweden, USSR (Ukraine and Dnieper-Donetz Basin), Polish Carpathians and Lowlands; Paleocene.

Family TURRILINIDAE CUSHMAN, 1927

Genus **PYRAMIDINA** BROTZEN, 1948

Pyramidina crassa BROTZEN, 1948

(Pl. V, Figs 14, 15)

1948. *Pyramidina crassa* BROTZEN; F. BROTZEN, p. 63, Pl. 6, Fig. 8.
1965. *Pyramidina crassa* BROTZEN; K. POŻARYSKA, p. 99, Pl. 15, Fig. 5.
1966. *Reussella crassa* (BROTZEN); J. HOFKER, p. 223, Pl. 81, Figs 157, 158; Pl. 45, Fig. 132.
1968. *Pyramidina crassa* BROTZEN; K. POŻARYSKA & J. SZCZECHURA, p. 46.

Material. — Eight specimens well preserved.
Dimensions of two specimens (in mm):

	F. XIV/68	F. XIV/69
Height	0.42	0.46
Maximal width . . .	0.26	0.25

Description, variation and remarks as given by POŻARYSKA (1965); see also remarks on p. 55 of the present paper.

Occurrence. — Sweden, Denmark, Austria, south-western region of USSR, Polish Lowlands and Carpathians; Paleocene.

Family BOLIVINITIDAE CUSHMAN, 1927

Genus **BOLIVINA** D'ORBIGNY, 1839

Bolivina crenulata CUSHMAN, 1936

(Pl. XXXVI, Figs 6, 7)

1936. *Bolivina crenulata* CUSHMAN; J. A. CUSHMAN, p. 50, Pl. 7, Fig. 13 (non SOETTERLE, 1937) (see Cat. of Foram.).
1961. *Bolivina crenulata* CUSHMAN; J. P. H. KAASSCHIETER, p. 194, Pl. 9, Figs 15-17.
1962. *Bolivinoides* cf. *oedumi* (BROTZEN); A. HILLEBRANDT, p. 71, Pl. 5, Fig. 14.
1965. *Bolivinoides oedumi* (BROTZEN); B. MCGOWRAN, p. 41, Pl. 1, Fig. 6.

Material. — Eight specimens, most of them damaged.
Dimensions of two specimens (in mm):

	F. XIV/70	F. XIV/71
Length	0.22	0.34
Width	0.13	0·17
Thickness . . .	0.07	0.09

Description. — Test elongated, biserial, compressed, with acutely rounded periphery. Chambers low, gradually enlarging in size towards the apertural end, with basal margins bearing single, elevated, retral processes. The last chambers bear also more or less deep concavities situated close to the retral processes. Sutures slightly depressed, strongly bent. Aperture basal, loop-shaped, narrow, elongated.

Variation small, concerning size and development of sutural ornamentation. Differences in size are related to the number of chambers, varying from 6 to 10 in each row. The sutural ornamentation may be more or less distinct.

Remarks. — Specimens assigned to *Bolivina crenulata* seem to be conspecific with those described as *Bolivinoides oedumi* (Brotzen) by MCGOWRAN (1965) from the Paleocene of Australia, and as *Bolivinoides* cf. *oedumi* (BROTZEN) by HILLEBRANDT (1962) from the Paleocene of Austria. The forms described by HILLEBRANDT and MCGOWRAN markedly differ from the topotype of *Bolivina oedumi* — species described by BROTZEN (1948) from the Paleocene of Sweden, in much better development of lobes along sutures and in more compressing of tests.

The Polish, Austrian and Australian specimens are very close to those figured as *B. crenulata* by CUSHMAN (1951) from the Eocene of Hungary. In comparison with the representatives of this species described by KAASSCHIETER (1961) from the Eocene of Belgium, Polish specimen differ in smaller size and less prominent crenulation marked along sutures.

Occurrence. — The species occurs in Belgium, Austrian Alps, Polish Carpathians, Hungary, Gulf Coast of USA, and Australia (?). Similar forms are described from south-western part of USSR; Paleocene — Eocene.

Bolivina cf. **paula** CUSHMAN & CAHILL, 1932

(Pl. XXXVIII, Figs 9-11)

Material. — Fifteen specimens, in most cases damaged.
Dimensions of three specimens (in mm):

	F. XIV/72	F. XIV/73	F. XIV/74
Length	0.29	0.27	0.22
Width	0.12	0.10	0.10
Thickness . . .	0.07	0.07	0.06

Description. — Test biserial, minute, elongated and compressed, very slowly growing in size towards the apertural end, with somewhat tapered lowermost part; test consisting of 6-9 pairs of chambers. Peripheral margin rounded. Sutures flush with the surface, indistinctly incised, particularly in the youngest test part, sometimes sinuously bent or almost horizontally arranged. Wall smooth. Aperture elongate, loop-like slit situated at the base of the last chamber.

Variation not conspicuous, concerning the length and depending on the number of chambers. There are also some differences in degree of incision of sutures separating the youngest chambers, in tapering of the initial test part, and in arrangement of sutures.

Remarks. — In comparison with the figured holotype of *Bolivina paula*, the species described by CUSHMAN and CAHILL (1932) from the Miocene of Virginia (USA), the specimens from the Paleocene of Polish Carpathians have less numerous chambers, i.e. up to 9 instead of 12, and less limbate sutures.

Occurrence. — Polish Carpathians; Upper Paleocene.

Genus **BOLIVINOIDES** CUSHMAN, 1927

Bolivinoides paleocenicus (BROTZEN, 1948)

(Pl. IV, Fig. 9)

1948. *Bolivina paleocenica* BROTZEN; F. BROTZEN, p. 66, Pl. 9, Fig. 5.
1962. *Bolivinoides paleocenicus* (BROTZEN); H. HILTERMANN & W. KOCH, p. 317, Pl. 50, Fig. 15.
1962. *Bolivinoides paleocenica* BROTZEN; J. HOFKER, Text-fig. 15b-c.
1966. *Bolivinoides paleocenica* (BROTZEN); J. HOFKER, pp. 39, 59, 311; Pl. 5, Fig. 33; Pl. 10, Fig. 75; Pl. 70, Figs 103, 104.
1970. *Bolivinoides paleocenicus* (BROTZEN); F. T. BARR, p. 650, Pl. 99, Fig. 7.

Material. — Two specimens badly preserved.
Dimensions of one specimen (in mm):

	F. XIV/75
Length	0.20
Width	0.15
Thickness . . .	0.06

Description. — Test small, biserial, subrhomboidal in general outline and with uniformly flattened sides. Sutures oblique, almost flush with test surface near periphery, elevated in the middle. Middle part of tests also ornamented with short, rised ribs, which are almost perpendicular to the sutures. Aperture damaged.

Remarks. — The Polish specimens are very similar to the topotype of this species described by BROTZEN (1948) from the Paleocene of Sweden and are undoubtedly conspecific with it. Comparison with *Aragonia aragonensis* (NUTTALL) is given in remarks on the latter species.

Occurrence. — The species is reported from Sweden, Germany, Denmark, Holland, Belgium, Polish Lowlands and Carpathians, and Libya, and seems to be typical for epicontinental facies; Upper Cretaceous — Paleocene.

Genus **LOXOSTOMOIDES** REISS, 1957

Loxostomoides applinae (PLUMMER, 1926)

(Pl. V, Figs 1-4)

1926. *Bolivina applini* PLUMMER; H. J. PLUMMER, p. 69, Pl. 4, Fig. 1.
1957. *Loxostomoides applinae* (PLUMMER); Z. REISS, p. 4.
1962. *Loxostomum applinae* (PLUMMER); A. HILLEBRANDT, p. 88, Pl. 6, Fig. 17.
1965. *Loxostomum applinae* (PLUMMER); K. POŻARYSKA, p. 96, Pl. 15, Fig. 6.
1966. *Loxostomoides applinae* (PLUMMER); J. HOFKER, p. 224, Pl. 43, Fig. 106.

Material. — Seventeen specimens, most of them well preserved.
Dimensions of two specimens (in mm):

	F. XIV/76	F. XIV/77
Height	0.64	0.50
Maximal width . . .	0.22	0.20
Thickness	0.19	0.15

Description as given by POŻARYSKA (1965).

Variation concerning differences in degree of sutures crenulation and in development of striae commonly marked only on the first chambers and continuing across the whole tests of small (juvenile?) forms. Similar variation was found by the present authors in the material from the Paleocene (Midway Fm.) of Texas, wherefrom the species was described. In the latter material the variation concerns occurrence or complete lack of striae.

Remarks. — Specimens of *Loxostomoides applinae* (PLUMMER) from the Polish Carpathians are very similar to those known from the Polish Lowlands, differing in more distinct striae on the initial part of tests. However, the former specimens appear to be nearly identical with the figured holotype and specimens from the comparative material from the Paleocene (Midway Fm., stratum typicum of *L. applinae*) of Texas studied by the present authors (see Pl. V, Figs 2, 3 herein).

Occurrence. — The species seems to be characteristic mainly for epicontinental facies. It occurs in Gulf Coast of USA, Denmark, Sweden, Austrian Alps, Polish Lowlands and Carpathians, Israel, Western Pakistan, Libya and Borneo; (?)Upper Cretaceous — Paleocene.

Genus **TAPPANINA** MONTANARO GALLITELLI, 1955

Tappanina selmensis (CUSHMAN, 1933)

(Pl. III, Fig. 4-6)

1933. *Bolivinita selmensis* CUSHMAN; J. A. CUSHMAN, p. 58, Pl. 7, Figs 3, 4.
1937. *Bolivinita exigua* GLAESSNER; M. F. GLAESSNER, p. 369, Pl. 2, Fig. 17.
1940. *Eouvigerina excavata* CUSHMAN; J. A. CUSHMAN, p. 66, Pl. 11, Fig. 18.

1948. *Bolivinita selmensis* CUSHMAN, emend. BROTZEN, 1948; F. BROTZEN, p. 56, Pl. 9, Fig. 7.
1957. *Tappanina selmensis* (CUSHMAN); E. MONTANARO GALLITELLI, p. 147, Pl. 33, Fig. 21.
1960. *Tappanina selmensis* CUSHMAN; R. K. OLSSON, p. 30.
1965. *Tappanina selmensis* (CUSHMAN); K. POŻARYSKA, p. 102, Pl. 15, Fig. 9.
1965. *Tappanina selmensis* (CUSHMAN); B. MCGOWRAN, p. 41, Pl. 1, Fig. 7.
1966. *Bolivina selmaensis* (CUSHMAN); J. HOFKER, p. 154, Pl. 70, Fig. 107.

Material. — Six specimens well preserved.
Dimensions of three specimens (in mm):

	F. XIV/78	F. XIV/79	F. XIV/80
Length	0.27	0.30	0.26
Maximal width . . .	0.16	0.14	0.15
Thickness	0.10	0.10	0.09

Description as given by POŻARYSKA (1965).

Variation significant, primarily concerning length/width ratio of the tests; there are short, wide forms, as well as long and narrow ones.

Remarks. — Specimens from the Paleocene of Carpathians do not differ from those recorded from the Polish Lowlands and from the Paleocene (Midway Fm.) of Texas. Discussion on this species, given by BROTZEN (1948), is accepted herein.

Occurrence. — This cosmopolitan species is present in: Gulf Coast of USA, Mexico, Israel, Sweden, Denmark, Austria, Germany, Polish Lowlands and Carpathians, USSR (Caucasus) and Australia; Upper Cretaceous — Paleocene.

Family BULIMINIDAE JONES, 1875

Genus **BULIMINA** D'ORBIGNY, 1846

Bulimina karpatica n. sp.

(Pl. VI, Figs 8-11)

1962. *Bulimina* cf. *reussi* MORROW; A. HILLEBRANDT, p. 78, Pl. 5, Fig. 24.
Holotypus: Specimen presented on Pl. VI, Fig. 11.
Paratypi: Specimens presented on Pl. VI, Figs 9, 10.
Stratum typicum: Paleocene (Thanetian).
Locus typicus: outcrop in Babica (SE Poland).
Derivatio nominis: karpatica — after the Carpathians Mts. (Karpaty, in Polish), wherefrom the species is described.

Material. — Eight specimens, in most cases damaged.
Dimensions of three specimens (in mm):

	F. XIV/81	F. XIV/82	F. XIV/83
Height	0.33	0.25	0.24
Maximal width . . .	0.23	0.18	0.18

Diagnosis. — Test subtriangular in transversal section, with width equalling about three-quarter of height. Chambers overhanging each other, rapidly growing in size and becoming progressively more inflated along with growth.

Description. — Test high, trochospiral, subtriangular in transversal section; margins gently rounded. Chambers, three in the last whorl, inconspicuously more in older whorls increasing in size and inflation towards the top of the test; younger chambers overhanging

older ones, being at the same time more elongated vertically than the latters. Sutures depressed. Test surface smooth, finely porous. Aperture loop-shaped, with distinct tooth-plate extending upwards from the base of the apertural face, with prominent, elevated rim of free border.

Variation insignificant, primarily concerning size of tests and arrangement of chambers.

Remarks. — The specimen figured as *Bulimina* cf. *reussi* MORROW by HILLEBRANDT (1962) from the Paleocene of Austria seems not to differ from the above specimens reported from the Paleocene of Polish Carpathians; it is herein included in the synonymy of *Bulimina karpatica* n.sp. Both, the specimen of HILLEBRANDT (1962) and the Polish specimens are similar to *Bulimina reussi* described by MORROW (1934) and previously known as *Bulimina ovulum* (REUSS, 1845), present in the Cretaceous of North America and Europe. *Bulimina karpatica* n.sp. differs from *B. reussi* in almost triangular transversal section and in more inflated and overhanging chambers. *Bulimina karpatica* n. sp. appears also to be somewhat similar to *B. ventricosa* described by Brotzen (1936) from the Cretaceous of Sweden, and differing in the ratio between initial and apertural test parts, as well as in more gradual increase in size of chambers; the chambers of the last whorl of Sweden forms are much greater than the chambers of the preceding whorls; moreover, initial test part of *B. karpatica* n. sp. is more elongated than that of *B. ventricosa.*

Occurrence. — Austrian Alps and Polish Carpathians; Paleocene.

Bulimina midwayensis CUSHMAN & PARKER, 1936

(Pl. VI, Figs 2-7)

1926. *Bulimina aculeata* D'ORBIGNY; H. J. PLUMMER, p. 73, Pl. 4, Fig. 3.
1929. *Bulimina aculeata* D'ORBIGNY; M. P. WHITE, p. 47, Pl. 5, Fig. 5.
1936. *Bulimina arkadelphiana* var. *midwayensis* CUSHMAN & PARKER; J. A. CUSHMAN & F. L. PARKER, p. 42, Pl. 7, Figs 9, 10 (see Catalogue of Foraminifera).
1948. *Bulimina midwayensis* CUSHMAN & PARKER; F. BROTZEN, p. 58, Pl. 10, Fig. 8.
1960. *Bulimina arkadelphiana midwayensis* CUSHMAN & PARKER; R. K. OLSSON, p. 31, Pl. 5, Fig. 9.
1962. *Bulimina midwayensis* CUSHMAN & PARKER; A. HILLEBRANDT, p. 76, Pl. 5, Fig. 19.
1963. *Bulimina midwayensis* CUSHMAN & PARKER; P. T. BERMUDEZ, p. 3, Pl. 3, Figs 1-4.
1966. *Bulimina midwayensis* CUSHMAN & PARKER; J. HOFKER, p. 335, Pl. 81, Figs 129, 134, 136, 138, 139, 142, 143, 151.
1967. *Bulimina whitei* MOROZOVA; V. G. MOROZOVA, G. E. KOJEWNIKOVA & A. M. KURILEVA, p. 183, Pl. 7, Fig. 2.
1969. *Bulimina spinata* CUSHMAN & CAMPBELL; E. HANZLIKOVA, p. 33, Pl. 5, Fig. 16.

Material. — Forty two specimens, most of them well preserved.

Dimensions of four specimens (in mm):

	F. XIV/84	F. XIV/85	F. XIV/86	F. XIV/87
Height	0.31	0.34	0.32	0.30
Maximal width . . .	0.25	0.24	0.23	0.22

Description. — Test somewhat conical, distinctly tapering in its initial part, coiled of 5-6 whorls consisting of 3 chambers; chambers enlarging rapidly in size as added. Last chambers inflated and laterally separated by incised sutures. Lower margins of chambers usually imbricate and bordered by spines. Test base with more or less distinct spine. Loop-like aperture at the base of the last formed chamber. Wall of the test, except for the above mentioned ornamentation, smooth and very finely porous.

Variation primarily concerning general shape, i.e. height/width relation and development of ornamentation, as well as arrangement of chambers. Basal spine occasionally observable.

Remarks. — The Polish specimens are almost identical with those found in the comparative material from the Paleocene of Denmark and Austria, and do not differ from those figured by various authors mentioned in the synonymy.

The specimens figured by PLUMMER (1926) as *Bulimina aculeata* D'ORBIGNY do not differ from those, reported from the Paleocene (Velasco Fm.) of Mexico, markedly differing from the holotype of the species in question.

Occurrence. — The species is present in: Gulf Coast of USA, Mexico, Guatemala, Sweden, Denmark, Germany, Polish and Slovak Carpathians, Austrian Alps, and USSR (Turkmenia); Upper Cretaceous — Eocene.

Bulimina ovata D'ORBIGNY, 1846

(Pl. V, Fig. 13)

1846. *Bulimina ovata* D'ORBIGNY; A. D'ORBIGNY, p. 185, Pl. 11, Figs 13, 14.
1926. *Bulimina quadrata* PLUMMER; H. J. PLUMMER, p. 72, Pl. 4, Figs 4, 5.
1948. *Bulimina ovata* D'ORBIGNY; F. BROTZEN, p. 59, Pl. 10, Figs 9, 10.
1965. *Bulimina ovata* D'ORBIGNY; K. POŻARYSKA, p. 98, Pl. 15, Fig. 10 *(here additional synonymy included)*.
1965. *Praeglobobulimina quadrata* (PLUMMER); B. MCGOWRAN, p. 37, Pl. 1, Fig. 8.
1966. *Praeglobobulimina ovata* (D'ORBIGNY); J. HOFKER, p. 335, Pl. 81, Figs 130, 141, 149, 150, 154-156.
1968. *Bulimina ovata* D'ORBIGNY; K. POŻARYSKA & J. SZCZECHURA, p. 47, Text-fig. 10.
1970. *Bulimina ovata* D'ORBIGNY; Y. KIESEL, p. 258, Pl. 12, Fig. 15.
?1970. *Bulimina ovata* D'ORBIGNY; H. J. HANSEN, p. 74, Pl. 8, Fig. 6.

Material. — Three specimens well preserved.

Dimensions of one specimen (in mm):

	F. XIV/88
Length	0.62
Maximal width . . .	0.49

Description, variation and remarks as given by POŻARYSKA (1965) and POŻARYSKA & SZCZECHURA (1968).

Remarks. — The Carpathian specimens fall within the limits of variability of this species established primarily on the basis of the Polish material (see POŻARYSKA & SZCZECHURA, 1968). The specimen from the Paleocene of Greenland, assigned to *Bulimina ovata* by HANSEN (1970), seems to represent a separate species, as it differs from the former in proportions between the height of chambers from initial and last whorls. Whorls of the Greenland specimen are initially markedly shortened, moreover the chambers of the last whorl are too much extended and protruding. The forms described from the Paleocene (Midway Fm.) of America by PLUMMER (1926) as *B. quadrata*, which are also represented in the comparative materials studied by the present authors, and from the Paleocene of Australia, described by MCGOWRAN (1965) under the same specific name, although presumably comprise micro- and macrospheric forms, do not differ and are probably conspecific with the representatives of *B. ovata* known from Europe.

Occurrence. — This cosmopolitan species is reported from: Europe (Sweden, Denmark, England, Germany, France, Austria, Poland, Czechoslovakia, USSR), Israel, Gulf Coast of USA and Mexico, Guatemala, Greenland and Australia; Upper Cretaceous — Miocene.

Bulimina velascoensis WHITE, 1929

(Pl. V, Figs 10-12)

1929. *Bulimina velascoensis* WHITE; M.P. WHITE, p. 50, Pl. 5, Fig. 13 (non *Gaudryina* (recte *Bulimina*) *velascoensis* CUSHMAN, 1925).
?1930. *Bulimina semicostata* NUTTALL; W.L.F. NUTTALL, p. 285, Pl. 23, Figs 15, 16.
1937. *Bulimina rugifera* GLAESSNER; M.F. GLAESSNER, p. 372, Pl. 2, Fig. 19.
1962. *Bulimina velascoensis* (CUSHMAN, 1925); A. HILLEBRANDT, p. 79, Pl. 5, Fig. 26.
1970. *Bulimina rugifera* GLAESSNER; H.J. HANSEN, p. 72, Pl. 7, Figs 3, 4; Pl. 18, Figs 1-4.

Material. — Thirteen specimens, in most cases damaged.
Dimensions of two specimens (in mm):

	F. XIV/89	F. XIV/90
Height	0.40	0.26
Maximal width . . .	0.22	0.19

Description. — Test triserial, trochospirally coiled, nearly triangular in cross-section tapering at the base. Chambers moderately increasing in size as added, slightly inflatted, with more or less projected lateral margins. Sutures sigmoidal, with sinus on each chamber, flush with the surface on older part of the test, becoming depressed on the younger part. The older test part ornamented with narrow, irregular ribs, which may continue across the sutures. Proloculus with short spine; aperture — a loop-shaped opening connected with suture.

Variation moderate, primarily concerning the general outline, ornamentation, and the development of sinus-like depression at places where sutures meet. Generally, tests are more or less elongated.

Remarks. — The specimens from the Paleocene of the Polish Carpathians are undoubtedly conspecific with those represented in the sample from the Paleocene (Velasco Fm.) of Mexico, described by WHITE (1929) as *Bulimina velascoensis*. They are also similar to those found in the comparative material from the Paleocene of Austria and to those figured by GLAESSNER (1937) and HANSEN (1970) as *B. rugifera*. Relation of *B. rugifera* to *B. velascoensis* was discussed by GLAESSNER (1937). However, separation of these species appears unsubstantiated.

In the sample from the Eocene (Aragon Fm.) of Mexico there were found specimens most probably assignable to *Bulimina semicostata* described by NUTTALL (1930) from these strata. These specimens are almost identical with those referred herein to *Bulimina velascoensis*. Unfortunately, NUTTALL (1930) rather very schematically and inaccurately figured his species; thus, it is allocated here with reservation.

Occurrence. — The species seems to be typical for Tethyan regions: Trinidad, Mexico, Austrian Alps, Italy (Vieste), Polish Carpathians, Caucasus (USSR), found however also in Greenland; Paleocene — Eocene.

Family UVIGERINIDAE HAECKEL, 1894

Genus **PSEUDOUVIGERINA** CUSHMAN, 1927

Pseudouvigerina wilcoxensis CUSHMAN & PONTON, 1932

(Pl. V, Figs 8, 9)

1932. *Pseudouvigerina wilcoxensis* CUSHMAN & PONTON; J. A. CUSHMAN & G. M. PONTON, p. 66, Pl. 8, Fig. 18 (see Cat. of Foram.).
1937. *Pseudouvigerina wilcoxensis* CUSHMAN & PONTON; M. F. GLAESSNER, p. 374, Pl. 2, Fig. 21.

1941. *Angulogerina wilcoxensis* (CUSHMAN & PONTON); L.D. TOULMIN, p. 599, Pl. 80, Fig. 30.
1948. *Angulogerina wilcoxensis* CUSHMAN & PONTON; F. BROTZEN, p. 63, Pl. 6, Fig. 7.
1953. *Angulogerina wilcoxensis* (CUSHMAN & PONTON); N.K. BYKOVA, p. 75, Pl. 2, Figs 10, 11.
1960. *Angulogerina wilcoxensis* (CUSHMAN & PONTON); R.K. OLSSON, p. 34, Pl. 5, Fig. 12.
1961. *Trifarina wilcoxensis* (CUSHMAN & PONTON); J. P.H. KAASSCHIETER, p. 199, Pl. 10, Fig. 6.
1962. *Pseudouvigerina wilcoxensis* CUSHMAN & PONTON; A. HILLEBRANDT, p. 85, Pl. 6, Figs 10, 11.
1970. *Trifarina wilcoxensis* (CUSHMAN & PONTON); Y. KIESEL, p. 268, Pl. 13, Fig. 13.

Material. — Eight specimens well preserved.
Dimensions of two specimens (in mm):

	F. XIV/91	F. XIV/92
Height	0.26	0.29
Maximal width . . .	0.15	0.15

Description. — Test slender, triserial, fairly triangular in transversal section, with angles bearing double keels. Sutures weakly curved, slightly incised. Wall finely perforated. Aperture terminal, with short neck.

Variation concerning height/width ratio and development of marginal keels, which are parallel and straight or not.

Remarks. — The specimens from the Paleocene of the Polish Carpathians, which are assigned to *Pseudouvigerina wilcoxensis* CUSHMAN & PONTON, are similar to the holotype of this species from the Eocene of the USA (Alabama) and are almost identical to those recorded in the comparative material from the Paleocene of Mexico (Velasco Fm.). Similarity between *P. wilcoxensis* and *P. cristata* (MARSSON, 1878) from the Cretaceous of Rugen, as well as between the species in question and *P. naheolensis* CUSHMAN & TODD, 1942 from the Eocene of the USA, and with *P. cimbrica* TROELSEN (1945) from the Maastrichtian of Denmark, was discussed in the literature. The above mentioned species seem to be at least related.

Occurrence. — The species is reported from: Germany, Sweden, Belgium, Austria, Polish Lowlands and Carpathians, south-western part of USSR and North America; Paleocene — Eocene.

Genus **ANGULOGERINA** CUSHMAN, 1927

Angulogerina cuneata BROTZEN, 1948

(Pl. V, Figs 5-7)

1948. *Angulogerina cuneata* BROTZEN; F. BROTZEN, p. 64, Pl. 6, Fig. 10.
1965. *Angulogerina cuneata* BROTZEN; K. POŻARYSKA, p. 99, Pl. 15, Fig. 7.

Material. — Twelve specimens, in most cases well preserved.
Dimensions of three specimens (in mm):

	F. XIV/93	F. XIV/94	F. XIV/95
Height	0.49	0.49	0.54
Maximal width . . .	0.24	0.25	0.26

Description and remarks as given by BROTZEN (1948) and POŻARYSKA (1965).

Variation distinct, primarily concerning size and general shape of tests.

Remarks. — Specimens included in this species may be easily compared with *Pyramidina crassa* BROTZEN on one hand, and with *Pseudouvigerna wilcoxensis* CUSHMAN & PONTON on the other. They differ from *P. crassa* in more angulate margins, usually keeled along their entire length, while from *P. wilcoxensis* they differ in larger size and less distinct keels

developed along their margins. These two forms, i.e. *A. cuneata* and *P. wilcoxensis*, are sometimes hardly separable and probably closely related.

Discussion on generic assignment of this species as given in remarks on *?Angulogerina europaea* CUSHMAN & EDWARDS, 1937 (see p. 56).

Occurrence. — Sweden, Polish Lowlands and Carpathians; Paleocene.

?**Angulogerina europaea** CUSHMAN & EDWARDS, 1937

(Pl. V, Figs 16, 17)

1937. *Angulogerina europaea* CUSHMAN & EDWARDS; J. A. CUSHMAN & P. S. EDWARDS, p. 61, Pl. 8, Figs 17, 18.
1937. *Pseudouvigerina selseyensis* (HERON ALLEN & EARLAND) var. *sculpta* GLAESSNER; M. F. GLAESSNER, p. 373, Pl. 2, Fig. 20.
1962. *Pseudouvigerina sculpta* GLAESSNER; A. HILLEBRANDT, p. 84, Pl. 6, Fig. 12.
1966. *Reussella europaea* (CUSHMAN & EDWARDS); J. HOFKER, p. 223, Pl. 45, Fig. 133; p. 242, Pl. 49, Fig. 58.
1968. *Angulogerina europaea* CUSHMAN & EDWARDS; K. POŻARYSKA & J. SZCZECHURA, p. 48, Pl. 1, Figs 1-7 *(here additional synonymy included)*.
1970. *Angulogerina europaea* CUSHMAN & EDWARDS; Y. LE CALVEZ, p. 123, Pl. 23, Fig. 6.
1970. *Angulogerina europaea* CUSHMAN & EDWARDS; Y. KIESEL, p. 266, Pl. 13, Fig. 9.

Material. — Thirty two specimens, most of them well preserved.
Dimensions of three specimens (in mm):

	F. XIV/96	F. XIV/97	F. XIV/98
Height	0.34	0.32	0.31
Maximal width . . .	0.17	0.15	0.20

Description as given by POŻARYSKA and SZCZECHURA (1968). Variation essentially the same as discussed in the latter paper.

Remarks. — It should be added here to the remarks on this species given by POŻARYSKA and SZCZECHURA (1968) that the specimen figured as *Pseudouvigerina selseyensis sculpta* n. var. by GLAESSNER (1937) from the Paleocene of Caucasus, seems to be conspecific with *?Angulogerina europaea.*

Generic assignment of this species is questionable because *Angulogerina* CUSHMAN (1927) is a synonym of *Trifarina* CUSHMAN (1923) according to LOEBLICH and TAPPAN (1964). True *Trifarina* is characterized by terminal aperture with a neck, and by triserial test part passing into uniserial one. However, the Polish specimens have subterminal, ovate aperture, occasionally with short neck, and distinct sutures reaching the base of the last chambers, which is typical of the genus *Pyramidina* BROTZEN, 1948. Moreover, the type of aperture found in *?Angulogerina europaea* from Polish Paleocene seems to be more primitive than that of *Angulogerina europaea* described by LE CALVEZ (1970) from the Eocene of France, where the aperture is terminal. Analysis of the generic status and evolution of this species requires much richer comparative material than that which was at the authors' disposal.

Occurrence. — This cosmopolitan species is common in: England, Germany, Austria, Denmark, Holland, Sweden, France (Paris Basin), USSR (Caucasus), Polish Lowlands and Carpathians, and Australia; Paleocene — Eocene.

Family DISCORBIDAE EHRENBERG, 1838

Genus **CONORBINA** BROTZEN, 1936

Conorbina transuralicus (MOROZOVA, 1953) (*in* MJATLIUK, 1953)

(Pl. VIII, Figs 3, 4)

1953. *Discorbis transuralicus* MOROZOVA; E. V. MJATLIUK, p. 48, Pl. 2, Fig. 1.
1961. *Discorbis transuralensis* MOROZOVA; V. P. VASSILENKO, p. 38, Pl. 7, Fig. 6.
?1966. *Neoconorbina squamiformis* (REUSS); J. HOFKER, pp. 139, 185; Pl. 20, Fig. 34; Pl. 32, Fig. 51; Pl. 70, Fig. 117.
1968. *Discorbis quadrata* (TERQUEM); K. POŻARYSKA & J. SZCZECHURA, p. 49, Pl. 2, Fig. 3.
?1970. *Epistominella acutimargo* (HALKYARD); Y. KIESEL, p. 298, Pl. 17, Fig. 14 (non *Pulvinulina acutimargo* HALKYARD, 1918).

Material. — Ten specimens badly preserved.
Dimensions of two specimens (in mm):

	F. XIV/99	F. XIV/100
Longest diameter . . .	0.35	0.37
Shortest diameter . . .	0.33	0.32
Height	0.15	0.15

Description. — Test plano-convex, conical, low, with spiral side convex, and umbilical side more or less concave; peripheral margin narrowly rounded, or bluntly keeled; outline entire or slightly lobulate. Chambers flattened — 4-6 in number — in the only visible last formed whorl on the umbilical side. Sutures slightly depressed on umbilical side, sickle-shaped, flush with the surface or somewhat rised on spiral side. On umbilical side, umbilical depression formed by weakly inflattened chambers; lack of an open umbilicus. Aperture slit-like, situated at the base of the last formed chamber, within arcuate tenon. Wall smooth, very finely porous.

Variation primarily concerning development of sutures on the spiral side which are flush with the surface or raised, a variable convexity of chambers on umbilical side, as well as overall outline of the tests.

Remarks. — The Polish specimens are essentially similar to the holotype of the species *Discorbis transuralicus* MOROZOVA figured by MJATLIUK (1953) and later by VASSILENKO (1961) and known from the uppermost Cretaceous and Lower Paleocene of the USSR. The specimens from the Upper Cretaceous and Paleocene of Holland and from the Upper Cretaceous of Denmark, assigned to *Neoconorbina squamiformis* (REUSS) by HOFKER (1966), although very schematically drawn, seem to be conspecific with the species in question, differing from REUSS' (1854) species in the course of sutures and number of chambers.

The reexamination of the Polish specimens previously assigned to the species *Discorbis quadrata* (TERQUEM), and the study of SEMicrographs of the type specimens of this species given by LE CALVEZ (1970), show that the Polish specimens undoubtedly belong to the species *Conorbina transuralicus* MOROZOVA. The latter species differ from *Discorbis quadrata* (TERQUEM) in the lack of both open umbilicus and chamber flaps.

Forms resembling *C. transuralicus* were described from the Eocene of Germany as *Epistominella acutimargo* (HALKYARD) by KIESEL (1970). According to the present authors, the German specimens markedly differ from *Pulvinulina acutimargo* HALKYARD in the mode of development of the umbilical side and the type of aperture, and cannot be considered with that species; at the same time, those features bring them closer to the species *C. transuralicus*, to which they are included with reservation.

Occurrence. — The species known from Denmark, Holland, Germany, Polish Lowlands and Carpathians, and USSR (Crimea, Caucasus and Mangyshlak); Upper Cretaceous — Paleocene.

Genus **EPISTOMINELLA** HUSEZIMA & MARUHASI, 1944

Epistominella cf. **limburgensis** (VISSER, 1951)

(Pl. VIII, Figs 1, 2)

1968. *Epistominella* cf. *limburgensis* (VISSER); K. POŻARYSKA & J. SZCZECHURA, p. 50, Text-fig. 11 *(here additional synonymy included)*.

Material. — Thirty seven specimens well preserved.
Dimensions of two specimens (in mm):

	F. XIV/101	F. XIV/102
Longest diameter . . .	0.30	0.29
Shortest diameter . . .	0.28	0.25
Height	0.17	0.14

Description as given by POŻARYSKA (1965). Variation and remarks as given by POŻARYSKA (1965), and POŻARYSKA & SZCZECHURA (1968, 1971).

Occurrence. — The species is common mostly in epicontinental facies of Denmark, Belgium, Holland, Germany, England, France (Paris Basin), Polish Lowlands, USSR (Russian Platform). Found also in Polish Carpathians; Upper Cretaceous — Paleocene.

Epistominella vitrea PARKER, 1953

(Pl. XXXVIII, Figs 1-3)

1953. *Epistominella vitrea* PARKER; F.L. PARKER, F. B. PHLEGER & J. F. PEIRSON, p. 9, Pl. 4, Figs 34-36, 40-41 (see Cat. of Foram.).
1955. *Pseudoparella oveyi* BHATIA; S.B. BHATIA, p. 684, Pl. 66, Fig. 29, Text-fig. 7.
1956. *Epistominella vitrea* PARKER; J. HAYNES, p. 88, Pl. 16, Fig. 11.
1958. *Pseudoparella oveyi* BHATIA; D.A.J. BATJES, p. 158, Pl. 8, Fig. 10.

Material. — Thirty six specimens, most of them well preserved.
Dimensions of three specimens (in mm):

	F. XIV/103	F. XIV/104	F. XIV/105
Longest diameter . . .	0.12	0.17	0.15
Shortest diameter . . .	0.10	0.15	0.13
Height	0.08	0.11	0.09

Description. — Test very small, trochospiral. Spiral side, containing two or more whorls, more or less conically elevated; umbilical side flattened. The last whorl, the only visible on the umbilical side, containing 5-7 chambers. Peripheral outline almost entire; peripheral margin narrowly rounded. Umbilicus very shallow or not deepened. Sutures strongly curved, flush with the surface or slightly depressed between the last chambers on spiral side, radial and flush with the surface on umbilical side. Aperture — an elongated slit continuing close and parallel to peripheral margin, with deep fold of apertural face.

Variation distinct, primarily concerning general shape of tests which are more or less conical, number of chambers (5-7) and whorls seen on the spiral side. Peripheral outline is entire or lobulate, particularly along the last chambers. There are also some small differences in the development of apertural face.

Remarks. — The specimens from the Paleocene of the Polish Carpathians referred to *Epistominella vitrea* seem to be conspecific with the figured holotype of that species, recently inhabiting San Antonio Bay, Texas, and are almost identical with those found in comparative material from the Thanetian of England kindly supplied by Dr. J. HAYNES. Specimens described as *Epistominella* cf. *E. vitrea* PARKER by MCGOWRAN (1965) from the Paleocene of Australia differ from the European representatives of this species in more inflated chambers and less elevated spiral side.

Similar forms, although generally more biconvex, with more acute peripheral margin and with less prominent apertural notch, were found in a sample from the Paleocene (Velasco Fm.) of Mexico; most probably they represent the species determined by WHITE (1928) as *Rotalia* cf. *partschiana* (D'ORBIGNY). These latter cannot be conspecific with *Rotalia* (recte *Epistomina*) *partschiana* (D'ORBIGNY). Almost the same differences may be observed between the specimens assigned to *P. vitrea* PARKER from Europe and the holotype of *Pulvinulinella danvillensis* figured by HOWE and WALLACE, 1932, from the Eocene of North America (see Cat. of Foram.).

The species *Pseudoparella minuta*, described by OLSSON (1960) from the Paleocene of America, seems to fall within the limits of variability of *E. vitrea* PARKER. The specimens figured by OLSSON differ from Polish representatives of the latter species only in somewhat more acute peripheral margin. At the same time, specimens determined here as *E. vitrea* ought to be compared also with *Pseudoparella oveyi* BHATIA (1955) described from the Oligocene of England and also known from the Oligocene of Belgium (BATJES, 1958) which, taking large variation of the former species, cannot be separated.

Occurrence. — The species is known from England, Belgium, Polish Carpathians, ?Australia and ?Mexico; Paleocene — Oligocene. Recently occurs in Bay of Texas (USA). In London clay (England, Eocene dep.) this species "indicates an environment off delta outlet with rapid sedimentation and clay substrate in a region of river and sea water mixing" (WRIGHT, 1972 *l. c.* p. 343).

Family ASTERIGERINIDAE D'ORBIGNY, 1839

Genus **ASTERIGERINA** D'ORBIGNY, *in* DE LA SAGRA, 1839

Asterigerina cf. **noervangi** BROTZEN, 1948

(Pl. VII, Figs 1, 2, 6-9; Pl. XXXVI, Figs 1-3)

Material. — Thirty two specimens badly preserved.
Dimensions of two specimens (in mm):

	F. XIV/106	F. XIV/107
Longest diameter . . .	0.21	0.27
Shortest diameter . . .	0.18	0.22
Height	0.09	0.13

Description. — Test small, biconvex, with spiral side generally much higher than umbilical one. Peripheral outline lobate to a different degree; peripheral margin acute, somewhat serrate. Two to two and half whorls are observable on dorsal side; outer whorl consisting

of 5-6 chambers. Umbilical plug indistinct, poorly developed. Sutures limbate, rarely flush with the test surface, commonly elevated and thickened on spiral side and depressed on umbilical side. Secondary chambers, typical of this genus, present but generally obscure.Test surface finely porous and almost smooth, particularly on spiral side, or partly or even entirely finely tuberculated. Umbilical side tuberculated close to and around the aperture. Aperture of primary chambers in the form of slit situated on umbilical side.

Variation considerable, primarily concerning ornamentation of the tests. Some specimens are smooth, at least on their spiral side, whereas others are completely tuberculated on both sides. There are also some differences in arrangement of chambers and development of test margin, from carinate to smooth, as well as in development of sutures.

Remarks. — The Polish specimen differs from the figured holotype — *Asterigerina noervangi* BROTZEN, 1948 from the Paleocene of Sweden — in a smaller number of chambers per whorl, i.e. 5-6 chambers in comparison to 6-7 in the BROTZEN's assemblage, and in commonly ornamented spiral side. Comparison of *A. noervangi* with the species *A. primaria*, described by PLUMMER (1927) from the Paleocene (Midway Fm.) of Texas, was given by BROTZEN (1948). Polish specimens, identified as *A.* cf. *noervangi*, appear to be very close to the species *A. aberystwythi* HAYNES, 1956 from the Paleocene (Thanetian) of England, differing in being higher and usually ornamented on spiral side.

Occurrence. — Polish Carpathians; Upper Paleocene. Similar form is described from the Paleocene of Sweden.

Asterigerina sp.

(Pl. VII, Fig. 3-5)

Material. — Eighteen specimens badly preserved.

Dimensions of three specimens (in mm):

	F. XIV/108	F. XIV/109	F. XIV/110
Largest diameter . . .	0.34	0.39	0.42
Shortest diameter . . .	0.29	0.33	0.37
Height	0.16	0.17	0.20

Description. — Test biconvex, with somewhat more elevated and conical spiral side. Peripheral margin distinctly acute; peripheral outline almost entire. Chambers hardly distinguishable on spiral side, 8-10 in number in the outer whorl; at least 3 whorls are seen on spiral side. Sutures sickled, becoming narrow and raised towards the center where they form test ornamentation on spiral side, while almost flush with the surface or somewhat thickened on umbilical side. Primary and secondary chambers hardly distinguishable. Test very finely pitted; pits coarser on umbilical side. Aperture unknown.

Variation primarily concerning size of test and degree of elevation of sutures on spiral side.

Remarks. — The specimens from the Paleocene of Polish Carpathians assigned to *Asterigerina* sp. are somewhat similar to the specimen described as *Asterigerina* sp. by GOHRBANDT (1962) from the Upper Eocene of Austria, differing in more numerous chambers (8-10 in comparison to about 6 in the latter forms) and in more sickled sutures.

Occurrence. — Polish Carpathians; Upper Paleocene.

Genus **ROSALINA** D'ORBIGNY, 1826

Rosalina koeneni BROTZEN, 1948

(Pl. XXVIII, Fig. 2)

1948. *Rosalina koeneni* BROTZEN; F. BROTZEN, p. 73, Pl. 9, Fig. 11 *(here additional synonymy included)*.
1968. *Rosalina koeneni* BROTZEN; K. POŻARYSKA & J. SZCZECHURA, p. 52, Pl. 2, Fig. 2.
1970. *Rotorbinella koeneni* (BROTZEN); E. V. MJATLIUK, p. 120, Pl. 35, Fig. 7.
1970. *Rosalina koeneni* BROTZEN; Y. KIESEL, p. 286, Pl. 15, Fig. 14.

Material. — Four specimens, all damaged.
Dimensions of one specimen (in mm):

	F. XIV/111
Longest diameter . . .	0.27
Shortest diameter . . .	0.23
Height	0.10

Description as given by POŻARYSKA and SZCZECHURA (1968).

Variation indistinct, primarily concerning size and outline of tests; test outline varying from entire to somewhat lobulate.

Remarks. — Specimens from the Paleocene of Carpathians are almost identical with the topotypes of *Rosalina koeneni* from the Paleocene of Sweden and are undoubtedly conspecific with forms hitherto allocated in this species.

Occurrence. — The species is reported from the epicontinental facies, mostly: Sweden, Denmark, Holland, England, Germany and Polish Lowlands; occasionally found also in Soviet and Polish Carpathians; Paleocene.

Rosalina parisiensis D'ORBIGNY, 1826

(Pl. XV, Figs 5, 6)

1826. *Rosalina parisiensis* D'ORBIGNY; A. D'ORBIGNY, p. 271, Pl. 3, Figs 1, 2 (see Cat. of Foram.).
1968. *Rosalina selandiana* POŻARYSKA & SZCZECHURA; K. POŻARYSKA & J. SZCZECHURA, p. 52, Text-fig. 12; Pl. 2, Fig. 4.
1971. *Rosalina parisiensis* D'ORBIGNY; J. SZCZECHURA & K. POŻARYSKA, p. 361, Pl. 4, Figs 3, 4 *(here additional synonymy included)*.

Material. — Five specimens, all of them somewhat damaged.
Dimensions of two specimens (in mm):

	F. XIV/112	F. XIV/113
Longest diameter . . .	0.17	0.25
Shortest diameter . . .	0.15	0.22
Height	0.06	0.08

Description as given by POŻARYSKA and SZCZECHURA (1968).

Remarks. — The specimens from the Paleocene of the Carpathians, assigned to *Rosalina parisiensis* (D'ORB.), are almost identical with those from the Paleocene of Pamiętowo boring, assigned by POŻARYSKA and SZCZECHURA (1968) to *Rosalina selandiana* n. sp. However, SEMicrographs of the Carpathian specimens (Pl. XV, Fig. 5) revealed morphological details typical of *Rosalina parisiensis* (D'ORB.). Thin-walled, small representatives of this species, occurring in the Paleocene of Carpathians and Polish Lowlands, presumably inhabited cooler waters than the larger, thick-walled ones, as occur in its type level, i.e. Eocene of France and in the Paleocene of Crimea. (See also remarks in SZCZECHURA and POŻARYSKA, 1971).

Occurrence. — The species is recorded from: France (Paris Basin), Belgium, Holland, Polish Lowlands and Carpathians, and USSR (Crimea); Paleocene — Eocene.

Genus **VALVULINERIA** CUSHMAN, 1926

Valvulineria alpina HILLEBRANDT, 1962

(Pl. XI, Figs 3-5)

1962. *Valvulineria alpina* HILLEBRANDT; A. HILLEBRANDT, p. 104, Pl. 8, Figs 7, 8.
?1957. *Discorbis* aff. *cretacea* FRANKE; V. SACAL & A. DEBOURLE, p. 33, Pl. 11, Fig. 1.

Material. — Eleven specimens, most of them damaged.
Dimensions of three specimens (in mm):

	F. XIV/114	F. XIV/115	F. XIV/116
Longest diameter . . .	0.41	0.64	0.38
Shortest diameter . . .	0.34	0.54	0.29
Height	0.20	0.34	0.18

Description. — Test trochospiral, low spired, with somewhat lobulate peripheral outline and broadly rounded margin. Chambers gradually increasing in size as added, coiled in more than two spires, about 5 in number in the last whorl; inner whorls elevated over the outer ones. Sutures depressed on both sides, somewhat curved on spiral side, radial on umbilical side. Umbilicus large, opened or covered by umbilical flap. Aperture interiomarginal, slit-like, extraumbilical-umbilical. Test surface smooth.

Variation significant, primarily concerning size of specimens. The largest specimens are four times larger than the smallest ones. Large specimens are more globulous and with more differentiated chambers than the smaller ones. Moreover, apertural flap covering umbilicus is not always developed.

Remarks. — The Polish specimens in comparison with those from Austria have no more than 5 chambers instead of 5-7. The specimen figured as *Discorbis* aff. *cretacea* FRANKE by SACAL and DEBOURLE (1957) from the Upper Cretaceous of France (Aquitanian Basin) seems to fall within the limits of variability of the species in question.

Occurrence. — The species occurs in Austrian Alps and Polish Carpathians; similar form is recorded from France (Aquitanian Basin); Paleocene — ?Eocene.

Family EPISTOMARIIDAE HOFKER, 1954

Genus **NUTTALIDES** FINLEY, 1939

Nuttalides truempyi (NUTTALL, 1930)

(Pl. XI, Figs 1, 2)

1930. *Eponides trümpyi* NUTTALL; W.L.F. NUTTALL, p. 287, Pl. 24, Figs 9, 13, 14.
1937. *Eponides trümpyi* NUTTALL; M.F. GLAESSNER, p. 377, Pl. 2, Fig. 24.
1946. *Eponides bronnimanni* CUSHMAN & RENZ; J. A. CUSHMAN & H. H. RENZ, p. 45, Fig. 24.
1948. *Eponides trümpyi* NUTTALL; D.M. CHALILOV, p. 37, Pl. 4, Fig. 4.
1953. *Nuttalides trümpyi* (NUTTALL); J.P. BECKMANN, p. 384, Pl. 24, Figs 2, 3.
1955. *Eponides trümpyi* NUTTALL; N.I. MASLAKOVA, p. 69, Pl. 10, Figs 1, 3.
1955. *Nuttalides trümpyi* (NUTTALL); J.J. GRAHAM & W. J. CLASSEN, p. 25, Pl. 4, Fig. 12.
1957. *Eponides florealis* WHITE; V. SACAL & A. DEBOURLE, p. 38, Pl. 13, Fig. 5.
1959. *Nuttalides trümpyi* (NUTTALL); N.I. MASLAKOVA, p. 98, Pl. 3, Fig. 2.
1959. *Eponides trümpyi* NUTTALL; M. STANCHEVA, p. 332, Pl. 2, Fig. 3.
1962. *Asterigerina trümpyi bronnimanni* (CUSHMAN & RENZ); A. HILLEBRANDT, p. 111, Pl. 9, Fig. 10.

1966. *Nuttalides truempyi* (NUTTALL); P. J. BERMUDEZ & H. A. GAMEZ, p. 237, Pl. 5, Figs 12-14.
1969. *Asterigerina trümpyi* (NUTTALL); E. K. SCHUTZKAJA, p. 10.
non 1970. *Asterigerina trümpyi* (NUTTALL); E. K. SCHUTZKAJA, Pl. 36, Fig. 11.
1970. *Nuttalides trümpyi* (NUTTALL); A. JEDNOROWSKA, p. 62, Pl. 10, Fig. 1.

Material. — Eight specimens, most of them damaged.
Dimensions of two specimens (in mm):

	F. XIV/117	F. XIV/118
Longest diameter . . .	0.35	044
Shortest diameter . . .	0.34	0.43
Height of test	0.20	0.24

Description. — Test almost circular or somewhat lobulate in peripheral outline, lenticular in edge view, biconvex, with umbilical side more strongly convex than the opposite one. Peripheral margin acute, weakly keeled. Chambers, 7-8 in number in the last whorl, coiled into at least 4 whorls gradually growing in width as added. Central part of umbilical side bearing large, glossy boss formed of clear shell substance. Sutures raised and sickled on umbilical side, while flush with the surface on spiral side. Aperture slit-like, at the base of the last chamber, extending from the periphery to umbilical boss. Wall smooth, finely porous.

Variation not considerable, primarily concerning degree of convexity of both sides; some specimens are equally biconvex.

Remarks. — The Polish specimens from the Paleocene of Babica clays differ from the drawing of the holotype of *Eponides* (recte *Nuttalides*) *truempyi* from the Eocene of Mexico, given by NUTTALL (1930), in whorls markedly narrower on the dorsal side; however, they are surely conspecific with undoubtful representatives of this species, found in the comparative material from the Eocene (Aragon Fm.) of Mexico. Very similar forms were also found in the comparative material from the Paleocene (Velasco Fm.) of Mexico. It may be assumed therefore that *Gyroidina minuta* WHITE (1928) actually represents *Nuttalides truempyi*. The species *N. truempyi*, although it appears to be highly variable, is generally equivocally interpreted. Previous authors assigned here both bell-shaped forms (GRAHAM & CLASSEN, 1955; HILLEBRANDT, 1962) and the biconvex ones (GLAESSNER, 1937; RAUSER-CHERNOUSOVA & FURSSENKO, 1959). The form figured by SCHUTZKAJA (1970) from the Lower Eocene of Turkmenia (USSR) undoubtedly belongs to the genus *Asterigerina*, so cannot be conspecific with *N. truempyi*, the type species of the genus *Nuttalides*. *Eponides florealis* White described by SACAL and DEBOURLE (1957) from France, actually belongs to *N. truempyi* WHITE, as the specimens figured by the latter authors (SACAL & DEBOURLE, 1957, Pl. 23, Fig. 38) are characterized by well developed pluge on the umbilical side, not known in the species *E. florealis*.

Occurrence. — The species is reported mainly from Tethyan regions: Trinidad, Antilles, Mexico, Venezuela, Morocco, Italy, France (Aquitanian Basin), Austrian Alps, Slovak, Polish and Soviet Carpathians, Caucasus, Crimea, Bulgaria and New Zealand. It occurs also in California (USA); Upper Cretaceous — Eocene.

Family SPIRILLINIDAE REUSS, 1862

Genus **PLANISPIRILLINA** BERMUDEZ, 1952

Planispirillina striatogranulosa (TERQUEM, 1882)

(Pl. XV, Fig. 11)

1882. *Spirillina striato-granulosa* TERQUEM; O. TERQUEM, p. 33, Pl. 1, Fig. 30.
1882. *Spirillina nodifera* TERQUEM; O. TERQUEM, p. 34, Pl. 1, Fig. 32.
1948. *Spirillina nodifera* TERQUEM; F. BROTZEN, p. 67, Pl. 10, Fig. 12.

1949. *Spirillina striato-granulosa* TERQUEM; Y. LE CALVEZ, p. 11, Pl. 1, Figs 3, 4.
1968. *Spirillina* cf. *nodifera* TERQUEM; K. POŻARYSKA & J. SZCZECHURA, p. 58, Pl. 3, Figs 1-3.
1970. *Planispirillina striatogranulosa* (TERQUEM); Y. LE CALVEZ, p. 156, Pl. 33, Fig. 4.
1970. *Spirillina striatogranulosa* TERQUEM; H. J. HANSEN, p. 81, Pl. 19, Figs 5, 6.

Material. — Thirteen specimens, all of them damaged.
Dimensions of two specimens (in mm):

	F. XIV/119	F. XIV/120
Longest diameter . . .	0.54	0.26
Shortest diameter . . .	0.51	0.25
Height	0.18	0.09

Description as given by POŻARYSKA and SZCZECHURA (1968).

Variation significant, primarily concerning size and ornamentation of tests. Generally tuberculated side sometimes smooth. Spiral suture on unornamented side flush with the surface, slightly incised or highly elevated.

Remarks. — LE CALVEZ (1970) considers *Planispirillina striatogranulosa* (TERQUEM) and *P. nodifera* (TERQUEM) as conspecific.

Occurrence. — The species is reported from: France (Paris Basin), Sweden, Polish Lowlands and Carpathians, Greenland and North America; Paleocene — Eocene.

Family ROTALIIDAE EHRENBERG, 1839

Genus **ROTALIA** LAMARCK, 1804

Rotalia lithothamnica UHLIG, 1886

(Pl. XIII, Figs 3, 5-8)

1886. *Rotalia lithothamnica* UHLIG; V. UHLIG, p. 195, Pl. 5, Figs 9, 11 (see Cat. of Foram.).
1895. *Rotalia lithothamnica* UHLIG; J. GRZYBOWSKI, p. 204, Pl. 5, Fig. 13 (non Fig. 14).
?1928. *Rotalia mexicana* NUTTALL; W. L. F. NUTTALL, p. 374, Pl. 50, Figs 6-8.
1951. *Rotalia lithothamnica* UHLIG; O. K. KAPTARENKO-CHERNOUSOVA, p. 54, Pl. 9, Fig. 1.
1953. *Rotalia lithothamnica* var. *lithothamnica* UHLIG; E. V. MJATLIUK, p. 126, Pl. 19, Figs 1-3, 6.
1963. *Rotalia lithothamnica lithothamnica* UHLIG; Y. KIESEL & D. LOTSCH, p. 24, Pl. 10, Fig. 3.
?1964. *Pararotalia mexicana* (NUTTALL); A. R. LOEBLICH & H. TAPPAN, p. 612, Fig 486/5.
1968. *Rotalia lithothamnica* UHLIG; A. JEDNOROWSKA, p. 63, Pl. 9, Figs 1, 2.
1969. *Rotalia lithothamnica* UHLIG; E. J. KRAEVA & B. F. ZERNETZKIJ, p. 119, Pl. 48, Fig. 3.
1970. *Rotalia lithothamnica* UHLIG; Y. KIESEL, p. 342, Pl. 23, Figs 6, 7.

Material. — Seventeen specimens, most of them damaged.
Dimensions of five specimens (in mm):

	F. XIV/121	F. XIV/122	F. XIV/123	F. XIV/124	F. XIV/125
Longest diameter . . .	0.60	0.77	0.66	0.86	0.69
Shortest diameter . . .	0.54	0.70	0.59	0.78	0.55
Height	0.32	0.39	0.34	0.49	0.34

Description. — Test trochospiral, biconvex, with umbilical side more convex than the spiral one. Peripheral margin acute; peripheral outline serrate, sometimes with short, usually blunt peripheral spines. Spiral side with more than two whorls visible; the last whorl containing 9-12 chambers. Umbilical side bearing central, well developed, smooth or tuberculated

plug. Chambers slightly inflated, separated by distinct, depressed, radial sutures on umbilical side, while flattened, separated by thickened, sickled sutures on spiral side. Aperture in a form of short sutural slit along the last chamber, very weakly extending on spiral side. Both test sides distinctly pitted. Umbilical side smooth or with ornamentation more or less distinct, generally coarser towards central plug.

Variation considerable, concerning size of tests, convexity of test sides, size of central plug, and development of ornamentation of umbilical side and test margin.

Remarks. — The specimens from the Paleocene of Polish Carpathians easily fall into the limits of variability of *Rotalia lithothamnica* UHLIG (1886), adequately figured and described by UHLIG (1886) on the basis of material from the Eocene of Polish Carpathians. Some specimens from the Paleocene of Babica seem to be morphologically transitional between typical representatives of *R. lithothamnica* UHLIG and their presumable ancestors — *Pararotalia tuberculifera* (REUSS, 1862). *Rotalia lithothamnica* have never been reported from strata older than the Eocene. UHLIG (1886) noted a similarity between *R. lithothamnica* and *R. armata* D'ORB. (1826), the species known from the Upper Paleocene and Eocene of western Europe.

The species *R. mexicana* NUTTALL (1928), considered by NUTTALL (1928) as similar to *R. lithothamnica*, is placed in the synonymy of the latter species with a reservation. It should be noted that *R. mexicana* was placed in the genus *Pararotalia* by LOEBLICH and TAPPAN (1964).

Occurrence. — The species is reported from: Polish and Soviet Carpathians, south-western part of USSR (Asiatic part); Upper Paleocene — Eocene (up to now the species was known only from the Eocene).

Rotalia saxorum D'ORBIGNY, 1850

(Pl. XII, Figs 5-7)

1850. *Rotalia saxorum* D'ORBIGNY; A. D'ORBIGNY, p. 407, Fig. 5.
1968. *Rotalia saxorum* D'ORBIGNY; K. POŻARYSKA & J. SZCZECHURA, p. 61, Pl. 5, Figs 1, 3, 4; Pl. 18, Figs 5-9 *(here additional synonymy included)*.
pars 1970. *Rotalia germanica* KIESEL; Y. KIESEL, p. 333, Pl. 23, Fig. 4.
1970. *Rotalia perovalis* TERQUEM; Y. LE CALVEZ, p. 136, Text-fig. 45.
1972. *Rotalia saxorum* D'ORBIGNY; D.E. MAKARENKO & M. V. JARTZEVA, p. 79, Pl. 1, Figs 9, 10.
1972. *Rotalia saxorum* D'ORBIGNY; T.L. MOORKENS, p. 110, Pl. 7, Fig. 5.

Material. — Thirty six specimens, most of them damaged.

Dimensions of three specimens (in mm):

	F. XIV/126	F. XIV/127	F. XIV/128
Longest diameter . . .	0.39	0.59	0.71
Shortest diameter . . .	0.38	0.56	0.64
Height	0.23	0.29	0.32

Description, variation and remarks as given by POŻARYSKA and SZCZECHURA (1968).

Remarks. — Studies on the specimens of KIESEL's collection carried out by the first of the present authors, show that the forms assigned by KIESEL (1970) to *Rotalia germanica* actually represent two species. Some of them are conspecific with the forms from the Paleocene of Poland, attributed by the present authors (POŻARYSKA & SZCZECHURA, 1968) to *R. saxorum*, whereas the others are conspecific with those assigned by them to *R. marginata* D'ORBIGNY.

Occurrence. — The species is characteristic for warm-water, shallow seas, reported from: France (Paris Basin and Pyrenees), Holland, Belgium, Germany, Polish Lowlands (Pamiętowo boring) and Carpathians, USSR (Crimea); uppermost Cretaceous — Eocene.

Genus **PARAROTALIA** Le Calvez, 1949

Pararotalia globigeriniformis (Van Bellen, 1946)

(Pl. XIV, Figs 1-3)

1946. *Globorotalia globigeriniformis* Van Bellen; R.C. Van Bellen, p. 71, Pl. 10, Figs 10-12.
1966. *Pararotalia globigeriniformis* (Van Bellen); J. Hofker, p. 233, Pl. 44, Fig. 123.
1968. *Globorotalia globigeriniformis* Van Bellen; K. Pożaryska & J. Szczechura, p. 65, Pl. 7, Figs 11-19.
1971. *Globorotalia globigeriniformis* Van Bellen; J. Szczechura & K. Pożaryska, p. 373, Pl. 8, Fig. 2.
1972. *Pararotalia globigeriniformis* (Van Bellen); T.L. Moorkens, p. 114, Pl. 3, Figs 2, 3; Pl. 7, Fig. 7.

Material. — Fifteen specimens badly preserved.
Dimensions of two specimens (in mm):

	F. XIV/129	F. XIV/130
Longest diameter . . .	0.25	0.21
Shortest diameter . . .	0.20	0.17
Height	0.11	0.09

Description and variation as given by Pożaryska and Szczechura (1968).

Remarks. — Specimens found in the Carpathians are much smaller than those occurring in the Polish Lowlands, Crimea, and western Europe.

Occurrence. — The species is characteristic for warm-water, shallow seas, reported from: Holland, Germany, Belgium, Polish Lowlands (Pamiętowo boring) and Carpathians, USSR (Crimea); Paleocene.

Pararotalia minimalis Hofker, 1966

(Pl. XIV, Figs 4-7)

1966. *Pararotalia minimalis* Hofker; J. Hofker, p. 246, Pl. 49, Fig. 60.
1972. *Pararotalia minimalis* Hofker; T. L. Moorkens, p. 119, Pl. 8, Figs 4, 5.

Material. — Forty two specimens, almost all of them damaged.
Dimensions of three specimens (in mm):

	F. XIV/131	F. XIV/132	F. XIV/133
Largest diameter . . .	0.26	0.25	0.27
Shortest diameter . . .	0.22	0.20	0.20
Height	0.13	0.10	0.11

Description. — Test low, somewhat compressed, trochospiral, plano-convex, with peripheral outline serrate or angularly lobulate. Spiral side evolute, formed of at least two whorls; umbilical side involute, formed of 6-8 chambers; chambers gradually increasing in size; only those of the outer whorl are angular and inflated. Angular inflation results in rib-like protuberances, almost radially arranged on umbilical side, while inclined downwards and towards the beginning of coiling on spiral side. Sutures markedly incised on both sides. The central part of the test covered by granules or short irregular ribs, particularly on spiral side. Umbilicus shallow, covered by one or more tubercles. Aperture situated almost at the base of the last chamber, usually obscured or damaged. Test surface finely perforated.

Variation significant, concerning the size and number of chambers (from 6 to 8), the test outline, which varies from serrate to angularly lobulate, the degree and arrangement of rib-like angulation on chambers, and details of ornamentation of central parts of tests. Moreover, central part of spiral side is compressed to a various degree.

Remarks. — The specimens from the Polish Carpathians referred to the species *Pararotalia minimalis* are similar to the holotype of this species from the Montian of Holland, very schematically figured by HOFKER (1966). They are, however, undoubtedly conspecific with specimens from the Paleocene of Belgium, allocated in the same species by MOORKENS (1972).

Pararotalia minimalis seems to be very close to *Woodella* (recte *Pararotalia*) *nammalensis*, the species described from the Paleocene of Pakistan by HAQUE (1956) (see also LOEBLICH & TAPPAN, 1964, Fig. 486 (4a-c)). The similarity is particularly evident in the case of small forms with serrate outline; adult forms are characterized by rather lobulate general outline and stronger downward bent rib-like angulation from spiral side.

The specimens assigned to *P. minimalis* are also similar to those figured and described as *Boldia toeringae* from the Paleocene of Dutch Gujana by VOORTHUYSEN (1969), differing in morphological details of tests. Adult specimens of the latter species seem to be more heavily-ribbed than those of the former, moreover, there are also some differences in the type of aperture.

Smallest specimens, on the other hand, without distinct ribs, developed on both sides of tests, referred here to *P. minimalis*, may be easily placed in *P. globigeriniformis* HOFKER, also described herein (p. 66).

Occurrence. — The species occurs in: Belgium, Holland, Danian, Polish Lowlands and Carpathians; Paleocene. Identical forms are found also in the comparative material from the Eocene (Roesnes clay) of Denmark.

Pararotalia tuberculifera (REUSS, 1862)

(Pl. XIII, Figs 1, 2, 4)

1862. *Rotalia tuberculifera* REUSS; A.E. REUSS, p. 313, Pl. 2, Fig. 2.
1959. *Rotalia stellata* REUSS; J. MORGIEL, p. 136, Pl. 11, Fig. 11.
1970. *Pararotalia tuberculifera* REUSS; H. J. HANSEN, p. 82, Pl. 9, Figs 4-6; Pl. 21, Figs 1, 2.
1971. *Pararotalia tuberculifera* REUSS; J. SZCZECHURA & K. POŻARYSKA, p. 367, Pl. 6, Figs 1-6 *(here additional synonymy included)*.
1972. *Pararotalia tuberculifera* (REUSS); E. HANZLIKOVA, p. 89, Pl. 22, Fig. 1.
1972. *Pararotalia tuberculifera* REUSS; A. HILLEBRANDT, p. 103, Pl. 8, Fig. 5.

Material. — Thirty two specimens, most of them damaged.

Dimensions of two specimens (in mm):

	F. XIV/134	F. XIV/135
Longest diameter . . .	0.64	0.39
Shortest diameter . . .	0.52	0.34
Height	0.29	0.22

Description as given by POŻARYSKA (1965).

Variation considerable. Ornamentation of the Carpathian specimens in question is similar to that of specimens from the Polish Lowlands (cf. POŻARYSKA & SZCZECHURA, 1968). Moreover, there are some forms which may be regarded as transitional between *Pararotalia tuberculifera* and *Rotalia lithothamnica* (see Pl. XIII, Fig. 5).

Remarks. — In the Polish Miocene of Korytnica (comp. mat.) there were found forms which almost do not differ from both *Pararotalia tuberculifera* and *Rotalia stellata* REUSS, 1856, reported from the Miocene of the Bochnia area (ŁUCZKOWSKA, 1955). *R. stellata* was described from the Babica clays by MORGIEL (1959).

Occurrence. — The species is recorded from: Belgium, Holland, France (Paris Basin), Austrian Alps, Polish Lowlands (Pamiętowo boring), Slovak and Polish Carpathians, USSR (Crimea and Ukraina); uppermost Cretaceous — Paleocene?Miocene.

?**Pararotalia** cf. **minuta** (COLOM, 1954)

(Pl. XV, Figs 1-4)

Material. — Six specimens damaged.

Dimensions of two specimens (in mm):

	F. XIV/136	F. XIV/137
Longest diameter . . .	0.29	0.26
Shortest diameter . . .	0.25	0.20
Height	0.11	0.10

Description. — Test very small, trochospiral, plano-convex, with peripheral outline almost entire or lobulate and slightly serrate, and with acute margin. On spiral side, 6 to 7 chambers of the outer whorl may be distinguished; inner part of this side is covered with tubercles occasionally extending into the sutures. Sutures flush with the surface and slightly obliquely-oriented on the spiral side, and weakly depressed and radial on the umbilical side. Umbilical side smooth, finely porous, with closed umbilicus. Aperture slit-like, situated at the base of the last chamber, on umbilical side and presumably also extending on spiral side.

Variation primarily concerns the general outline, as it follows from the description, and the ornamentation, which covers to a various degree the spiral side, being confined to its center or extending on almost its entire area.

Remarks. — General appearance and the type of aperture cast some doubts on the generic assignment of the species in question. However, it seems closest to the genus *Pararotalia*.

Specimens from the Paleocene of Carpathians are very similar to forms from the Lower Eocene of Spain described by COLOM (1954) as *Neorotalia* (= *Pararotalia*, after LOEBLICH & TAPPAN, 1964) *minuta*. However, the comparison is based on rather schematic figures of the latter species and therefore should be regarded as a tentative one. Forms similar to the Polish specimens, but unfortunately insufficiently illustrated, are described by TAMBAREAU (1972) from the Thanetian of France (Pyrenees) under the same specific name, i.e. *Pararotalia minuta*.

Occurrence. — The species occurs in Polish Carpathians; Paleocene. Similar forms are recorded from the Upper Paleocene of Pyrenees (France) and Lower Eocene of Spain.

Genus **THALMANNITA** BERMUDEZ, 1952

Thalmannita sp.

(Pl. II, Figs 3, 4)

1968. *Thalmannita madrugaensis* (CUSHMAN & BERMUDEZ); O. SAMUEL & J. SALAJ, Text-fig. 1/3 (non *Boldia madrugaensis* CUSHMAN & BERMUDEZ, 1948).

Material. — Three specimens badly preserved.
Dimensions of two specimens (in mm):

	F. XIV/138	F. XIV/139
Largest diameter . . .	0·39	0·64
Smallest diameter . . .	0·34	0·50
Height	0·17	0·29

Description. — Test trochoidal, low; peripheral outline angularly lobulate; peripheral margin somewhat acute. On spiral, flattened side at least two whorls are visible, whereas on umbilical side only one whorl, containing 7-8 chambers can be noted. Sutures slightly arcuate, poorly visible on spiral side, deeper and better marked on the opposite side, where they radiate from a depressed umbilical region. Surfaces of both sides of test are covered with costa-like protuberances arranged subparallelly to the periphery. The oldest chambers rather irregularly ornamented. In small specimens younger chambers, from spiral side, are bordered with radial, arcuate ridges. Aperture damaged, but most probably interiomarginal, not extending on spiral side.

Remarks. — The Polish specimens most closely resemble the figured holotype of *Boldia* (recte *Thalmannita*) *madrugaensis*, described by CUSHMAN and BERMUDEZ (1948) from the Paleocene of Cuba, differing in well-ornamented both sides and in costa-like protuberances arranged almost parallelly to the periphery.

LOEBLICH and TAPPAN (1964, C 621, Fig. 494/1) also presented a figure of a holotype of that species markedly differing, however, from the figure of CUSHMAN and BERMUDEZ (1948), in outline and ornamentation. This caused a confusion in the interpretation of this species. The holotype of *T. madrugaensis* figured by LOEBLICH and TAPPAN (1964) is more similar to the Polish specimens, differing in more asymmetrical coiling and in the mode of projection of inner part of umbilical side.

The specimen from the Paleocene of Slovak Carpathians, assigned to *T. madrugaensis* (CUSHMAN & BERMUDEZ) by SAMUEL and SALAJ (1968), seems to be conspecific with the Polish specimens assigned to *Thalmannita* sp.

Thalmannita sp. somewhat resembles also *Cuvillierina*? (recte *Thalmannita*) *pomeraniana* described by POŻARYSKA and SZCZECHURA (1968) from the Paleocene of the northern Poland (Pamiętowo boring), differing in less asymmetrical coiling, more globulous chambers, shallower sutures from umbilical side, and somewhat different type of ornamentation.

Occurrence. — The species occurs in Polish and Slovak Carpathians; Paleocene. Species representing *Thalmannita* genus seem to be characteristic for warm-water shallow seas.

Family ELPHIDIIDAE GALLOWAY, 1933

Genus **CRIBRONONION** THALMANN, 1947

Cribrononion subnodosum (ROEMER, 1838)

(Pl. XXV, Figs 1-5)

1838. *Robulina subnodosa* ROEMER; F.A. ROEMER, p. 391, Pl. 3, Fig. 61 (*fide* Cat. of Foram.).
1958. *Elphidium subnodosum* (ROEMER); D.A.J. BATJES, p. 163, Pl. 8, Figs 12, 13.
1961. *Elphidium subnodosum* (ROEMER); J.P.H. KAASSCHIETER, p. 239, Pl. 16, Figs 17, 18.
1962. *Elphidium subnodosum* (ROEMER); F. BETTENSTAEDT, H. FAHRION, H. HILTERMANN & W. WICK, p. 368, Pl. 55, Fig. 14.

1969. *Cribrononion subnodosum* (ROEMER); C. W. DROOGER, p. 25, Pl. 5, Figs 3, 4.
1970. *Cribrononion subnodosum* (ROEMER); Y. KIESEL, p. 282, Pl. 15, Fig. 4.
1970. *Elphidium subnodosum* (MUENSTER); Y. LE CALVEZ, p. 170, Pl. 25, Fig. 7.
1971. *Elphidium subnodosum* (ROEMER); J. FERRER, p. 54, Pl. 7, Fig. 9.

Material. — Sixty one specimens, almost all damaged.
Dimensions of four specimens (in mm):

	F. XIV/140	F. XIV/141	F. XIV/142	F. XIV/143
Longest diameter . . .	0.31	0.32	0.22	0.25
Shortest diameter . . .	0.26	0.28	0.17	0.20
Height	0.12	0.12	0.09	0.09

Description. — Test planispiral, involute, equally and slightly only convex on both sides, rounded, entire or somewhat lobulate in peripheral outline; periphery generally distinctly keeled. Chambers numerous, 10-14 in number in the last whorl, moderately increasing in size as added. Umbonal area depressed or weakly umbonate. Chambers narrow, inflated, separated by deeply incised sutures. Sutures sickled to hook-like curved. Sutural perforation poorly visible. Aperture badly preserved. Surface smooth.

Variation significant, concerning width and number of chambers, size and elevation of umbonal region, which may occasionally be even concave; chambers more or less inflated, sometimes covered by rib-like elevations. Keel generally well developed, sometimes missing.

Remarks. — The species appears to be similarly highly variable in the Paleocene of Polish Carpathians as elsewhere. The specimens from the Polish Paleocene appear almost identical with the smallest representatives of that species found in comparative material from the Lower Eocene of Spain, kindly supplied by Dr J. FERRER. There is a great similarity in shape and morphology of tests, number of chambers, and size of tests, which indicates that these forms are undoubtedly conspecific. The Polish specimens differ from the figured holotype of *Robulina* (recte *Cribrononion*) *subnodosa*, described by ROEMER (1838) from the Oligocene of Germany, in number of chambers (10 to 14, instead 12 to 15) and in stronger lateral compression.

Occurrence. — The species is recorded from: Germany, Belgium, Holland, England, Spain, Austrian Alps and Polish Carpathians; Upper Paleocene — Oligocene.

Family GLOBOROTALIIDAE CUSHMAN, 1927

Genus **GLOBOROTALIA** CUSHMAN, 1927

Globorotalia angulata (WHITE, 1928)

(Pl. XXXII, Figs 1-3; Pl. XXXV, Fig. 4)

1928. *Globigerina angulata* WHITE; M.P. WHITE, p. 191, Pl. 27, Fig. 13.
1937. *Globorotalia angulata* (WHITE); M.F. GLAESSNER, p. 383, Pl. 6, Figs 35, 37 (non 36).
1953. *Acarinina conicotruncata* (SUBBOTINA); N. N. SUBBOTINA, p. 220, Pl. 20, Figs 5, 6, 12.
1957. *Globorotalia angulata* (WHITE); A.R. LOEBLICH & H. TAPPAN, p. 187, Pl. 45, Fig. 7; Pl. 48, Fig. 2; Pl. 50, Fig. 4; Pl. 55, Figs 2, 6, 7; Pl. 58, Fig. 2; Pl. 64, Fig. 5.
1957. *Globorotalia angulata* (WHITE); H.M. BOLLI, p. 74, Pl. 17, Figs 7-9.
1960. *Globorotalia angulata* WHITE; R.K. OLSSON, p. 44, Pl. 8, Figs 14-16.
1963. *Truncorotalia angulata* (WHITE); K. GOHRBANDT, p. 57, Pl. 4, Figs 4-6.
1964. *Globorotalia angulata* (WHITE); H. LUTERBACHER, p. 658, Figs 37-39.
1966. *Globorotalia angulata angulata* (WHITE); Z.R. EL-NAGGAR, p. 197, Pl. 22, Fig. 1.

1968. *Globorotalia angulata angulata* (WHITE); O. SAMUEL & J. SALAJ, p. 145, Pl. 8, Fig. 6.
1968. *Globorotalia angulata* WHITE; H.J. HANSEN, p. 280, Figs 1-3.
1969. *Globorotalia angulata* (WHITE); H.M. BOLLI, p. 102, Fig. 27.
1970. *Globorotalia angulata* (WHITE); B.K. SAMANTA, p. 619, Pl. 96, Figs 6-8.
1970. *Globorotalia angulata* (WHITE); E.K. SCHUTZKAJA, Pl. 19, Fig. 11; Pl. 22, Fig. 13.

Material. — Twenty two specimens, in most cases well preserved. Dimensions of three specimens (in mm):

	F. XIV/144	F. XIV/145	F. XIV/146
Longest diameter . . .	0.21	0.28	0.27
Shortest diameter . . .	0.18	0.25	0.23
Height	0.13	0.16	0.20

Description. — Test low, trochospiral; peripheral outline distinctly lobulate; peripheral margin angulate, subacute. Spiral side almost flat; umbilical side convex, conical. Chambers, 4-6 in number in the last whorl, rapidly increasing in size as added, coiled in more than two whorls; only the outer whorl is visible on umbilical side. Sutures obliquely curved on spiral side, radial on umbilical side, incised. Umbilicus opened, rather shallow. Test surface pitted and spiny tuberculated. Aperture represented by interiomarginal slit situated at the base of the last chamber.

Variation considerable, concerning the general size, angulation of peripheral margin, number of chambers, and development of umbilicus. Umbilicus badly pronounced and bordered by well-joined ends of chambers, or deepened and then bounded by separated ends of chambers.

Remarks. — Majority of Polish specimens assigned to *Globorotalia angulata* well agree with forms allocated in that species by previous authors, and particularly with those found in comparative material from the Upper Paleocene (Velasco Fm.) of Mexico, type locality of this species. However, some Polish forms with well-rounded margins seem to be intermediate between *G. angulata* and *G. whitei*, WEISS, 1955, the species also described in the present paper. Six-chambered specimens from the Paleocene of the Carpathians, assigned herein to *G. angulata*, are undoubtedly conspecific with representatives of *G. tadjikistanensis* BYKOVA, 1953, as well as with *G. abundocamerata* BOLLI, 1957, the species described from the Upper Paleocene, and presumably represent their taxonomical equivalents.

LUTERBACHER (1964) formed the *Globorotalia angulata* group and compared it with the *G. aequa* group, without any sharp separation. Thus he confirmed significant variation of these two species.

Occurrence. — The species is recorded from all Tethyan regions, having general distribution similar to that of *G. velascoensis* (CUSHMAN, 1925). It is recorded also from Denmark and England. Unknown in Polish Lowlands; ?Lower Paleocene (Danian by Russian authors only) — Upper Paleocene (?Lower Eocene).

Globorotalia chapmani PARR, 1938

(Pl. XXXIV, Figs 1-3)

1938. *Globorotalia chapmani* PARR; W. J. PARR, p. 87, Pl. 3, Figs 8, 9.
1962. *Globorotalia (Globorotalia) ehrenbergi* BOLLI; A. HILLEBRANDT, p. 126, Pl. 12, Figs 3, 4.
1963. *Globorotalia troelseni* LOEBLICH & TAPPAN; K. GOHRBANDT, p. 51, Pl. 6, Figs 13, 14.
1964. *Globorotalia chapmani* PARR; B. MCGOWRAN, p. 85, Figs 1-9.

1967. *Globorotalia chapmani* PARR; W. A. BERGGREN, R. K. OLSSON & R. A. REYMENT, p. 277, Pl. 1, Figs 1-6; Text-figs 1, 4.
1967. *Planorotalia pseudomenardii membraniformis* MOROZOVA; V. G. MOROZOVA, G. E. KOJEWNIKOVA & A. M. KURILEVA, p. 194, Pl. 6, Figs 1, 2.
1967. *Globorotalia chapmani* PARR; K. H. A. GOHRBANDT, p. 70, Pl. 1, Figs 1-3, 7-9.
1968. *Globorotalia chapmani* PARR; O. SAMUEL & J. SALAJ, p. 149, Pl. 9, Fig. 3.
1968. *Globorotalia emilei* EL-NAGGAR; H. J. HANSEN, p. 281, Figs 4-6.
1970. *Globorotalia chapmani* PARR; B. K. SAMANTA, p. 621, Pl. 98, Figs 15-18.

Material. — Twenty one specimens, some of them damaged.
Dimensions of three specimens (in mm):

	F. XIV/171	F. XIV/172	F. XIV/173
Longest diameter . . .	0.29	0.25	0.26
Shortest diameter . . .	0.22	0.20	0.20
Height	0.14	0.11	0.12

Description as given by MCGOWRAN (1964); it should be added here that the specimens from the Paleocene of Polish Carpathians have up to 6 chambers in the last whorl.

Variation primarily concerning the size of tests and shape and arrangement of chambers of outer and inner whorls. Number of chambers in the last whorl varying from 5 to 6.

Remarks. — The specimens from the Paleocene of Polish Carpathians are almost identical as those from PARR's collection, figured by MCGOWRAN (1964). However, Australian forms have never more than 5 chambers in the last whorl, whereas some Polish forms assigned to this species have six chambers. The variation of Polish specimens, as well as differences among forms placed in this species by different authors indicate the necessity of more extensive comparative studies. Such studies should also take into account the variation of the species resembling *Globorotalia chapmani*, i.e. *Globorotalia emilei* EL-NAGGAR (1966), *G. membranacea* (EHRENBERG, 1854), *G. ehrenbergi* BOLLI (1957), and *G. elongata* GLAESSNER (1937).

Occurrence. — The species is recorded from: Australia, south-eastern India, USSR (Caucasus and Crimea), Slovak and Polish Carpathians, Austrian Alps, Yugoslavia, Denmark, France (Aquitanian Basin), Egypt, Libya, Morocco, Israel, USA (California, Alabama and New Jersey); Middle and Upper Paleocene.

Globorotalia perclara LOEBLICH & TAPPAN, 1957

(Pl. XXXI, Figs 2-4)

1957. *Globorotalia perclara* LOEBLICH & TAPPAN; A. LOEBLICH & H. TAPPAN, p. 191, Pl. 40, Fig. 7; Pl. 41, Fig. 8; Pl. 42, Fig. 4; Pl. 45, Fig. 11; Pl. 46, Fig. 3; Pl. 47, Fig. 6; Pl. 50, Fig. 1; Pl. 54, Figs 6, 7; Pl. 57, Figs 3, 4; Pl. 60, Fig. 5.
1960. *Globorotalia perclara* LOEBLICH & TAPPAN; R.K. OLSSON, p. 46, Pl. 9, Figs 1-3.
1966. *Globorotalia perclara* LOEBLICH & TAPPAN; Z.R. EL-NAGGAR, p. 223, Pl. 21, Fig. 2.

Material. — Three specimens well preserved.
Dimensions of one specimen (in mm):

	F. XIV/147
Longest diameter . . .	0.12
Shortest diameter . . .	0.10
Height	0.07

Description. — Test small, low, trochospiral, with somewhat compressed sides and generally well inflated chambers. Peripheral outline weakly lobulate in small specimens, becoming markedly more lobulate in larger ones. Chambers slowly increasing in size as added, tightly coiled in early test part, becoming somewhat more loosely coiled in late test part, coiled in more than two whorls; the last whorl contains 5 chambers. Sutures almost radial on both sides, fairly incised, particularly those between chambers of the last whorl of larger tests. Umbilicus small, opened, and relatively deep. Aperture represented by crescentic arch, interiomarginal, reaching the umbilicus. Test surface of small specimens is pitted and papillous, whereas in larger specimens the roughness of test surface fades away on younger chambers.

Variation of the studied forms appears to be related to the stage of ontogenetic development of the particular specimens; small specimens seem to represent juvenile forms.

Remarks. — It cannot be excluded that the specimens assigned herein to *Globorotalia perclara* actually represent more than one species. However, the material is too scarce for any further separations to be made. A remarkable number of illustrations given by LOEBLICH and TAPPAN (1957), who described this species from the Paleocene (Danian) of USA (Alabama), indicates that they considered it as a highly variable species. If specific variation presented by these authors is accepted, the Polish specimens easily fall within the limits of variability of this species.

Occurrence. — The species occurs in: Gulf and Atlantic Coastal Plains of USA, England, Germany, Polish Carpathians, Nigeria and Egypt; Paleocene (?Lower Eocene).

Globorotalia velascoensis (CUSHMAN, 1925)

(Pl. XXXV, Fig. 2)

1925. *Pulvinulina velascoensis* CUSHMAN; J. CUSHMAN, p. 19, Pl. 3, Fig. 5 (see Cat. of Foram.).
1953. *Globorotalia velascoensis* (CUSHMAN); N.N. SUBBOTINA, p. 216, Pl. 19, Figs 1-4.
1956. *Globorotalia velascoensis* (CUSHMAN); A.F. M. HAQUE, p. 181, Pl. 24, Fig. 2.
1957. *Globorotalia velascoensis* (CUSHMAN); H.M. BOLLI, p. 76, Pl. 20, Figs 1-4.
1957. *Globorotalia velascoensis* CUSHMAN; V. SACAL & A. DEBOURLE, p. 64, Pl. 19, Figs 7-9.
1957. *Globorotalia velascoensis* (CUSHMAN); A.R. LOEBLICH & H. TAPPAN, p. 196, Pl. 64, Figs 1, 2.
1963. *Truncorotalia velascoensis velascoensis* (CUSHMAN); K. GOHRBANDT, p. 59, Pl. 5, Figs 7-9.
1964. *Globorotalia velascoensis* (CUSHMAN); H. LUTERBACHER, p. 681, Figs 92-94, 98, 99.
1966. *Globorotalia velascoensis velascoensis* (CUSHMAN); Z. R. EL-NAGGAR, p. 246, Pl. 20, Fig. 3; Pl. 21, Fig. 3.
1968. *Globorotalia velascoensis* (CUSHMAN); O. SAMUEL & J. SALAJ, p. 158, Text-fig. 41.
1970. *Globorotalia velascoensis* (CUSHMAN); B.K. SAMANTA, p. 636, Pl. 97, Figs 7-10.
1970. *Globorotalia velascoensis* CUSHMAN; E.K. SCHUTZKAJA, Pl. 24, Fig. 5; Pl. 25, Fig. 5; Pl. 29, Fig. 8.

Material. — Two specimens somewhat damaged.

Dimensions of one specimen (in mm):

	F. XIV/148
Longest diameter . . .	0.34
Shortest diameter . . .	0.31
Height	0.19

Description. — Test plano-convex, trochospiral. Peripheral outline almost entire; peripheral margin acute, heavily keeled. Spiral side flat, with three whorls of chambers; chambers — $6\frac{1}{2}$ in the last whorls, gradually increasing in size as added. Umbilical side highly elevated, with well separated ends of chambers. Sutures limbate, sickled on spiral side, radial and deeply incised on umbilical side. Umbilicus wide, opened. Aperture slit-like, situated at the base of the last chamber and extending from the umbilicus almost to the periphery. Test surface pitted and covered with spiny tubercles.

Remarks. — The specimens from the Paleocene of Polish Carpathians assigned to *Globorotalia velascoensis* differ from those found in the comparative material from the Paleocene (Velasco Fm.) of Mexico, wherefrom this species was described, in smaller size, less ornamented keel and ends of chambers on umbilical side. However, they closely resemble and are undoubtedly conspecific with many forms allocated by different authors in the same species.

Occurrence. — The species is reported from all Tethyan regions from Mexico up to New Zealand (see Text-fig. 3); Upper Paleocene (?Lower Eocene).

Globorotalia whitei WEISS, 1955

(Pl. XXXII, Fig. 6)

1928. *Globorotalia crassaformis* GALLOWAY & WISSLER; M. P. WHITE, p. 193, Pl. 27, Fig. 14 (non *Globigerina crassa formis* GALLOWAY & WISSLER, 1927) (see Cat. of Foram.).
1953. *Acarinina crassaformis* (GALLOWAY & WISSLER); N. N. SUBBOTINA, p. 223, Pl. 21, Figs 1-7 (non *Globigerina crassaformis* GALLOWAY & WISSLER, 1928).
?1953. *Acarinina intermedia* SUBBOTINA; N. N. SUBBOTINA, p. 227, Pl. 20, Figs 1-4, 14-16.
1955. *Globorotalia whitei* WEISS; L. WEISS, p. 18, Pl. 6, Figs 1-3.
1966. *Globorotalia whitei* WEISS; Z. R. EL-NAGGAR, p. 249, Pl. 23, Fig. 3.
?1968. *Turborotalia (Acarinina) intermedia* (SUBBOTINA); O. SAMUEL & J. SALAJ, p. 168, Pl. 14, Figs 3, 4.
1970. *Globorotalia whitei* WEISS; B. K. SAMANTA, p. 638, Pl. 95, Figs 3, 4.

Material. — Seven specimens well preserved.
Dimensions of two specimens (in mm):

	F. XIV/149	F. XIV/150
Longest diameter . . .	0.22	0.24
Shortest diameter . . .	0.16	0.22
Height	0.14	0.17

Description. — Test trochospiral, low, with weakly lobulate peripheral outline and rounded margin. Spiral side flattened, containing more than two whorls; chambers, 4 or occasionally 5 in the last whorl, rapidly increasing in size as added. Umbilical side convex, rounded. Sutures depressed on both sides, slightly oblique on spiral side, radial on umbilical side. Umbilicus shallow, weakly developed. Test surface pitted and fairly spiny tuberculated. Aperture interiomarginal, slit-like, situated at the base of the last chamber, extending from the umbilicus up to the periphery.

Variation not considerable, primarily concerning general test shape and especially peripheral margin, number of chambers in the last whorl (varying from 4 to 5) as well as development of umbilicus.

Remarks. — Taking into account variation within specimens from the Upper Paleocene of the Carpathians which are attributed to *Globorotalia whitei*, it is difficult to state whether or not all the specimens are conspecific. It is not excluded that at least some of them are similar to *G. angulata* (see remarks on p. 71). However, the majority of Polish specimens assigned to *G. whitei* do not differ from the figured holotype of that species described by WEISS (1955) from the Upper Paleocene of Peru. Discussion concerning the relation of *G. whitei* and *G. crassaformis* (GALLOWAY & WISSLER, 1927), accepted by the present authors, is given by EL-NAGGAR (1966) and other authors.

The specimens assigned by SUBBOTINA (1953) to *Acarinina (Globorotalia) crassaformis* seem to fall within the limits of variaton of *Globorotalia whitei*. Also specimens from the

Upper Paleocene of Slovak Carpathians, assigned to *Turborotalia (Acarinina) intermedia* SUBBOTINA by SAMUEL and SALAJ (1968), cannot be separated from the Polish representatives of *Globorotalia whitei*. The original representatives of *Acarinina intermedia*, figured by SUBBOTINA (1953) from the Paleocene of southern USSR seem to have much more globulous and more tightly coiled chambers than the representatives of *Globorotalia whitei*, so they are included in the synonymy of the latter species with reservation.

Occurrence. — The species is recorded from: South America (Venezuela, Peru, Trinidad), North America (Gulf and Atlantic Coastal Plains), Europe (Austrian Alps, Slovak and Polish Carpathians), Africa (Egypt), Asia (south-western part of USSR) and southern India; Upper Paleocene — Lower Eocene.

Globorotalia cf. **convexa** SUBBOTINA, 1953

(Pl. XXX, Figs 4, 5)

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

	F. XIV/151	F. XIV/152
Longest diameter . . .	0.25	0.20
Shortest diameter . . .	0.22	0.18
Height	0.16	0.15

Description. — Test trochospiral, low. Peripheral outline gently lobulate; peripheral margin rounded, somewhat angulate. Spiral side elevated, particularly in the centre, containing more than 2 whorls of chambers. Chambers, 5 in number in the last whorl, markedly increasing in size as added, inflated. Umbilical side more elevated than spiral side, with shallow umbilicus. Sutures incised on both sides, slightly curved on spiral side, radial on the opposite. Test surface coarsely pitted and spiny tuberculated. Aperture formed by interiomarginal slit situated at the base of the last chamber.

Variation difficult to evaluate because of scarcity of material. Specimens from Polish Paleocene, assigned to *Globorotalia* cf. *convexa* SUBBOTINA (1953), differ in the development of their spiral side, i.e. in the development of inner coils. However, the forms with weakly developed chambers of inner whorls may represent a separate species.

Remarks. — The Polish specimens assigned to *Globorotalia* cf. *convexa* are similar to the figured holotype of *Globorotalia convexa* described by SUBBOTINA (1953) from the Paleocene of USSR, differing in less equally biconvex test and in smaller number of chambers, never more numerous than 5 in the last whorl, in comparison with 6 or more found in the last whorls of Georgian forms; thus, the Polish forms are tentatively assigned to this species. They seem also to be close to the representatives of *G. apanthesma*, described from the Upper Paleocene of USA by LOEBLICH and TAPPAN (1957), differing however in better developed chambers of inner coils.

The specimens assigned to this species and described by LOEBLICH and TAPPAN (1957) from the Paleocene of USA and by SAMUEL and SALAJ (1968) from the Paleocene of Slovak Carpathians, are generally more tightly coiled in comparison with the specimens from USSR and Poland, and hardly match diagnosis of this species. It should be noted here that *G. convexa* SUBBOTINA was placed in the synonymy of *G. broedermanni* CUSHMAN & BERMUDEZ, 1949, by POSTUMA (1964).

Occurrence. — Polish Carpathians; Upper Paleocene.

Globorotalia cf. **laevigata** BOLLI, 1957

(Pl. XXXI, Fig. 1)

Material. — Two specimens damaged.

Dimensions of one specimen (in mm):

	F. XIV/153
Longest diameter . . .	0.20
Shortest diameter . . .	0.18
Height	0.12

Description. — Test extremely small, trochospiral, lenticular in edge view, with lobulate peripheral outline. Chambers coiled in more than two whorls, 5 in the last whorl, flattened on the spiral side, and somewhat inflated on the umbilical side; inner whorls somewhat elevated. Sutures curved, limbate on spiral side and almost radial on umbilical side, depressed. Umbilicus deep, small. Aperture — a low interiomarginal, extraumbilical arch. Test surface porous, very finely tuberculated.

Remarks. — In comparison with the type specimen of *Globorotalia laevigata* figured in POSTUMA's Manual of Planktonic Foraminifera, the Polish specimens have 5 instead of 6-7 chambers in the last whorl and are not keeled. Extremely small size of the Polish forms suggest that they represent juvenile forms. However, both general outline of tests and ornamentation of test surface suggest close relation of the Polish forms and the forms described as *Globorotalia laevigata* by BOLLI (1957) from the Upper Paleocene of Trinidad.

Occurrence. — Polish Carpathians; Upper Paleocene.

Globorotalia cf. **occlusa** LOEBLICH & TAPPAN, 1957

(Pl. XXXV, Fig. 3)

Material. — One specimen well preserved.

Dimensions of one specimen (in mm):

	F. XIV/154
Longest diameter . . .	0.34
Shortest diameter . . .	0.27
Height	0.17

Description. — Test low, trochospiral, with acute, slightly keeled peripheral margin, and weakly lobulate peripheral outline. Spiral side almost flat, somewhat elevated in the centre; umbilical side distinctly convex. Chambers, 4 in number in the last whorl, rapidly increasing in size as added, coiled in more than two whorls; only the last whorl is observable on the umbilical side. Sutures sickled, almost flush with the surface on spiral side, radial and incised on umbilical side. Umbilicus shallow, small, weakly opened; chamber ends somewhat protruding. Test surface pitted and covered with spiny tubercles; the tubercles are also developed on keel. Aperture extending from the umbilicus up to the peripheral margin at the base of the last chamber.

Remarks. — The Polish specimens assigned to *Globorotalia* cf. *occlusa* differ from the holotype of *G. occlusa*, described by LOEBLICH and TAPPAN (1957) from the Upper Paleocene of Mexico, in lower and not ornamented shoulders of chambers on umbilical side and in less distinct keel. However, the Polish specimens appear only slightly different from the paratype of this species from the Upper Paleocene of USA, differing only slightly in ornamentation and somewhat thinner sutures from spiral side. The Polish specimens also seem to be close to *Globorotalia subbotinae* described by MOROZOVA (1939; see Cat. of Foram.) from the Lower

Eocene of south-eastern USSR, differing in more solid and more heavily ornamented tests and in not so well-developed umbilicus. The specimens assigned to *G. subbotinae* by SCHUTZKAJA (1970) differ from the Polish forms in larger and deeper umbilicus, more protruding umbilical shoulders, and in more acute peripheral margin. The Paleocene forms assigned by SAMANTA (1970) and LUTERBACHER (1964) to *G. subbotinae* MOROZOVA do not show any distinct differences in respect to those assigned herein to *G.* cf. *occlusa* LOEBLICH & TAPPAN.

It should be noted that LUTERBACHER (1964) placed *G. subbotinae* in *G. aequa* group and at the same time *G. occlusa* in *G. velasco* group.

Occurrence. — Polish Carpathians; Upper Paleocene.

Globorotalia sp.

(Pl. XXX, Figs 6-8)

Material. — Five specimens well preserved.

Dimensions of two specimens (in mm):

	F. XIV/156	F. XIV/157
Longest diameter . . .	0.26	0.17
Shortest diameter . . .	0.20	0.14
Height	0.15	0.10

Description. — Test trochospiral, low, with gently lobulate peripheral outline and well rounded peripheral margin. Spiral side flattened; umbilical side convex, rounded. Chambers slowly enlarging in size as added, compressed on spiral side, tightly and regularly coiled in more than two whorls. The last whorl, the only seen on the umbilical side, composed of 4-5 chambers. Sutures somewhat more depressed on umbilical side. Umbilicus — small, distinct. Aperture slit-like, extending from umbilicus to the periphery, with lip. Test surface porous, distinctly reticulate.

Variation insignificant, primarily concerning the size of tests and arrangement of chambers.

Remarks. — The specimens from the Upper Paleocene of Polish Carpathians, assigned to *Globorotalia* sp., are very similar to those assigned herein to *Globigerina pseudobulloides* or *G. varianta*, differing however from these latters in more tightly coiled chambers and in more flattened spiral side. There is also close similarity between *Globorotalia* sp. and *G. imitata* described by SUBBOTINA (1953) from the Lower Paleocene of USSR; the difference primarily concerns ornamentation of test surface, which is distinctly reticulated in the former species and smooth in the latter species.

Occurrence. — Polish Carpathians; Upper Paleocene.

Family GLOBIGERINIDAE CARPENTER, PARKER & JONES, 1862

Genus **GLOBIGERINA** D'ORBIGNY, 1826

Globigerina pseudobulloides PLUMMER, 1926

(Pl. XXXIV, Fig. 4)

1926. *Globigerina pseudo-bulloides* PLUMMER; H. J. PLUMMER, p. 133, Pl. 8, Fig. 9.
1963. *Globigerina pseudobulloides pseudobulloides* PLUMMER; K. GOHRBANDT, p. 44, Pl. 1, Figs 7-9.
1965. *Globigerina pseudobulloides* PLUMMER; K. POŻARYSKA, p. 123, Pl. 23, Figs 2, 3.
1970. *Globorotalia pseudobulloides* (PLUMMER); B. K. SAMANTA, p. 630, Pl. 98, Figs 19, 20.

Material. — Twelve specimens well preserved.
Dimensions of two specimens (in mm):

	F. XIV/158	F. XIV/159
Longest diameter . . .	0.39	0.39
Shortest diameter . . .	0.31	0.31
Height	0.22	0.23

Description as given by POŻARYSKA (1965). It should be added, however, that the individuals from the Upper Paleocene of Carpathians have maximally up to 4½ chambers instead of 5 chambers in the last whorl.

Variation insignificant, concerning test size and arrangement of chambers.

Remarks. — Polish specimens assigned to *Globigerina pseudobulloides* somewhat differ from the majority of specimens found by the present authors in comparative material from the Paleocene (Midway Fm.) of Texas, wherefrom this species was described. The Polish specimens never have 5 complete chambers, but only up to 4½ chambers in the last whorl. Moreover, they are more tightly coiled in the Polish specimens, i.e. they are less lobulate in outline than the American specimens, and thus they are closer to *Globigerina varianta*, the species described by SUBBOTINA (1953) from the Paleocene of Caucasus (see also HILLEBRANDT, 1962; POŻARYSKA, 1965; SAMUEL & SALAJ, 1968; SCHUTZKAJA, 1970). SCHUTZKAJA (1970) figured a number of specimens from the Paleocene and Lower Eocene of SW parts of USSR, which she assigned to *Globigerina* ex gr. *varianta*. Some of her specimens correspond to those reported herein from the Polish Carpathians. However, the variation of *Globigerina pseudobulloides* observed in samples from its type locality, and the variation of this species as interpreted by various authors, as well as variation of *G. varianta* as interpreted by SUBBOTINA (1953) and that observed in Polish Paleocene, appear to be very high. Thus the Polish material cannot be placed in the species *G. varianta* SUBBOTINA, which was described after *G. pseudobulloides* PLUMMER. The treatment of *G. varianta* as a subspecies of *G. pseudobulloides*, suggested by GOHRBANDT (1963), seems to be adequately substantiated.

Some specimens from the Paleocene of Polish Carpathians are assigned to *G. pseudobulloides* with reservation, as they share some morphological features typical of *G. pseudobulloides*, *G. varianta* and *G. triloculinoides*.

Occurrence. — This cosmopolitan species is recorded from all continents, from geosynclinal as well as from epicontinental facies; uppermost Cretaceous — Paleocene (?Lower Eocene).

Globigerina (Subbotina) triloculinoides PLUMMER, 1926

(Pl. XXXIII, Figs 1-4, 6; Pl. XXXV, Fig. 1)

1926. *Globigerina triloculinoides* PLUMMER; H.J. PLUMMER, p. 134, Pl. 8, Fig. 10.
1957. *Globigerina triloculinoides* PLUMMER; A. LOEBLICH & H. TAPPAN, p. 183, Pl. 40, Fig. 4; Pl. 41, Fig. 2; Pl. 43, Figs 5, 8, 9; Pl. 45, Fig. 3; Pl. 46, Fig. 1; Pl. 47, Fig. 2; Pl. 56, Fig. 8; Pl. 62, Figs 3, 4.
1962. *Globigerina triloculinoides* PLUMMER; A. HILLEBRANDT, p. 119, Pl. 11, Fig. 1.
1963. *Globigerina triloculinoides* PLUMMER; K. GOHRBANDT, p. 42, Pl. 1, Figs 1-3.
1965. *Globigerina (Subbotina) triloculinoides* PLUMMER; K. POŻARYSKA, p. 124, Pl. 22, Fig. 2.
1967. *Globigerina triloculinoides* group; I. BANG, p. 61, Pl. 2, Figs 1-4.
1968. *Globigerina (Subbotina) triloculinoides* PLUMMER; K. POŻARYSKA & J. SZCZECHURA, p. 71.
1970. *Globigerina triloculinoides* PLUMMER; B.K. SAMANTA, p. 614, Pl. 94, Figs 5, 9, 13-16.
1970. *Globigerina triloculinoides* PLUMMER; E.K. SCHUTZKAJA, Pl. 18, Fig. 1; Pl. 23, Fig. 12.

Material. — Twenty two specimens, in most cases well preserved.
Dimensions of three specimens (in mm):

	F. XIV/160	F. XIV/161	F. XIV/162
Longest diameter . . .	0.30	0.32	0.23
Shortest diameter . . .	0.24	0.25	0.18
Height	0.20	0.21	0.17

Description as given by POŻARYSKA (1965).

Variation considerable, concerning size of test as well as size, shape and arrangement of particular chambers, resulting in remarkable differences in general appearance of tests.

Remarks. — In the Upper Paleocene of Polish Carpathians there occur numerous forms closely resembling both the figured holotype of *Globigerina triloculinoides* and the specimens found in comparative material from the Paleocene (Midway Fm.) of Texas wherefrom this species was described. However, some Polish forms tentatively identified as *G.* cf. *triloculinoides* somewhat resemble other species as *Globigerina finlay* BRONNIMAN (1952), *G. trivialis* SUBBOTINA (1953), *G. triangularis* WHITE (1928), (see BOLLI, 1957), or even *G. inaequispira* SUBBOTINA (1953). Moreover, some small and very compact specimens appear also similar to *Globigerina velascoensis parva* EL-NAGGAR (1966). Great variation of the species *Globigerina triloculinoides* PLUMMER (1926) resulted in different interpretations of this species. More exhaustive discussion of the affinities of this species was given by BANG (1967), EL-NAGGAR (1966) and others.

According to the present authors, some species of the genus *Globigerina*, erected by CHALILOV (1967) and SCHUTZKAJA (1970), may actually belong to the *G. triloculinoides* group.

Occurrence. — The cosmopolitan species is recorded from all continents, from geosynclinal as well as from epicontinental facies; Paleocene.

Globigerina trivialis SUBBOTINA, 1953

(Pl. XXXI, Fig. 5)

1953. *Globigerina trivialis* SUBBOTINA; N. N. SUBBOTINA, p. 64, Pl. 4, Figs 4-6.
1965. *Globigerina trivialis* SUBBOTINA; K. POŻARYSKA, p. 125, Pl. 22, Fig. 3.
1970. *Globigerina trivialis* SUBBOTINA; E. K. SCHUTZKAJA, Pl. 23, Fig. 6.
1970. *Globigerina trivialis* SUBBOTINA; B. K. SAMANTA, p. 614, Pl. 94, Figs 10-12.

Material. — Four specimens well preserved.
Dimensions of one specimen (in mm):

	F. XIV/163
Longest diameter . . .	0.26
Shortest diameter . . .	0.22
Height	0.17

Description as given by POŻARYSKA (1965).

Variation indistinct; some specimens with low inner whorls on spiral side could have been tentatively assigned to *Globigerina triloculinoides.*

Remarks. — The specimens from the Polish Carpathians are very similar to those described and figured by SUBBOTINA (1953) from the Danian of Caucasus, and to those previously reported by POŻARYSKA (1965) from the Paleocene of the Polish Lowlands.

Occurrence. — The species is reported from: USSR (Russian Platform), Caucasus, Crimea, Kamchatka and Turkmenia), Polish Carpathians and Lowlands, south-eastern India; ?uppermost Cretaceous — Paleocene.

Globigerina velascoensis CUSHMAN, 1925

(Pl. XXXIII, Fig. 5)

1925. *Globigerina velascoensis* CUSHMAN; J.A. CUSHMAN, p. 19, Pl. 3, Fig. 6 (see Cat. of Foram.).
1928. *Globigerina velascoensis* CUSHMAN; M.P. WHITE, p. 196, Pl. 28, Fig. 2.
1928. *Globigerina velascoensis* var. *compressa* WHITE; M. P. WHITE, p. 196, Pl. 28, Fig. 2.
1957. *Globigerina velascoensis* CUSHMAN; H.M. BOLLI, p. 71, Pl. 15, Figs 9-11.
1962. *Globigerina velascoensis* CUSHMAN; A. HILLEBRANDT, p. 120, Pl. 11, Fig. 4.
1963. *Globigerina velascoensis* CUSHMAN; K. GOHRBANDT, p. 47, Pl. 2, Figs 1-3.
1966. *Globigerina velascoensis* CUSHMAN; Z.R. EL-NAGGAR, p. 183, Pl. 16, Fig. 3.
1968. *Globigerina velascoensis* CUSHMAN; O. SAMUEL & J. SALAJ, p. 135, Pl. 2, Fig. 2.
1970. *Globigerina velascoensis* CUSHMAN; B.K. SAMANTA, p. 615, Pl. 94, Figs 7, 8.
1970. *Globigerina velascoensis* CUSHMAN; E.K. SCHUTZKAJA, Pl. 2, Fig. 5; Pl. 22, Fig. 4.

Material. — Six specimens well preserved.
Dimensions of two specimens (in mm):

	F. XIV/164	F. XIV/165
Longest diameter . . .	0.24	0.29
Shortest diameter . . .	0.19	0.23
Height	0.19	0.21

Description. — Test small, subquadrate in peripheral outline, trochospiral, low. Chambers tightly coiled into two whorls, $3\frac{1}{2}$ in number in the last whorl, the only visible on umbilical side; chambers rapidly increasing in size as added, flattened on spiral side, inflated and elongated on umbilical side; moreover, top part of the last chamber is compressed. Sutures more incised on umbilical side. Umbilicus small, narrow, opened. Aperture interiomarginal, umbilical, slit-like, bordered from above by lip. Test surface distinctly reticulated, porous.

Variation primarily concerning relative size and arrangement of chambers and their shape.

Remarks. — The holotype of *Globigerina velascoensis*, described from the Paleocene (Velasco Fm.) of Mexico, was very schematically figured. That is why the specimens from the Polish Carpathians were compared with those found in the comparative material from the Paleocene of Mexico, most probably conspecific with the above holotype. The majority of Polish specimens fall within the limits of variability of the Mexican population of *G. velascoensis*. However, a few of the Polish forms appear closer to *G. triloculinoides*.

Occurrence. — The species is known from Tethyan regions: Trinidad, Mexico, Austrian Alps, Italy, Yugoslavia, Slovak and Polish Carpathians, USSR (Crimea), south-eastern India and Egypt; Upper Paleocene.

Globigerina cf. yeguaensis WEINZIERL & APPLIN, 1929

(Pl. XXX, Figs 1-3)

Material. — Five specimens well preserved.
Dimensions of two specimens (in mm):

	F. XIV/166	F. XIV/167
Longest diameter . . .	0.17	0.20
Shortest diameter . . .	0.17	0.17
Height	0.13	0.14

Description. — Test trochospiral, moderately low. Peripheral outline subquadrate, lobulate; peripheral margin broadly rounded. Chambers gradually increasing in size as added, randomly coiled in almost three whorls; inner whorls elevated; outer whorl, the only seen on umbilical side, containing $3\frac{1}{2}$-4 chambers, rather tightly coiled and well inflated on both sides. Umbilicus small, opened. Aperture median or low arched, situated at the base of the last chamber, interiomarginal, umbilical, with lip. Test surface distinctly porous, slightly spinose in early chambers.

Variation primarily concerning the arrangement of chambers and height of inner whorls.

Remarks. — The Polish specimens assigned to *Globigerina* cf. *yeguaensis* are similar to the figured holotype of *G. yeguaensis*, the species described by WEINZIERL and APPLIN, 1929, from the Middle Eocene of USA (Texas), and particularly to the specimen figured under that name in POSTUMA'S (1964) Manual of Planktonic Foraminifera. They differ, however, in more quadrate general outline and in the lack of tooth-like apertural lip, typical of this species.

Occurrence. — Polish Carpathians; Upper Paleocene. *Globigerina yeguaensis* is recorded from the Eocene beds.

?Globigerina inconstans SUBBOTINA, 1953

(Pl. XXXIV, Figs 5-7)

1953. *Globigerina inconstans* SUBBOTINA; N. N. SUBBOTINA, p. 58, Pl. 3, Figs 1, 2.
1964. *Globorotalia inconstans* (SUBBOTINA); H. LUTERBACHER, p. 650, Figs 19-23.
1968. *Turborotalia (Acarinina) inconstans inconstans* (SUBBOTINA); O. SAMUEL & J. SALAJ, p. 166, Pl. 13, Fig. 5.
1970. *Acarinina inconstans inconstans* (SUBBOTINA); E. K. SCHUTZKAJA, Pl. 19, Fig. 1.
1972. *Subbotina inconstans* (SUBBOTINA); H. W. DABAGIAN, p. 197, Pl. 10, Figs 2, 3.

Material. — Six specimens, most of them damaged.

Dimensions of three specimens (in mm):

	F. XIV/168	F. XIV/169	F. XIV/170
Longest diameter . . .	0.25	0.31	0.39
Shortest diameter . . .	0.22	0.27	0.37
Height	0.15	0.17	0,25

Description. — Test trochospiral, low. Peripheral outline subquadrate, lobulate; peripheral margin broadly rounded. Chambers globulous, rather rapidly growing in size as added, coiled into nearly 3 whorls, of which only the last one is seen on umbilical side. In the outer whorl there are 4-$4\frac{1}{2}$ chambers. Inner whorls somewhat elevated or almost flush with the outer one. Sutures weakly incised, radial on both sides. Umbilicus fairly narrow and moderately deep. Test surface distinctly pitted. Aperture — a slit at the base of the last formed chamber, extraumbilical-umbilical, occasionally with a lip.

Variation not significant, primarily concerning size of tests as well as arrangement of chambers, especially within inner whorls.

Remarks. — The specimens from the Paleocene of the Polish Carpathians assigned to *?Globigerina inconstans* SUBBOTINA do not differ from those referred to the same species by DABAGIAN (1972) from the Danian of the eastern Carpathians (USSR). In comparison with the original representatives of *Globigerina inconstans*, figured by SUBBOTINA (1953) from the Danian of Caucasus, the Polish specimens have less numerous chambers in the last whorl, i.e. 4-$4\frac{1}{2}$ instead of 5-6. Four-chamber forms were also assigned to this species by LUTERBACHER (1964) who described it from the Paleocene of northern Caucasus.

Specimens with elevated inner whorls, recorded from the Paleocene of the Polish Carpathians somewhat resemble those assigned by BOLLI (1957) to *Globigerina spiralis* and *G. hagni* GOHRBANDT (1967). The former species is known from the Paleocene, whereas the latter — from the Eocene.

Occurrence. — The species is reported from USSR (Caucasus, Turkmenia), Slovak, Polish and Soviet Carpathians, Italy; Paleocene. (The species is characteristic for Lower Paleocene beds).

Family EPONIDIDAE HOFKER, 1951

Genus **EPONIDES** DE MONTFORT, 1808

Eponides lunata BROTZEN, 1948

(Pl. XXXVII, Figs 4, 5)

1948. *Eponides lunata* BROTZEN; F. BROTZEN, p. 77, Pl. 10, Figs 17, 18.
?1950. *Cibicides* (?)*lunatus* (BROTZEN); V. P. VASSILENKO, p. 220, Pl. 6, Fig. 6.
1953. *Eponides lunata* BROTZEN; L. W. LE ROY, p. 30, Pl. 9, Figs 24-26.
1966. *Eponides lunata* BROTZEN; J. HOFKER, p. 337, Pl. 83, Fig. 205(non p. 140, Pl. 20, Fig. 39, non p. 198, Pl.33, Figs 22, 24, non p. 229, Pl. 42, Fig. 81).
non 1970. *Paralabamina lunata* (BROTZEN); H. J. HANSEN, p. 102, Pl. 27, Figs 1, 2; Pl. 14, Figs 5-7.

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

	F. XIV/174	F. XIV/175
Longest diameter . . .	0.16	0.12
Shortest diameter . . .	0.15	0.11
Height	0.07	0.07

Description. — Test extremely small, nearly equally biconvex, distinctly elevated in central part of spiral side; peripheral margin sharply angled and keeled; peripheral outline weakly lobulate. On spiral side, 3 whorls are clearly visible. The last whorl, the only one seen on the umbilical side, contains about 6 chambers. Sutures transparent, curved, slightly depressed on umbilical side; umbilicus lacking. Aperture not visible. Wall smooth, glossy, very finely perforated.

Remarks. — Discussion concerning exclusion of the specimens described by HANSEN (1970) from this species is given in remarks on *Paralabamina toulmini* (see p. 97).

Cibicides (?)*lunatus* described by VASSILENKO (1950) from the Paleocene of Dnieper-Donetz Basin, USSR, is allocated here with reservation, as it differs from the original representatives of *Eponides lunata* from the Paleocene of Sweden in having more chambers, and in being not compressed and too coarsely porous. It is possible that the species *Eponides karsteni*, described by VASSILENKO (1961) from the Cretaceous of Mangyshlak, USSR, which is morphologically very close to *E. lunata*, may be at least closely affined to it.

Occurrence. — The species is recorded from: Sweden, Denmark, Polish Lowlands and Carpathians, USSR (Russian Platform), Egypt and USA (New Jersey Coastal Plain); Paleocene.

Eponides megastomus (RZEHAK, 1838) emend. (GRZYBOWSKI, 1896)

(Pl. XVI, Figs 5-7)

1838. *Pulvinulina megastoma* RZEHAK; *nomen nudum.*
1896. *Pulvinulina megastoma* GRZYBOWSKI; J. GRZYBOWSKI, p. 43, Pl. 11, Fig. 9.
1937. *Eponides megastoma* (GRZYBOWSKI); M. F. GLAESSNER, p. 377, Pl. 3, Fig. 25.
1948. *Eponides megastomus* (GRZYBOWSKI); D. M. CHALILOV, Pl. 6, Fig. 1.
1953. *Eponides praemegastomus* MJATLIUK; E. V. MJATLIUK, p. 107, Pl. 14, Figs 2, 3.
1953. *Eponides megastomus* (RZEHAK) emend. (GRZYBOWSKI); E. V. MJATLIUK, p. 108, Pl. 14, Fig. 4.
1962. *Eponides megastoma* (GRZYBOWSKI); A. HILLEBRANDT, p. 105, Pl. 8, Figs 13, 14.
1969. *Gyroidina megastoma* (GRZYBOWSKI, 1896); E. HANZLIKOVA, p. 60, Pl. 16, Fig. 8.
1972. *Gyroidina megastoma* (GRZYBOWSKI); E. HANZLIKOVA, p. 126, Pl. 37, Fig. 1.

Material. — Twenty three specimens, mostly somewhat damaged.
Dimensions of two specimens (in mm):

	F. XIV/176	F. XIV/177
Longest diameter . . .	0.44	0.45
Shortest diameter . . .	0.38	0.39
Height	0.32	0.29

Description. — Test trochospiral, half-round in side view, with almost entire, rounded peripheral outline and angulated peripheral margin. Spiral side flattened or slightly elevated in the centre; umbilical side fairly convex, more or less rounded. Spiral side containing more than two hardly distinguishable whorls, the outer of which consists of 5-6 chambers. Sutures weakly marked, especially so on the spiral side where they flush with the test surface, while slightly incised and S-shaped on the umbilical side. Test surface smooth. Aperture — an arched slit at the base of the last formed chamber, situated on the umbilical side, extending to the closed umbilicus.

Variation small, primarily concerning general shape of tests. Spiral side flat to convex. Peripheral outline occasionally slightly lobulate and then peripheral margin becomes somewhat rounded.

Remarks. — The Polish specimens are higher than those from the Paleocene of Austria, attributed to this species by HILLEBRANDT (1962) and may represent only related species.

On the basis of small morphological differences in size and shape of tests and in number of chambers between Carpathian and Caucasian representatives of *Eponides megastoma*, MJATLIUK (1953) separated Lower Paleocene specimens of the Caucasus region in a new species, *E. praemegastomus*, with *E. megastoma* described and figured by GLAESSNER (1937), designed as the holotype. However, according to the present authors, those Caucasian forms fall within the limits of variability of *E. megastoma*. Similar point of view is held by HANZLIKOVA (1972), who also considers Mexican species *Gyroidina comma* WHITE (1928), as conspecific with *E. megastoma* (GRZYBOWSKI), whereas HILLEBRANDT (1962) includes to the synonymy of *E. megastoma* other WHITE's (1928) species — *G. beisseli*. *Gyroidina beisseli*, however, as figured by WHITE (1928), appears markedly lower and more evenly biconvex in comparison with the holotype of *Eponides megastoma*.

Specimens almost identical as those occurring in the Polish Carpathians were found by the present authors in comparative material from the Paleocene (Velasco Fm.) of Mexico, but whether or not they were described by WHITE (1928), it is an open question.

Occurrence. — The species is reported from Tethyan regions of: Mexico, France (Aquitanian Basin), Austrian Alps, Slovak and Polish Carpathians, USSR (Caucasus); Upper Cretaceous — Paleocene.

Eponides subcandidulus (GRZYBOWSKI, 1896)

(Pl. XVI, Figs 1, 2)

1896. *Pulvinulina subcandidula* GRZYBOWSKI; J. GRZYBOWSKI, p. 43, Pl. 11, Figs 10, 11.
?1953. *Eponides sparksi* (WHITE); E. V. MJATLIUK, p. 103, Pl. 13, Fig. 4.
1962. *Eponides subcandidulus* (GRZYBOWSKI); A. HILLEBRANDT, p. 106, Pl. 8, Fig. 12.

Material. — Five specimens, all of them somewhat damaged.
Dimensions of two specimens (in mm):

	F. XIV/179	F. XIV/180
Longest diameter . . .	0.65	0.61
Shortest diameter . . .	0.59	0.58
Height	0.41	0.38

Description. — Test trochospiral, lensiform in side view, with slightly lobulate peripheral outline and broadly acute peripheral margin. Test sides almost uniformly convex. Chambers coiled in 3-4 whorls, the outer of which — the only one seen on the umbilical side — contains 6 chambers. Sutures almost flush with the surface. Aperture as an arched slit situated at the base of the last chamber, on umbilical side extending up to the closed umbilicus.

Variation not significant, primarily concerning general shape of tests resulting of differences in convexity of test sides.

Remarks. — The specimens from the Babica clays differ from the figured holotype of this species described by GRZYBOWSKI (1896), also from the Paleocene of Polish Carpathians, in smaller number of chambers in the last whorl (6 chambers in comparison with 8-10 in the last whorl of the latter form). It should be noted that the specimens from the Paleocene of Austria described as *E. subcandidulus* by HILLEBRANDT (1962) have 7 chambers in the last whorl.

Specimens identical with those assigned here to *E. subcandidulus* were found in comparative material from the Paleocene (Velasco Fm.) of Mexico. Mexican forms may be conspecific with those described by WHITE (1928) as *Gyroidina sparksi*. MJATLIUK (1953) considered the three species described by WHITE (1928) from Velasco Fm. of Mexico, i.e. *G. sparksi*, *G. simplex* and *G. comma*, as conspecific and named them *E. sparksi*.

The species *E. sparksi* WHITE was reported both by MJATLIUK (1953) and SUBBOTINA (1947) from Cretaceous and Paleocene of Crimea, Caucasus and Russian Platform.

Eponides subcandidulus (GRZYBOWSKI) and *E. sparksi* (WHITE) seem to be conspecific. However, further studies on variation of these species, more detailed analysis of the holotype of Mexican species and larger comparative materials are required for univocal statement whether or not the above assumption is true.

Occurrence. — The species occurs in Tethyan regions of: Mexico, France (Aquitanian Basin), Yugoslavia, Polish Carpathians, Austrian Alps, USSR (Caucasus, Crimea and Russian Platform); Upper Cretaceous — Eocene.

Eponides umbonatus (REUSS, 1851)

(Pl. XVII, Figs 1, 2)

1851. *Rotalina umbonata* REUSS; A. E. REUSS, p. 75, Pl. 5, Fig. 35.
1929. *Eponides umbonatus* (REUSS); J. A. CUSHMAN, p. 665, Pl. 95, Fig. 11.
1954. *Eponides umbonatus* (REUSS); E. V. MJATLIUK, p. 113, Pl. 16, Fig. 3.
1961. *Eponides umbonatus* (REUSS); J. P. H. KAASSCHIETER, p. 211, Pl. 13, Fig. 1.
1970. *Eponides umbonatus* (REUSS); Y. KIESEL, p. 292, Pl. 17, Fig. 2.

Material. — Eight specimens, most of them damaged.
Dimensions of two specimens (in mm):

	F. XIV/272	F. XIV/273
Longest diameter . . .	0.30	0.32
Shortest diameter . . .	0·28	0.28
Height	0.17	0.19

Description. — Test trochoidal, lensiform in edge view. Spiral side formed of about two whorls, the outer of which contains 5-6 chambers. Peripheral outline weakly lobulate; peripheral margin acute, keeled. Umbilicus small, filled with glossy material. Sutures almost flush with the surface on both sides, radial, straight and somewhat enlarging towards the center on the umbilical side, curved on spiral side. Aperture elongated, slit-like, situated at the base of the last chamber, on umbilical side. Test surface smooth.

Variation insignificant, primarily concerning the size of tests and development of test margin. The margin more or less lobulate, with keel showing different degree of development. Number of chambers varying from 5 to $6\frac{1}{2}$.

Remarks. — The Polish specimens seem not to differ from the specimens so far included to this species. It should be noted, however, that the majority of specimens hitherto placed in this species do not have more than 5 chambers in the last whorl.

Occurrence. — The species is recorded from: Germany, Belgium, Holland, north-western and southern parts of USSR, Polish Carpathians and USA (South Carolina); Upper Paleocene — Oligocene; it is here for the first time recorded from the Paleocene beds.

Genus **NEOEPONIDES** Reiss, 1960

?**Neoeponides** cf. **acria** (Loeblich & Tappan, 1946)

(Pl. XV, Figs 7-10)

?1946. *Eponides acria* Loeblich & Tappan; A. R. Loeblich & H. Tappan, p. 255, Pl. 37, Fig. 13.

Material. — Twenty specimens, most of them damaged.
Dimensions of two specimens (in mm):

	F. XIV/181	F. XIV/182
Longest diameter . . .	0.30	0.34
Shortest diameter . . .	0.27	0.30
Height	0.12	0.13

Description. — Test very small, trochoid, plano-convex. Spiral side more or less convex, umbilical side flat to weakly concave. Peripheral outline almost entire; peripheral margin narrowly rounded, subacute. Chambers coiled into more than three whorls, 13 in number in the last whorl, the only one visible on umbilical side. Sutures straight, radiating from small, slightly depressed, opened umbilicus on the umbilical side, while thickened, more or less irregular and gently curved on spiral side. Aperture as a slit along the base of the last chamber on the umbilical side, generally badly visible. Wall smooth, finely porous on spiral side.

Variation primarily concerning the height of tests and development of ornamentation along sutures; test varying in height from low to highly trochoidal.

Remarks. — The specimens from the Paleocene of Polish Carpathians are similar to those described as *Eponides acria* by Loeblich and Tappan (1946) from the Lower Cre-

taceous (Washita group) of America. Quite flat Polish specimens also resemble *Planulina costata* HANTKEN (1875) known from the Eocene of Europe. The difference in morphology of these species primarily concerns development of their umbilical sides. Poor preservation of Polish specimens precludes their more exact generic and specific assignment.

Occurrence. — Polish Carpathians; Upper Paleocene.

Family CIBICIDIDAE CUSHMAN, 1927

Genus **CIBICIDES** DE MONTFORT, 1808

Cibicides asteroides POŻARYSKA & SZCZECHURA, 1968

(Pl. XXIII, Figs 1, 2)

1968. *Cibicides asteroides* POŻARYSKA & SZCZECHURA; K. POŻARYSKA & J. SZCZECHURA, p. 73, Pl. 11, Figs 3-7.

Material. — Some dozen of specimens, in most cases damaged.
Dimensions of two specimens (in mm):

	F. XIV/185	F. XIV/186
Longest diameter . . .	0.34	0.30
Shortest diameter . . .	0.32	0.25
Height	0.17	0.12

Description and variation as given by POŻARYSKA and SZCZECHURA (1968).

Remarks. — The specimens from the Polish Carpathians do not differ from those recorded from the Polish Lowlands. A similar species, differing from that in question in sutures from the spiral side, which are flush with the surface, was described as *Cibicides* sp. cf. *Cibicides mauricensis* HOWE & ROBERTS by KAASSCHIETER (1961) from the Eocene of Belgium.

Occurrence. — The species occurs in: Polish Lowlands and Carpathians, Belgium, Austrian Alps (Kroisbach), France (Aquitanian Basin); Paleocene — Lower Eocene.

Cibicides carinatus (TERQUEM, 1882)

(Pl. XVIII, Figs 6, 7)

1882. *Truncatulina carinata* TERQUEM; O. TERQUEM, p. 94, Pl. 10, Figs 1, 2 (see Cat. of Foram.).
1957. *Cibicides* cf. *Cibicides carinata* TERQUEM; A. WOOD & J. HAYNES, p. 50, Pl. 5, Fig. 15.
1968. *Cibicides carinatus* (TERQUEM); K. POŻARYSKA & J. SZCZECHURA, p. 75, Pl. 11, Fig. 1; Text-fig. 16.
1970. *Cibicides carinatus* (TERQUEM); Y. LE CALVEZ, p. 180, Figs 66-68.
1970. *Cibicides carinatus* MJATLIUK; E.V. MJATLIUK, p. 152, Pl. 63, Fig. 1.
?1970. *Cibicides bellus* MJATLIUK; E.V. MJATLIUK, p. 151, Pl. 63, Fig. 2.

Material. — Four specimens damaged, very badly preserved.
Dimensions of two specimens (in mm):

	F. XIV/187	F. XIV/188
Longest diameter . . .	0.39	0.40
Shortest diameter . . .	0.33	0.29
Height	0.14	0.10

Description and variation as given by POŻARYSKA and SZCZECHURA (1968).

Remarks. — The specimens from the Polish Carpathians do not differ from those pre-

viously described from the Polish Lowlands (POŻARYSKA & SZCZECHURA, 1968). The Polish specimens and representatives of the species *Cibicides carinatus* MJATLIUK and *C. bellus* MJATLIUK, described by MJATLIUK (1970) from the Paleocene of the Ukrainian Carpathians, seem to be conspecific.

Occurrence. — The species is reported from France (Paris Basin), England, Belgium, Holland, Polish Lowlands, Polish and Soviet Carpathians; Paleocene — Lower Eocene.

Cibicides cuvillieri ROUVILLOIS, 1960

(Pl. XX, Figs 4-6)

1960. *Cibicides cuvillieri* ROUVILLOIS; A. ROUVILLOIS, p. 74, Pl. 3, Fig. 51 (non Pl. 3, Fig. 52; non Pl. 4, Fig. 54).
1965. *Cibicides* cf. *cryptomphalus hercegovinensis* DE WITT PUYT; K. POŻARYSKA, p. 130, Pl. 26, Fig. 1.
1965. *Cibicides* sp. 2; B. MCGOWRAN, p. 55, Pl. 4, Fig. 2.
1968. *Cibicides cuvillieri* ROUVILLOIS; K. POŻARYSKA & J. SZCZECHURA, p. 76, Pl. 12, Figs 1-7.
1971. *Cibicides cuvillieri* ROUVILLOIS; J. SZCZECHURA & K. POŻARYSKA, p. 375, Pl. 12, Fig. 4.

Material. — Thirteen specimens, in some cases damaged.
Dimensions of two specimens (in mm):

	F. XIV/189	F. XIV/190
Longest diameter . . .	0.31	0.45
Shortest diameter . . .	0.23	0.36
Height	0.11	0.19

Description, variation and remarks — by POŻARYSKA and SZCZECHURA (1968).

Occurrence. — The species is recorded from: Holland, Belgium, France, Polish Lowlands and Carpathians, USSR (Crimea) and Australia, and seems to be characteristic for epicontinental facies; Paleocene.

Cibicides mariae (JONES, 1852)

(Pl. XXV, Figs 7-11)

1852. *Rosalina mariae* RUPERT JONES; R. T. JONES, p. 267, Pl. 16, Fig. 13 (see Cat. of Foram.).
1926. *Discorbis newmanae* PLUMMER; H. J. PLUMMER, p. 138, Pl. 9, Fig. 4.
1948. *Cibicides ekblomi* BROTZEN; F. BROTZEN, p. 82, Pl. 13, Fig. 2.
?1951. *Cibicides newmanae* (PLUMMER) CUSHMAN & TODD; J. A. CUSHMAN, p. 66, Pl. 19, Figs 12-14.
?1957. *Cibicides cushmani* NUTTALL; V. SACAL & A. DEBOURLE, p. 68, Pl. 31, Fig. 10.
?1962. *Cibicides ekblomi* BROTZEN; A. HILLEBRANDT, p. 114, Pl. 10, Fig. 8.
1965. *Anomalina ekblomi* (BROTZEN); K. POŻARYSKA, p. 127, Pl. 27, Fig. 6.
1965. *Cibicides (Cibicidina) mariae* (RUPERT JONES); B. MCGOWRAN, p. 51, Pl. 4, Fig. 1.
1968. *Anomalina ekblomi* (BROTZEN); K. POŻARYSKA & J. SZCZECHURA, p. 87, Pl. 13, Figs 1-4.
1968. *Anomalina (Anomalina) ekblomi* (BROTZEN); O. SAMUEL & J. SALAJ, p. 96, Text-fig. 16b.
1970. *Cibicides ekblomi* BROTZEN; H. J. HANSEN, p. 90, Pl. 9, Figs 7-9.
1970. *Cibicides ekblomi* BROTZEN; Y. KIESEL, p. 309, Pl. 18, Figs 18, 19.

Material. — Some dozens of specimens, rather well preserved.
Dimensions of two specimens (in mm):

	F. XIV/192	F. XIV/193
Longest diameter . . .	0.34	0.38
Shortest diameter . . .	0.27	0.31
Height	0.11	0.15

Description and variation as given by POŻARYSKA (1965).

Remarks. — The comparative materials from the Paleocene (Thanetian) of England, Paleocene (Midway Fm.) of Texas (USA) and from the Paleocene of Sweden made possible identification of the species *Rosalina* (recte *Cibicides*) *mariae* JONES (1852), *Discorbis* (recte *Cibicides*) *newmanae* PLUMMER (1926), and *Cibicides ekblomi* BROTZEN (1948) described from these strata, respectively. The representatives some of the above species are figured in Pl. XXV, Figs 9, 10. Taking into account great variation of the species compared, the present authors accept their conspecific status. The idea is not new, as previously MCGOWRAN (1965) suggested that these species may actually be synonymous.

Moreover, SACAL and DEBOURLE (1957) described the species *Cibicides cushmani* NUTTALL from the Lower Eocene of France (Aquitanian Basin). The juvenile representatives of the latter species resemble, on the one hand, those assigned here to *Cibicides mariae*, on the other hand, those from the Paleocene of the Carpathians assigned herein to *Anomalina mantaensis* GALLOWAY & MORREY (1929); thus, this French species described by SACAL and DEBOURLE (1957) as *C. cushmani* is allocated into the synonymy of *C. mariae* with reservation.

Cibicides ekblomi sensu HILLEBRANDT (1962) is placed in the synonymy of the species in question with reservation, because of differences in test outline and in development of central part of umbilical side.

Occurrence. — This cosmopolitan species is reported from: England, France (Paris Basin), Denmark, Sweden, Germany, Austria, Polish Lowlands, Slovak, Polish and Soviet Carpathians, Russian Platform, North America (Coastal Plains of USA), Greenland and Australia; Upper Cretaceous — Paleocene (?Lower Eocene).

Cibicides proprius (BROTZEN, 1948)

(Pl. XIX, Figs 3-5; Pl. XX, Figs 2, 3)

1948. *Cibicidoides proprius* BROTZEN; F. BROTZEN, p. 78, Pl. 12, Figs 3, 4.
1965. *Cibicides proprius* BROTZEN; K. POŻARYSKA, p. 134, Pl. 27, Figs 1, 5.
1968. *Cibicides proprius* (BROTZEN); K. POŻARYSKA & J. SZCZECHURA, p. 77, Pl. 16, Figs 1-4 *(here additional synonymy included)*.

Material. — Thirty one specimens, most of them badly preserved.
Dimensions of three specimens (in mm):

	F. XIV/197	F. XIV/198	F. XIV/199
Longest diameter . . .	0.64	0.55	0.66
Shortest diameter . . .	0.52	0.47	0.56
Height	0.34	0.28	0.36

Description, variation and remarks were given in the papers by POŻARYSKA (1965) and POŻARYSKA & SZCZECHURA (1968). However, it should be added that the specimens from Babica clays, tentatively regarded as the juvenile representatives of *C. proprius* (see Pl. XX Figs 2, 3) may, in fact, represent a separate species. In comparison with the true *C. proprius* they are generally more convex on spiral side than on the umbilical one, having at the same time small or no plug on the umbilical side and being more finely porous dorsally.

Almost identical forms were found in comparative materials from the Paleocene of Denmark and England, as well as in upper part of the Paleocene section of the Pamiętowo boring from northern Poland.

Occurrence. — The species seems to be typical for epicontinental facies of Boreal province; it occurs in: Sweden, Denmark, Holland, France (Paris Basin), England, Polish Lowlands and Carpathians, Austrian Alps (Kroisbach), USSR (Russian Platform); ?Upper Cretaceous — Paleocene.

Cibicides sahlstroemi BROTZEN, 1948

(Pl. VIII, Fig. 5)

1948. *Cibicides sahlstroemi* BROTZEN; F. BROTZEN, p. 85, Pl. 17, Fig. 1.
1961. *Gavelinella sahlstroemi* (BROTZEN); J. HOFKER, p. 66, Fig. 5.
1965. *Cibicides sahlstroemi* BROTZEN; K. POŻARYSKA, p. 134, Pl. 27, Fig. 2.
1968. *Cibicides sahlstroemi* BROTZEN; K. POŻARYSKA & J. SZCZECHURA, p. 78, Text-fig. 17.

Material. — Six specimens well preserved.
Dimensions of one specimen (in mm):

	F. XIV/202
Longest diameter . . .	0.25
Shortest diameter . . .	0.20
Height	0.07

Remarks. — The specimens from the Paleocene of the Polish Carpathians are very small but undoubtedly conspecific with those known from the Polish Lowlands and Sweden.

Occurrence. — The species is known from: Sweden, Denmark, Belgium, Holland, England, Polish Lowlands and Carpathians; Upper Cretaceous — Paleocene.

Cibicides succedens BROTZEN, 1948

(Pl. XIX, Figs 1, 2)

1948. *Cibicides succedens* BROTZEN; F. BROTZEN, p. 80, Pl. 12, Figs 1, 2; Text-fig. 21.
1965. *Cibicides succedens* BROTZEN; K. POŻARYSKA, p. 136, Pl. 28, Figs 1, 5.
1968. *Cibicides succedens* BROTZEN; K. POŻARYSKA & J. SZCZECHURA, p. 79, Text-fig. 18.
1970. *Cibicides succedens* BROTZEN; H. J. HANSEN, p. 91, Pl. 23, Figs 4-6.

Material. — Forty two specimens, most of them damaged.
Dimensions of two specimens (in mm):

	F. XIV/203	F. XIV/204
Longest diameter . . .	0.47	0.59
Shortest diameter . . .	0.44	0.52
Height	0.25	0.32

Description as given by POŻARYSKA (1965).

Variation significant, concerning size of tests and development of central plug. The specimens are more or less conical in edge view, as shown in figures given by POŻARYSKA and SZCZECHURA (1968).

Remarks and comparisons were given by BROTZEN (1948) and POŻARYSKA & SZCZECHURA (1968).

Occurrence. — The species is reported from Europe (Sweden, Denmark, Holland, Polish Lowlands and Carpathians, Russian Platform), North America (New Jersey Coastal Plain) and Greenland, and seems to be characteristic for epicontinental facies of the Boreal province; ?Upper Cretaceous — Paleocene.

Cibicides cf. **tezhevaensis** MOROZOVA & KURILEVA, 1967

(Pl. XIX, Figs 6, 7)

1962. *Cibicides dayi* (WHITE); A. HILLEBRANDT, p. 113, Pl. 10, Figs 1, 2.

Material. — Five specimens, all of them damaged.
Dimensions of two specimens (in mm):

	F. XIV/205	F. XIV/206
Longest diameter . . .	0.64	0.69
Shortest diameter . . .	0.52	0.58
Height	0.25	0.29

Description. — Test trochospiral, biconvex, more convex on umbilical side. Peripheral margin acute; peripheral outline somewhat lobulate. The outer whorl, the only well-distinguishable, containing 13-15 chambers. Spiral side with well-developed central plug ornamented with spire-like elevation. Umbilical side with elevated, transparent umbo. Sutures fairly curved, raised, particularly on spiral side where they are enlarging towards the central plug; sutures separating the last chambers occasionally somewhat concave. Central plug from spiral side partly bordered by distinct deep furrow. Aperture slit-like, interiomarginal, extending on spiral side where it runs under weakly developed flaps of the last chambers. Test wall distinctly pitted on both sides, except for sutures and umbo areas of the umbilical side.

Variation not significant, concerning size of tests, development of sutures, and ornamentation of central plug; sutures more or less distinct and generally elevated, becoming sometimes slightly concave.

Remarks. — The specimens from the Paleocene of Polish Carpathians are very similar to those described by MOROZOVA and KURILEVA (in MOROZOVA *et al.*, 1967) from the Danian of south-eastern part of USSR, as *Cibicides tezhevaensis* differing in stronger compression of whorls, more lobulate general outline, and in more acute peripheral outline. Moreover, the Polish forms have more numerous chambers in the last whorl and seem to have thicker sutures than the typical representatives of *C. tezhevaensis*. Forms identical with those found in Polish Carpathians occur in samples from the Paleocene of France (Aquitanian Basin), Slovak Carpathians (Frydek Fm.) and Austrian Alps (Reichenhall). The latter forms were assigned by HILLEBRANDT (1962) to *Cibicides dayi* (WHITE). However, it appears very difficult to compare these European forms with those described as *Planulina dayi* by WHITE (1928) from the Paleocene of Mexico (Velasco Fm.), as they are inadequately illustrated and described. No specimens resembling those known from Europe and assigned here to *Cibicides* cf. *tezhevaensis* were found in comparative material from the Paleocene (Velasco Fm.) of Mexico, wherefrom *C. dayi* WHITE (1928) was described; it may be assumed that the forms similar to *Anomalina acuta* PLUMMER (1926), represented in that comparative material, may have been those described by WHITE (1928) as *Planulina dayi*. Comparative material more abundant than that at the disposal of the present authors and reexamination of WHITE's original collection are necessary for the solution of this problem.

Occurrence. — The species occurs in: Polish and Slovak Carpathians, France (Aquitanian Basin), Italy (Vieste), Austrian Alps; similar form, i.e. *C. tezhevaensis*, is described from south-western part of USSR (Turkmenia); Paleocene.

?**Cibicides commatus** MOROZOVA, 1954

(Pl. XXI, Figs 4, 5)

1954. *Cibicides (Cibicidoides) commatus* MOROZOVA n. sp.; V. P. VASSILENKO, p. 158, Pl. 26, Fig. 2.
1965. *Cibicides commatus* MOROZOVA; K. POŻARYSKA, p. 130, Pl. 27, Fig. 3.

Material. — Twenty one specimens badly preserved.
Dimensions of two specimens (in mm):

	F. XIV/207	F. XIV/208
Longest diameter . . .	0.49	0.47
Shortest diameter . . .	0.39	0.39
Height	0.24	0.24

Description as given by POŻARYSKA (1965).

Variation insignificant, primarily concerning the convexity and size of plug on spiral side; tena, bordering the plug, are also differently developed, being more or less distinct.

Remarks. — It should be added to the remarks given by POŻARYSKA (1965) that ?*Cibicides commatus* MOROZOVA (1954) is very similar to *Anomalinoides* cf. *hyphalus* FISHER (1969), occurring also in the Paleocene of Polish Carpathians, differing however in more strongly pronounced biconvexity of test, finer pores in test, and in less numerous chambers (about 10 chambers in comparison to about 14 in the latter species). The species in question is allocated in the genus *Cibicides* tentatively, because of the general shape of the test, i.e. biconvex instead plano-convex, and development of its spiral side which is indistinctly evolute.

Occurrence. — The species is reported from: USSR (Russian Platform) and Polish Lowlands; found also in samples from Polish Carpathians, Austrian Alps (Kroisbach) and Italy (Vieste); similar forms occurs in samples from England (London clay) and Denmark (Roesnes clay); Upper Cretaceous — Paleocene (?Lower Eocene).

Family CAUCASINIDAE BYKOVA, 1959

Genus **CAUCASINA** CHALILOV, 1951

Caucasina cf. **schischkinskayae** (SAMOILOVA) **oligocaenica** CHALILOV, 1967

(Pl. XXXVII, Figs 6-9)

Material. — Twenty three specimens badly preserved.
Dimensions of three specimens (in mm):

	F. XIV/209	F. XIV/210	F. XIV/211
Height	0.08	0.15	0.10
Maximal width . . .	0.08	0.10	0.08

Description. — Test very small, elongated; earliest whorl low and discorbine, containing 5-6 chambers; subsequent coils spirally arranged, with number of chambers reduced to 3 in the last whorl. Early chambers inconspicuously inflated; subsequent chambers flattened and more rapidly increasing in size. Sutures weakly incised, almost flush with the surface. Aperture in the form of an elongated loop, commonly with narrow lip, situated at the inner margin of the last chamber. Surface smooth.

Variation rather wide, concerning the size and general shape of the test and most probably related to ontogenetic stage of particular specimens allocated in the species *Caucasina* cf. *schischkinskayae oligocaenica* CHALILOV, 1967. Some differences in length of the specimens appear to be related to the number of spirally arranged coils, varying from 2 to 5. There are also some differences in the arrangement of chambers, as well as in the shape and degree of inflation of chambers.

Remarks. — Of all the species hitherto allocated in the genus *Caucasina*, the species occurring in the Paleocene of the Polish Carpathians appears to be most similar to *Caucasina schischkinskayae oligocaenica* described by CHALILOV (1967) from the Oligocene of Caucasus. The Polish specimens differ from those of CHALILOV (1967) in more stocky overall shape and more numerous chambers.

Some Polish forms allocated in that species also appears to be similar to the specimens from the Oligocene of England, allocated in the species *Bulimina* (recte *Caucasina*) *coprolithoides* (Andreae) by BHATIA (1955). These species seem to be at least closely related.

Occurrence. — Polish Carpathians; Upper Paleocene.

Family LOXOSTOMIDAE LOEBLICH & TAPPAN, 1962

Genus **ARAGONIA** FINLEY, 1939

Aragonia aragonensis (NUTTALL, 1930)

(Pl. IV, Figs 6-8)

1930. *Textularia aragonensis* NUTTALL; W.L.F. NUTTALL, p. 280, Pl. 23, Fig. 6.
1956. *Aragonia aragonensis* (NUTTALL); C.A. WICHER, Pl. 13, Fig. 19.
?1960. *Bolivinoides compressa* OLSSON; R.K. OLSSON, p. 30, Pl. 4, Figs 20, 21.
1962. *Aragonia aragonensis* (NUTTALL); A. HILLEBRANDT, p. 73, Pl. 5, Fig. 17.

Material. — Four specimens badly preserved.

Dimensions of three specimens (in mm):

	F. XIV/213	F. XIV/214	F. XIV/215
Height	0.26	0.22	0.23
Maximal width . . .	0.18	0.15	0.17
Thickness	0.07	0.06	0.07

Description. — Test biserial, rhomboidal in general outline, compressed; sutures elevated, generally somewhat serrate, oblique; axial part of the test covered by irregular network-like ornamentation. Aperture badly preserved.

Variation small, primarily concerning the general outline and the intensity of ornamentation.

Remarks. — Specimens assigned to *Aragonia aragonensis* (NUTTALL, 1930) from the Paleocene of Polish Carpathians are similar to those found in the comparative material from the Lower Eocene of Mexico (Aragon Fm.), wherefrom the holotype of that species is described; they are however larger, with more serrate outline. Forms, almost identical as those occurring in Poland, were found by the authors in the comparative material from the Paleocene of Mexico (Velasco Fm.), from the Lower Eocene of Denmark (Roesnes clay) and from the Lower Eocene of France (Aquitanian Basin). OLSSON'S (1960) *Bolivinoides compressa* from the Paleocene of USA seems to be less ornamented in the axial part of the test and this is why it is tentatively included into the synonymy of *Aragonia aragonensis*.

Occurrence. — The species is reported from: Trinidad, Mexico, USA (New Jersey Coastal Plain), France (Aquitanian Basin), Austrian Alps, Polish Carpathians, Israel. It is also found in comparative material from Denmark (Roesnes clay) and Italy (Vieste); Paleocene — Lower Eocene.

Aragonia velascoensis (CUSHMAN, 1925)

(Pl. II, Fig. 2)

1925. *Textularia velascoensis* CUSHMAN; J. A. CUSHMAN, p. 18, Pl. 3, Fig. 1 (see Cat. of Foram.).
1927. *Bolivinoides velascoensis* (CUSHMAN); J. A. CUSHMAN, p. 159, Pl. 28, Fig. 10.
1928. *Gümbelina velascoensis* (CUSHMAN); M. P. WHITE, p. 39, Pl. 4, Fig. 14.
?1937. *Textularia excolata* CUSHMAN; M. F. GLAESSNER, p. 362, Pl. 11, Fig. 12.
1955. *Bolivinoides ouezzanensis* REY; M. REY, p. 210, Pl. 12, Fig. 2.
1956. *Aragonia ouezzanensis* REY; C. A. WICHER, p. 110, Pl. 13, Fig. 15.
non 1956. *Aragonia velascoensis* (CUSHMAN); C. A. WICHER, Pl. 13, Figs 9-14.
1957. *Bolivinoides velascoensis* CUSHMAN; V. SACAL & A. DEBOURLE, p. 14, Pl. 3, Fig. 17.
1959. *Aragonia ouezzanensis* (REY); J. LISZKOWA, p. 97, Pl. 3, Figs 7, 8.
1962. *Aragonia ouezzanensis* (REY); A. HILLEBRANDT, p. 73, Pl. 5, Fig. 15.
non 1962. *Aragonia velascoensis* (CUSHMAN); A. HILLEBRANDT, p. 74, Pl. 5, Fig. 16.
1969. *Aragonia ouezzanensis* (REY); E. HANZLIKOVA, p. 57, Pl. 15, Fig. 10.
1970. *Aragonia ouezzanensis* (REY); T. NEAGU, p. 73, Pl. 39, Figs 7, 8.

Material. — One specimen badly preserved.
Dimensions of one specimen (in mm):

	F. XIV/216
Height	0.36
Maximal width . . .	0.32
Thickness	0.22

Description. — Test rhomboidal in general outline, biserial, fusiform in cross-section, more rapidly enlarging in width than in thickness. Marginal keel rather narrow. Sutures distinctly raised, slightly oblique, and somewhat meandric. Chambers low, 5 to 6 in one row. Ornamentation well pronounced, mainly related to meandric sutures. Aperture formed by small opening situated at the base of the last formed chambers. Apertural face wide, smooth.

Remarks. — The specimens from the Paleocene of the Polish Carpathians inconspicuously differ from the holotype of that species described and figured by CUSHMAN (1925) from Upper Cretaceous shales of the Velasco Fm. (Mexico) and are almost identical with specimens found by the present authors in samples from the Paleocene of Mexico. The specimens assigned to that species by WICHER (1956) and by HILLEBRANDT (1962) from the Paleocene of Austria, belong rather to *A. trinitatensis* (CUSHMAN & JARVIS, 1932) than to the species in question, as they differ from the original material in being more elongated and more intensively reticulated; at the same time, the specimens assigned by the latter authors to *A. ouezzanensis* (REY, 1955) appear to be very similar to those representing *A. velascoensis*. According to the present authors, the species *Aragonia ouezzanensis* (REY) is conspecific with *A. velascoensis* (CUSHMAN).

Occurrence. — The species seems to be typical of Tethyan regions: Mexico, Trinidad, Spain, France (Aquitanian Basin), Austrian Alps, Polish, Slovak and Rumanian Carpathians, Caucasus (USSR) and Morocco. *Aragonia* sp. is reported from New Zealand; Upper Cretaceous — Lower Eocene.

Family CHILOSTOMELLIDAE Brady, 1881

Genus **GLOBIMORPHINA** Voloshina, 1969

Globimorphina trochoides (Reuss, 1845)

(Pl. VI, Fig. 1)

1845. *Globigerina trochoides* Reuss; A. E. Reuss, p. 36, Pl. 12, Fig. 12 (*fide* Cat. of Foram.).
1929. *Turrilina trochoides* (Reuss); M. P. White, p. 46, Pl. 4, Fig. 4.
?1949. *Allomorphina conica* Cushman & Todd; J. A. Cushman & R. Todd, p. 62, Pl. 11, Fig. 8 (*fide* Cat. of Foram.).
1954. *Eggerella trochoides* (Reuss); L. Frizzell, p. 74, Pl. 6, Fig. 15.
1962. *Allomorphina conica* Cushman & Todd; A. Hillebrandt, p. 90, Pl. 6, Fig. 21.
1963. *Allomorphina conica* Cushman & Todd; P. J. Bermudez, p. 13, Pl. 3, Figs 31-33.
1969. *Globimorphina trochoides* (Reuss); A. M. Voloshina, p. 4, Pl. 1, Figs 1-3 *(here earlier synonymy included)*.

Material. — Two specimens, one of them markedly damaged.
Dimensions of one specimens (in mm):

	F. XIV/217
Height	0.24
Maximal width . . .	0.22

Description. — Test trochospiral, rapidly enlarging towards the aperture end, consisting of about 4 coils; every coil containing 3 chambers. Chambers, and particularly the last chambers, spherical, markedly overlapping each other. Aperture slit-like, situated at the base of the last chamber. Test wall thin, smooth.

Remarks. — *Globigerina* (recte *Globimorphina*) *trochoides* was described by Reuss (1845) from the Maastrichtian of Czechoslovakia and from Lvov area. The comparative material gathered by Voloshina (1969) did not differ from the original material described by Reuss (1845), so it was used as a basis for the revision of the species *Globigerina* (recte *Globimorphina*) *trochoides*, and for erection of the new genus — *Globimorphina*. Voloshina (1969) placed in the synonymy of this species American and West-European forms previously described as *Valvulina trochoides* in Franke (1928), *Allomorphina trochoides* in Marie (1941) or *Eggerella*? *trochoides in* Cushman (1946). Earlier, in 1949, Cushman and Todd erected the species *Allomorphina conica* for some forms from the Upper Cretaceous of America, previously described as *Bulimina*(?) *trochoides*, *Allomorphina trochoides* and *Eggerella*? *trochoides*. Cushman and Todd (1949) suggested that in the Cretaceous of America there are two isomorphic species differing in test structure, only one of which is conspecific with the species described by Reuss (1845).

Taking into account results of the studies of Voloshina (1969), and particularly her interpretation of variation of tests of *Globimorphina trochoides*, the present authors consider European and, partly, American forms as conspecific with the Reuss' species (vide synonymy). American forms described as *Allomorphina conica* (Cushman & Todd) are placed in the synonymy with reservation, as the problem of the differences in test structure remains open. The Polish specimens easily fall within the limits of variability of *Globimorphina trochoides* (Reuss), as interpreted by Voloshina (1969).

According to the present authors, additional studies are required for explaining the taxonomic relationship between *Globimorphina trochoides* (Reuss) and a very similar form from the Upper Cretaceous of Sweden, described by Brotzen (1948) as *Valvulina bullata*. It should be noted that Hanzlikova (1972) identified the latter form with *Valvulina trochoides* (Reuss).

Occurrence. — The species seems to be very characteristic of Tethyan regions; it is known from: Mexico, Trinidad, Guatemala, Spain, Austrian Alps, Polish, Slovak and Soviet Carpathians, Crimea and Russian Platform, Morocco, Israel, Western Pakistan and New Zealand; Upper Cretaceous — Lower Eocene.

Family NONIONIDAE SCHULTZE, 1854

Genus **NONION** DE MONTFORT, 1808

Nonion graniferum (TERQUEM, 1882)

(Pl. XXV, Fig. 6)

1882. *Nonionina granifera* TERQUEM; O. TERQUEM, p. 42, Figs 8, 9.
1965. *Nonion graniferum* TERQUEM; K. POŻARYSKA, p. 93, Pl. 21, Fig. 5.
1968. *Nonion graniferum* (TERQUEM); K. POŻARYSKA & J. SZCZECHURA, p. 81, Pl. 9, Figs 10-12; Text-fig. 19.
1970. *Nonion graniferum* (TERQUEM); H. J. HANSEN, p. 97, Pl. 11, Figs 1, 2; Pl. 26, Figs 1, 2; Text-fig. 34.
1970. *Nonion graniferum* (TERQUEM); Y. LE CALVEZ, p. 192, Pl. 26, Fig. 5.
1970. *Nonion graniferum* (TERQUEM); Y. KIESEL, p. 281, Pl. 15, Fig. 2.

Material. — Six specimens well preserved.
Dimensions of two specimens (in mm):

	F. XIV/218	F. XIV/219
Longest diameter . . .	0.21	0.27
Shortest diameter . . .	0.17	0.22
Height	0.09	0.12

Description and variation as given by POŻARYSKA and SZCZECHURA (1968).

Remarks. — The Carpathian specimens fall within the limits of variability of representatives of this species recorded from the Paleocene of the Polish Lowlands (see POŻARYSKA & SZCZECHURA, 1968, Text-fig. 19). They are generally smaller than those described under that name from the Polish Lowlands and from elsewhere (see synonymy).

Occurrence. — The species is reported from: Europe (Denmark, Holland, Sweden, Germany, Belgium, France (Paris Basin), Polish Lowlands and Carpathians), Greenland, North America and Asiatic part of USSR; Paleocene — Oligocene.

Genus **PULLENIA** PARKER & JONES, 1862

Pullenia coryelli WHITE, 1929

(Pl. IX, Fig. 1; Pl. XXXVII, Figs 1-3)

1929. *Pullenia coryelli* WHITE; M. P. WHITE, p. 56, Pl. 5, Fig. 22.
1947. *Pullenia coryelli* WHITE; N. N. SUBBOTINA, p. 106, Pl. 4, Figs 6, 7.
1948. *Pullenia coryelli* WHITE; D. M. CHALILOV, p. 30, Pl. 6, Fig. 2.
1953. *Pullenia coryelli* WHITE; N. K. BYKOVA, p. 82, Pl. 3, Fig. 4.
1962. *Pullenia coryelli* WHITE; A. HILLEBRANDT, p. 94, Pl. 6, Fig. 34 *(here additional synonymy included)*.
1972. *Pullenia coryelli* WHITE; E. HANZLIKOVA, p. 125, Pl. 36, Fig. 4.

Material. — Eleven specimens, some of them damaged.
Dimensions of three specimens (in mm):

	F. XIV/220	F. XIV/221	F. XIV/222
Longest diameter . . .	0.29	0.34	0.27
Shortest diameter . . .	0.27	0.29	0.25
Height	0.29	0.33	0.27

Description. — Test nearly spheroidal, almost as broad as high, circular and entire in peripheral outline. Chambers not inflated, low, 5-6 in number in the last whorl. Sutures poorly visible, straight, flush with the surface. Umbilicus not developed. Aperture slit-like, situated at the base of the last chamber. Surface smooth.

Variation insignificant, primarily concerning the general shape of test.

Remarks. — The specimens from the Paleocene of the Polish Carpathians are very similar to the figured holotype of *Pullenia coryelli* WHITE (1929), the species described from the Paleocene (Velasco Fm.) of Mexico; undoubtedly conspecific forms occur in sample from the Paleocene (Velasco Fm.) of Mexico.

Occurrence. — The species seems to be typical for Tethyan regions mostly; it occurs in: Mexico, France (Aquitanian Basin), Yugoslavia, Italy (Vieste), Slovak and Polish Carpathians, Crimea, Caucasus and Kamchatka in USSR, and New Zealand; Upper Cretaceous — Lower Eocene.

Pullenia quinqueloba (REUSS, 1851)

(Pl. IX, Fig. 5)

1851. *Nonionina quinqueloba* (REUSS); A. REUSS, p. 47, Pl. 5, Fig. 31.
1926. *Pullenia quinqueloba* (REUSS); H. J. PLUMMER, p. 136, Pl. 8, Fig. 12.
1958. *Pullenia quinqueloba* (REUSS); D. A. J. BATJES, p. 139, Pl. 6, Fig. 8.
1961. *Pullenia quinqueloba* (REUSS); J. P. H. KAASSCHIETER, p. 202, Pl. 11, Figs 1, 2.
1969. *Pullenia quinqueloba* (REUSS); E. J. KRAEVA & B. F. ZERNETZKIJ, p. 101, Pl. 42, Fig. 3.

Material. — Two specimens well preserved.
Dimensions of one specimen (in mm):

	F. XIV/223
Longest diameter . . .	0.33
Shortest diameter . . .	0.29
Height	0.22

Description. — Test planispiral, slightly laterally compressed, with well rounded peripheral margin and weakly lobulate peripheral outline, subovate in edge view. Chambers moderately inflated, slowly increasing in size, 5 in number in the last whorl. Sutures almost radial, inconspicuously depressed. Test surface smooth. Umbilicus weakly deepened. Aperture low, slit-like, typical of this genus; apertural face moderately high.

Remarks. — The Polish specimens differ from those figured by REUSS (1851; see Cat. of Foram.) from the Eocene of Germany as *Nonionina* (recte *Pullenia*) *quinqueloba* in being less laterally compressed, in more compressed margin of the last chambers, and in more inflated chambers, but they are similar to the majority of specimens assigned to this species by various authors. It cannot be, however, excluded that the Polish forms represent a variety of the species of REUSS (1851). Very similar is a subspecies *Pullenia quinqueloba aplata* Bandy (1949), from Alabama USA).

Occurrence. — The species is recorded from all continents; Cretaceous — Oligocene (?Recent).

Family ALABAMINIDAE HOFKER, 1951

Genus **ALABAMINA** TOULMIN, 1941

Alabamina cf. **wilcoxensis** TOULMIN, 1941

(Pl. IX, Figs 2-4)

Material. — Fifty two specimens, almost all of them more or less damaged. Dimensions of three specimens (in mm):

	F. XIV/224	F. XIV/225	F. XIV/226
Longest diameter . . .	0.38	0.37	0.45
Shortest diameter . . .	0.32	0.33	0.40
Height	0.28	0.28	0.29

Description. — Test trochospiral, plano-convex, somewhat conically elevated on umbilical side, flattened on spiral side, entire in peripheral outline. Peripheral margin angulate. Chambers coiled in at least two whorls, the inner of which is poorly visible, about 6 in number in the last whorl, moderately increasing in size as added. Sutures oblique and almost flush with the surface on spiral side, radial and somewhat incised on umbilical side. Umbilical depression meager. Aperture slit-like, interiomarginal, extending from umbilicus almost to the periphery. Test surface smooth.

Variation concerning the size and number of chambers, ranging from 4 to $6\frac{1}{2}$, and general shape of test. Spiral side flattened, but sometimes slightly convex or concave. Umbilical side high, conical or compressed and rounded.

Remarks. — Poor preservation and large variation of the specimens assigned here to *Alabamina* cf. *wilcoxensis* does not allow for unequivocal establishment of their actual taxonomic position. Similar specimens from the Paleocene of Polish Lowlands were formerly attributed by POŻARYSKA and SZCZECHURA (1968) to *A. midwayensis* BROTZEN. In the population discussed herein, 5-6 — chambered specimens predominate. These specimens appear to be most similar to the figured representatives of *Alabamina wilcoxensis*, the species described by TOULMIN (1941) from the Paleocene of North America. This species was subsequently described by some authors (HILLEBRANDT, 1962; HOFKER, 1966; KIESEL, 1970) from the Paleocene of Europe, by BERMUDEZ (1963) from the Paleocene of Guatemala and by HAQUE (1956) from the Paleocene of Pakistan. The authors listed above also found this species to be highly variable.

According to MCGOWRAN (1965), *Alabamina wilcoxensis* is a junior synonym of *A. westraliensis* (PARR, 1938), the species known from the Paleocene of Australia and India.

Occurrence. — The species occurs in Polish Carpathians; Upper Paleocene. At least related species, i.e. *Alabamina wilcoxensis* TOULMIN (1941) is recorded from all continents, from the Paleocene deposits.

Genus **PARALABAMINA** HANSEN, 1970

Paralabamina toulmini (BROTZEN, 1948)

(Pl. XVIII, Figs 2-4)

1946. *Eponides gratus* (REUSS); R. C. VAN BELLEN, p. 57, Pl. 7, Figs 4-9 (non *Rotalia grata* REUSS, 1865).
1948. *Eponides toulmini* BROTZEN; F. BROTZEN, p. 178, Pl. 10, Fig. 16.
?1959. *Eponides* sp.; J. MORGIEL, p. 137, Pl. 14, Fig. 8.

1968. *Eponides toulmini* BROTZEN; K. POŻARYSKA & J. SZCZECHURA, p. 72, Pl. 15, Figs 1-4 *(here additional synonymy included)*.
1968. *Eponides toulmini* BROTZEN; O. SAMUEL & J. SALAJ, p. 27, Text-fig. 2c.
1970. *Eponides toulmini* BROTZEN; Y. KIESEL, p. 292, Pl. 16, Fig. 13.
1970. *Paralabamina lunata* (BROTZEN); H. J. HANSEN, p. 102, Pl. 14, Figs 5-7; Pl. 27, Figs 1, 2.
1971. *Eponides toulmini* BROTZEN; J. SZCZECHURA & K. POŻARYSKA, p. 374, Pl. 10, Fig. 4.

Material. — Some dozen of specimens, in most cases well preserved. Dimensions of three specimens (in mm):

	F. XIV/227	F. XIV/228	F. XIV/229
Longest diameter . . .	0.54	0.58	0.53
Shortest diameter . . .	0.44	0.49	0.44
Height	0.29	0.32	0.33

Description and variation as given by POŻARYSKA and SZCZECHURA (1968), SZCZECHURA and POŻARYSKA (1971).

Remarks. — Independently on still actual remarks regarding interpretation of *Paralabamina toulmini* (BROTZEN) (POŻARYSKA & SZCZECHURA, 1968; SZCZECHURA & POŻARYSKA, 1971), it may be added that the species *Eponides* sp. described by MORGIEL (1959) falls within the limits of variability of the species in question. Also *Eponides lotus* (SCHWAGER) reported by GLAESSNER (1937) from the early Paleocene of Caucasus, appears very close to this species.

The specimen described as *Paralabamina lunata* (BROTZEN) by HANSEN (1970) from the Paleocene of Greenland falls within the limits of variability of the species *Paralabamina toulmini* (BROTZEN), as interpreted by the present authors. It differs from true *Eponides lunata* in smaller number of coils on spiral side, as well as in being not so regularly biconvex, less keeled and too coarsely perforated. The above conclusion is based on studies on the topotypes of *E. lunata* and *P. toulmini*, both species described by BROTZEN (1948) from the Paleocene of Sweden and also present in the Paleocene of the Polish Lowlands. *Eponides lunata* (recte *Paralabamina toulmini*) was assigned by HANSEN (1970) to his new genus *Paralabamina* on the basis of wall structure.

Occurrence. — The species is reported from: Sweden, Denmark, Holland, Germany, Belgium, France (Paris Basin and Pyrenees), Polish Lowland and Carpathians, Slovak Carpathians, USSR (Crimea, Caucasus and Russian Platform) and Greenland; Upper Cretaceous — Lower Eocene.

Genus **GYROIDINA** D'ORBIGNY, 1826

Gyroidina babicensis n. sp.

(Pl. XVII, Figs 3, 4; Pl. XXXVI, Fig. 4)

Holotypus: Specimen presented on Pl. XVII, Fig. 4 (F. XIV/231).
Paratypus: Specimen presented on Pl. XVII, Fig. 3 (F. XIV/230).
Stratum typicum: Paleocene (Thanetian).
Locus typicus: Outcrop near Babica (Carpathians), SE Poland.
Derivatio nominis: babicensis — after Babica loc.

Diagnosis. — Test half-rounded in edge view. Peripheral outline lobulate; peripheral margin acute, keeled. Spiral side contains somewhat more than two whorls, the outer of which conissts of 6 chambers. Umbilicus small, open.

Material. — Thirteen specimens, most of them to a different degree damaged. Dimensions of three specimens (in mm):

	F. XIV/230	F. XIV/231	F. XIV/232
Longest diameter . . .	0.34	0.36	0.22
Shortest diameter . . .	0.30	0.32	0.20
Height	0.26	0.24	0.17

Description. — Test trochospiral. Umbilical side high, broadly rounded. Spiral side flattened, slightly elevated in the centre. Peripheral outline lobulate; peripheral margin acute weakly keeled. Test formed of more than two whorls, the outer of which and the only one seen on umbilical side, consists of 6 chambers. Umbilicus weakly opened, small. Sutures slightly limbate, incised on umbilical side, slightly elevated on spiral side. Aperture as an arched slit situated at the base of the last chamber, extending from umbilicus to some distance from periphery; apertural lip rarely observed. Valve surface smooth, very finely porous.

Variation is significant, primarily concerning size of tests and inflation of chambers on spiral side, and particularly the inflation of chambers of inner whorls.

Remarks. — *Gyroidina babicensis* n. sp. somewhat resembles the specimens assigned to *Eponides megastoma* (GRZYBOWSKI) differing in its umbilical side being more broadly rounded in lateral outline, in more lobulate and more acute peripheral margin, and in open umbilicus; these species also differ in the arrangement of chambers.

Occurrence. — Polish and Slovak Carpathians; Paleocene.

Family OSANGULARIIDAE LOEBLICH & TAPPAN, 1964

Genus **OSANGULARIA** BROTZEN, 1940

Osangularia cordieriana navarroana (CUSHMAN, 1938)

(Pl. XXI, Fig. 1)

1938. *Pulvinulinella navarroana* CUSHMAN; J. A. CUSHMAN, p. 66, Pl. 11, Fig. 5.
1940. *Osangularia lens* BROTZEN; F. BROTZEN, p. 30, Pl. 27, Fig. 1.
1962. *Osangularia cordieriana navarroana* (CUSHMAN); E. HERMANNI, p. 280, Pl. 19, Figs 2-4.
1968. *Osangularia cordieriana navarroana* (CUSHMAN); K. POŻARYSKA & J. SZCZECHURA, p. 85.
non 1970. *Osangularia navarroana* (CUSHMAN); T. NEAGU, p. 77, Pl. 33, Figs 20-22.

Material. — About fifty specimens, most of them damaged. Dimensions of one specimen (in mm):

	F. XIV/233
Longest diameter . . .	0.29
Shortest diameter . . .	0.27
Height	0.15

Description as given by POŻARYSKA (1965).

Variation considerable concerning size and general shape of test, primarily concerning differences in convexities of umbilical and spiral sides and in development of sutures from the umbilical side. The sutures vary from thickened and elevated to somewhat incised.

Remarks. — It seems that more than one species is present within the Carpathian material. However, the specimens are too poorly preserved for making any further separations.

Similar forms were described under the specific names *Parella navarroana* and *P. cordieriana* by AKIMEZ (1961) from the Cretaceous of the Belorussian S.S.R.

Occurrence. — This cosmopolitan species is known from all continents; ?Upper Cretaceous — Paleocene.

Osangularia plummerae BROTZEN, 1940

(Pl. X, Figs 3-5)

1926. *Truncatulina culter* (PARKER & JONES); H. J. PLUMMER, p. 147, Pl. 10, Fig. 1; Pl. 15, Fig. 2 (non *Planorbulina culter* PARKER & JONES, 1865).
1940. *Osangularia plummerae* BROTZEN; F. BROTZEN, p. 30.
1962. *Osangularia plummerae* BROTZEN, 1940; A. HILLEBRANDT, p. 110, Pl. 9, Fig. 15 *(here additional synonymy included)*.

Material. — A dozen of specimens badly preserved.
Dimensions of three specimens (in mm):

	F. XIV/234	F. XIV/235	F. XIV/236
Longest diameter . . .	0.42	0.38	0.38
Shortest diameter . . .	0.34	0.32	0.33
Height	0.24	0.20	0.21

Description. — Test trochospiral, lensiform in edge view, almost evenly biconvex, with subcircular peripheral outline, very weakly lobulate. Peripheral margin sharply acute, bordered by more of less distinct keel. More than two whorls are visible on the spiral side; the last whorl comprising 7 to 9 chambers. Sutures curved and slightly raised on spiral side and radial, almost flush with test surface on umbilical side. Aperture — an opening along the base of the last chamber on umbilical side, usually destroyed; additional areal aperture occasionally observable. Test surface smooth.

Variation concerning size of tests, their outline and mode of development of sutures; the sutures are flush with test surface or slightly incised on umbilical side.

Remarks. — The specimens from the Paleocene of the Polish Carpathians are almost identical with those found in the comparative material from the Paleocene (Midway Fm.) of Texas (USA), undoubtedly belonging to the species *Truncatulina culter* (PARKER & JONES, 1926) sensu PLUMMER (1926). BROTZEN (1940) separated the specimens designated by PLUMMER from the latter species and allocated them in his newly erected species *Osangularia plummerae*.

Occurrence. — The species is recorded from: North America (Gulf Coastal Plain of USA), Europe (Sweden, Austria, Polish Lowlands and Carpathians), Egypt and Kamchatka (USSR); Paleocene.

Osangularia cf. **crassaformis** (CUSHMAN & SIEGFUS, 1935)

(Pl. XII, Figs 3, 4)

Material. — Four specimens poorly preserved.
Dimensions of two specimens (in mm):

	F. XIV/237	F. XIV/238
Longest diameter . . .	0.33	0.32
Shortest diameter . . .	0.29	0.28
Height	0.19	0.19

Description. — Test trochospiral, plano-convex, bell-like shaped, flattened to slightly convex on spiral side, strongly convex on umbilical side, with shallow depression in its central part. At least three whorls are visible on spiral side, the outermost of which comprises 6 to 8 chambers. Periphery strongly angular, with sharp, ragged keel. Sutures oblique, flush with the surface on spiral side, depressed and bent or even sickled on umbilical side. Aperture formed by a long slit situated at the base of the last formed chamber. Wall surface smooth, finely porous.

Remarks. — The specimens described herein appear to be very close to those described as *Asterigerinoides crassaformis* by CUSHMAN and SIEGFUS (1935) from the Eocene of California (USA), and also known from the Paleocene of Austria (HILLEBRANDT, 1962), differing in markedly smaller size.

Occurrence. — Polish Carpathians; Upper Paleocene.

Genus **GLOBOROTALITES** BROTZEN, 1942

Globorotalites granulatus POŻARYSKA & SZCZECHURA, 1968

1962. *Globorotalites*? n.sp.; M.E. SCHMID, p. 350, Pl. 6, Fig. 8.
1965. *Globorotalites* cf. *lobata* BROTZEN; K. POŻARYSKA, p. 106, Pl. 17, Fig. 3.
1968. *Globorotalites granulatus* POŻARYSKA & SZCZECHURA; K. POŻARYSKA & J. SZCZECHURA, p. 67, Pl. 8, Figs 1-7.

Material. — A single specimen well preserved.
Dimensions of one specimen (in mm):

	F. XIV/239
Longest diameter . . .	0.20
Shortest diameter . . .	0.17
Height	0.12

Description as given by POŻARYSKA and SZCZECHURA (1968).

Remarks. — A single specimen from the Polish Carpathians does not differ from the specimens described by the present authors (POŻARYSKA & SZCZECHURA, 1968) from the Paleocene of the Polish Lowlands. KIESEL (1970) described a very similar form from the Paleocene of Germany as *Globorotalites* sp.

Occurrence. — Austrian Alps, Germany, Polish Lowlands and Carpathians; Paleocene.

Genus **GYROIDINOIDES** BROTZEN, 1942

Gyroidinoides girardana (REUSS, 1851)

(Pl. X, Fig. 2)

1851. *Rotalina girardana* REUSS; A. E. REUSS, p. 73, Pl. 5, Fig. 34.
1946. *Gyroidina girardana* (REUSS); J. A. CUSHMAN & H. H. RENZ, p. 44, Pl. 7, Fig. 20.
1953. *Gyroidinoides girardana* (REUSS); J. P. BECKMANN, p. 382, Pl. 23, Figs 23, 24.
?1962. *Gyroidinoides girardanus* (REUSS); K. GOHRBANDT, p. 91, Pl. 5, Fig. 1.
1962. *Gyroidinoides girardanus* (REUSS); A. HILLEBRANDT, p. 107, Pl. 9, Fig. 1.
1970. *Gyroidinoides girardanus* (REUSS); Y. KIESEL, p. 288, Pl. 16, Fig. 2.

Material. — Seven specimens, most of them damaged.
Dimensions of one specimen (in mm):

	F. XIV/240
Longest diameter . . .	0.39
Shortest diameter . . .	0.34
Height	0.31

Description. — Test trochoidal, high, plano-convex. Peripheral outline almost entire; peripheral margin angulate. Chambers coiled into more than two whorls, 6-8 in number in the last whorl, the only one visible on the umbilical side. Umbilicus small, opened or covered by umbilical flap. Sutures slightly depressed on both sides, radial on umbilical side, somewhat curved on spiral side; outer spiral suture markedly depressed. Aperture slit-like, extending along the last chamber on umbilical side. Test surface smooth.

Variation significant, primarily concerning general size and height of tests and of umbilicus, which may be opened or covered by flap. Some specimens are subtriangular in side view, whereas others are rounded. Peripheral margin more or less acute.

Remarks. — *Gyroidinoides girardana* (REUSS, 1851) represents quite uniformly interpreted species. There are however some differences in the number of chambers in the last whorl among specimens placed in this species by different authors; Polish specimens have 6-8 chambers, whereas those reported by BECKMANN (1954), from the Oligocene of Belgium have about 10 chambers in the last whorl.

Occurrence. — The species is recorded from: Trinidad, Spain, Yugoslavia, Germany, Belgium, Austria, Polish Carpathians, Israel, Antilles, Western Pakistan and New Zealand; Paleocene — Oligocene.

Gyroidinoides pontoni BROTZEN, 1948

(Pl. IX, Fig. 6)

1948. *Gyroidinoides pontoni* BROTZEN; F. BROTZEN, p. 76, Pl. 11, Figs 4, 5.
1965. *Gyroidinoides pontoni* BROTZEN; K. POŻARYSKA, p. 108, Pl. 18, Fig. 4.
1966. *Gyroidinoides pontoni* BROTZEN; J. HOFKER, pp. 75, 93, 139, 148, 227, 243, 289, 336; Pl. 13, Fig. 61; Pl. 16, Fig. 50; Pl. 20, Fig. 42; Pl. 23, Fig. 110; Pl. 42, Fig. 73; Pl. 47, Fig. 26; Pl. 64, Fig. 109; Pl. 83, Fig. 201.

Material. — Five specimens well preserved.
Dimensions of one specimen (in mm):

	F. XIV/241
Longest diameter . . .	0.32
Shortest diameter . . .	0.26
Height	0.17

Description as given by POŻARYSKA (1965).

Variation primarily concerns general appearance of tests, and particularly convexity of chambers and height of tests. However, variation of Polish specimens remains essentially the same as within this species observed by HOFKER (1966) in his material.

Remarks. — The specimens from the Polish Carpathians are very similar to the holotype of *G. pontoni*, differing however in umbilical lips seldom well-developed.

Occurrence. — The species is reported from: Sweden, Denmark, Holland, Polish Lowlands and Carpathians; Upper Cretaceous — Paleocene.

Gyroidinoides cf. **globosa** (HAGENOW, 1842)

(Pl. XVI, Figs 3, 4)

Material. — Three specimens, two of them damaged.
Dimensions of two specimen (in mm):

	F. XIV/242	F. XIV/243
Longest diameter . . .	0.49	0.44
Shortest diameter . . .	0.44	0.37
Height	0.37	0.32

Description. — Test trochoidal, biconvex, much more convex on umbilical side than on the opposite side; peripheral margin broadly rounded; peripheral outline almost entire. Chambers, 5-6 in the last whorl, the only one seen on the umbilical side; on spiral side more than 3 whorls are weakly visible; the inner whorls are somewhat elevated. Chambers moderately increasing in size as added, except for the last chambers which are conspicuously inflated and somewhat overhang the inner whorl. Sutures slightly incised on both sides. Umbilicus small, weakly opened. Aperture — a slit along the base of the last chamber, extending from the periphery to the umbilicus. Test surface smooth, glossy.

Remarks. — Holotype of *Nonionina* (recte *Gyroidinoides*) *globosa* was not figured by HAGENOW, 1842 and is not known, hence the present authors accept here the subsequent interpretations and illustrations of this species, mostly those of REUSS (1862), HOFKER (1966), MOROZOVA (*in* MJATLIUK 1953), HILLEBRANDT (1962) and BERMUDEZ (1963). The species appears to be similar to *Gyroidina nitida* (REUSS), what was also emphasized by HOFKER (1957). CUSHMAN & JARVIS (1932) identify this species with *Gyroidina naranjoensis* WHITE (1928), the species described from the Paleocene (Velasco Fm.) of Mexico. A larger comparative material would be required for the revision of the above views. Thus the specimens from Poland are here tentatively included into *Gyroidinoides globosa* (HAGENOW).

Occurrence. — Polish Carpathians; Upper Paleocene. *Gyroidinoides globosa* (HAGENOW, 1842) is known from the Cretaceous — Lower Eocene deposits of all continents.

Family ANOMALINIDAE CUSHMAN, 1927

Genus **ANOMALINA** D'ORBIGNY, 1826

Anomalina acuta PLUMMER, 1926

(Pl. XXVI, Figs 1-3, 6,7)

1926. *Anomalina ammonoides* var. *acuta* PLUMMER; H. J. PLUMMER, p. 149, Pl. 10, Fig. 2.
1937. *Anomalina acuta* PLUMMER; M.F. GLAESSNER, p. 386, Pl. 5, Fig. 39.
1944. *Anomalina acuta* PLUMMER; C.L. COOPER, p. 353, Pl. 54, Figs 3-5.
1948. *Anomalinoides acuta* (PLUMMER); F. BROTZEN, p. 87, Pl. 14, Fig. 2.
1948. *Anomalina* ex. gr. *acuta* PLUMMER; D.M. ÇHALILOV, p. 37, Pl. 4, Fig. 5.
1950. *Anomalina praeacuta* VASSILENKO; V. P. VASSILENKO, p. 208, Pl. 5, Figs 2-3.
1951. *Anomalina acuta* PLUMMER; J.A. CUSHMAN, p. 62, Pl. 18, Figs 3-6.
1953. *Anomalina desertorum* LE ROY; L. W. LE ROY, p. 17, Pl. 7, Figs 18-20.
1954. *Anomalina (Pseudovalvulineria) praeacuta* VASSILENKO; V. P. VASSILENKO, p. 111, Pl. 16, Figs 1-2.

1954. *Anomalina (Pseudovalvulineria) acuta* var. *acuta* PLUMMER; V. P. VASSILENKO, p. 113, Pl. 16, Figs 3 4.
1959. *Anomalina acuta* PLUMMER; M. STANCHEVA, p. 341 Pl. 4, Fig. 2.
non 1960. *Anomalinoides acuta* (PLUMMER); R. K. OLSSON, p. 51, Pl. 11, Figs 4-5.
1961. *Pseudovalvulineria pozaryskii* WITWICKA; E. WITWICKA, p. 130, Pl. 5, Fig. 9.
non 1962. *Anomalinoides praeacuta* VASSILENKO; A. HILLEBRANDT, p. 112, Pl. 9, Fig. 8.
1965. *Anomalina praeacuta* VASSILENKO; K. POŻARYSKA, p. 129, Pl. 28, Fig. 2.
1966. *Gavelinopsis acuta* (PLUMMER); J. HOFKER, p. 122, Pl. 19, Fig. 46; p. 312, Pl. 72, Fig. 147.
1968. *Anomalina praeacuta* VASSILENKO; K. POŻARYSKA & J. SZCZECHURA, p. 88.
1969. *Anomalina praeacuta subsphaerica* GOLUBEVA; Z. V. GOLUBEVA, p. 22, Text-fig. 1.
1969. *Anomalina praeacuta elongata* GOLUBEVA; Z. V. GOLUBEVA, p. 23, Text-fig. 2.
1970. *Anomalina* ex. gr. *praeacuta* VASSILENKO; E. K. SCHUTZKAJA, p. 32, Fig. 8.
non 1970. *Anomalina praeacuta* VASSILENKO; Y. KIESEL, p. 1302, Pl. 18, Fig. 10.
non 1972. *Anomalina acuta* PLUMMER; W. A. BERGGREN, Pl. 11, Fig. 3.

Material. — Thirty eight specimens, most of them damaged.
Dimensions of two specimens (in mm):

	F. XIV/244	F. XIV/245
Longest diameter . . .	0.34	0.39
Shortest diameter . . .	0.26	0.32
Height	0.12	0.13

Description and variation as given by POŻARYSKA (1965). It should be added here that the specimens from the Paleocene of Polish Carpathians, assigned to *Anomalina acuta*, differ in degree of evolutness of spiral side.

Remarks. — The authors studied the comparative material from the Paleocene (Midway Fm.) of Texas, wherefrom PLUMMER (1926) described the subspecies *Anomalina ammonoides* var. *acuta*, which was subsequently raised to the specific rank by GLAESSNER (1937). The variation found in the material from Texas is essentially the same as that found in the population from the Polish Carpathians. In these localities both the specimens with almost involute and the specimens with distinctly evolute spiral side were found (see Pl. XXVI, Figs 1, 3, 6). Hence *Anomalina praeacuta* VASSILENKO, which was said to differ from *A. acuta* in evolutely coiled spiral side (VASSILENKO, 1950), appears to be a junior synonym of the species in question.

A number of subspecies were proposed for the Paleocene representatives of the species *A. acuta*. According to the present authors, majority (if not all) of these subspecies should be neglected, and further, extensive studies are required for proper establishment of possible relationships between numerous varietes distinguished by different authors.

Although *Anomalina praeacuta* VASSILENKO is placed in the synonymy of *A. acuta* PLUMMER, the species *A. praeacuta* sensu HILLEBRANDT (1962), described from the Paleocene of Austria, and *A. praeacuta* sensu KIESEL (1970), described from the Paleocene of Germany are not placed herein; the specimen described by the latter author undoubtedly belongs to *Stensioeina beccariiformis* (WHITE, 1928).

The specimens figured as *Anomalinoides acuta* by OLSSON (1960) seem to be more similar to *Cibicidina cunobelini* HAYNES (1958), known from the Upper Paleocene of England. In turn, the specimen described from Paleocene sediments of North Atlantic as *Anomalina acuta* by BERGGREN (1972) is almost identical with those from the Polish Carpathians assigned herein to *Anomalinoides affinis* (HANTKEN).

Occurrence. — The species is characteristic for epicontinental facies; it is known from all continents; Upper Cretaceous — Eocene.

Anomalina danica (BROTZEN, 1940)

(Pl. XXIX, Figs 2-5)

1940. *Cibicides danica* BROTZEN; F. BROTZEN, p. 31, Pl. 7, Fig. 2.
1948. *Anomalinoides danica* BROTZEN; F. BROTZEN, p. 87, Pl. 14, Fig. 1; Text-fig. 22.
1950. *Anomalina danica* BROTZEN; J. HOFKER, p. 49, Figs 1-2.
1960. *Gavelinella danica* (BROTZEN); H. HILTERMANN & W. KOCH, p. 75, Pl. 4.
1962. *Gavelinella rubiginosa* (CUSHMAN); A. HILLEBRANDT, p. 102, Pl. 8, Fig. 1.
1968. *Anomalina danica* (BROTZEN); K. POŻARYSKA & J. SZCZECHURA, p. 86, P. 14, Figs 6-11.
1968. *Anomalina (Gavelinella) danica* (BROTZEN); O. SAMUEL & J. SALAJ, p. 25, Text-fig. 1a.
1970. *Gavelinella rubiginosa* (CUSHMAN); Y. KIESEL, p. 287, Pl. 15, Figs 15-17.
1970. *Anomalinoides nobilis* BROTZEN; Y. KIESEL, p. 304, Pl. 18, Fig. 11.
1971. *Anomalina danica* (BROTZEN); J. SZCZECHURA & K. POŻARYSKA, p. 376, Pl. 10, Fig. 3.

Material. — Over two hundreds of specimens, in most cases badly preserved. Dimensions of three specimens (in mm):

	F. XIV/251	F. XIV/252	F. XIV/253
Longest diameter . . .	0.44	0.70	0.75
Shortest diameter . . .	0.35	0.58	0.64
Height	0.25	0.39	0.42

Description as given by POŻARYSKA & SZCZECHURA (1968).

Variation significant, mostly concerning the size of the test and ornamentation. Ornamentation is either lacking or represented by irregular protuberances as it was shown in paper by POŻARYSKA and SZCZECHURA (1968).

Remarks. — Most of the specimens recorded from the Paleocene of the Polish Carpathians do not differ from those occurring in the Paleocene strata of the Polish Lowlands, which are undoubtedly conspecific with the forms described from Sweden by BROTZEN (1940). Taking under consideration HAGN and OHMERT's (1971) paper, *Korobkovella grosserugosa grosserugosa* (GUEMBEL), previously known as *Truncatulina grosserugosa* GUEMBEL (1868), is here excluded of the synonymy of *Anomalina danica*.

Differences between the true representatives of *A. rubiginosa* (CUSHMAN) found in the Paleocene of Bircza, Polish Carpathians, and figured herein of Pl. XXVII, Figs 1-3 and *A. danica* (BROTZEN, 1940), concern the porosity and overall shape of tests.

Occurrence. — The species is reported from: Sweden, Denmark, Holland, Germany, USSR (Russian Platform and Crimea), Slovak and Polish Carpathians, Polish Lowlands and Israel; Upper Cretaceous — Paleocene.

Anomalina mantaensis GALLOWAY & MORREY, 1929

(Pl. XXIII, Figs 6-8)

1929. *Anomalina mantaensis* GALLOWAY & MORREY; J. J. GALLOWAY & M. A. MORREY, p. 28, Pl. 4, Fig. 5 (see Cat. of Foram.).
1930. *Cibicides cushmani* NUTTALL; W.L.F. NUTTALL, p. 291, Pl. 25, Figs 3, 5, 6 (see Cat. of Foram.).
1953. *Anomalina mantaensis* GALLOWAY & MORREY; N. K. BYKOVA, p. 90, Pl. 4, Fig. 3 non 2.
1954. *Cibicides cushmani* (NUTTALL); G. COLOM, Pl. 19, Figs 5-8; Pl. 12, Figs 35-38.
1954. *Anomalina (Anomalina) mantaensis* GALLOWAY & MORREY; V. P. VASSILENKO, p. 59, Pl. 3, Figs 2-3. non 1.
?1957. *Cibicides cushmani* NUTTALL; V. SACAL & A. DEBOURLE, p. 68, Pl. 31, Fig. 10.
1968. *Cibicides cushmani* NUTTALL; A. JEDNOROWSKA, p. 15.

Material. — Twenty seven specimens, most of them damaged. Dimensions of three specimens (in mm):

	F. XIV/255	F. XIV/256	F. XIV/257
Longest diameter . . .	0.44	0.43	0.60
Shortest diameter . . .	0.35	0.32	0.49
Height	0.14	0.14	0.18

Description. — Test trochospiral, compressed. Peripheral margin acute, keeled; peripheral outline lobulate, sometimes also undulated. Umbilical side involute; spiral side evolute, with well-visible two whorls of chambers. Chambers about 10 in number in the last whorl. Sutures sickled, transparent; only the sutures between the youngest chambers are distinctly raised. Chambers of the last whorl much more inflated than the preceding ones, resulting in a depression separating inner whorls, typical of this species. Umbilicus opened, moderately deep, generally bordered by flaps developed at the base of the last chambers. Aperture interiomarginal, extending up to the umbilicus. Test surface smooth, very finely perforated, except for sutures.

Variation not significant, primarily concerning size and outline of tests, and depth of central part of spiral side. Peripheral margin entire to undulated, lobulate. Some small specimens have weakly evolute spiral side and weakly raised sutures.

Remarks. — Polish specimens assigned to this species seem not to differ from rather schematically figured holotype of *Anomalina mantaensis*, described by GALLOWAY and MORREY, 1929, from the Eocene of Equador. The Polish specimens are also almost identical with those from the Paleocene and Eocene of USSR (Caucasus and Turkmenia), assigned to the same species by BYKOVA (1953) and VASSILENKO (1954). At the same time, the specimens here assigned to *A. mantaensis* closely resemble some specimens identified as *A. cushmani* NUTTALL (1930), differing in stronger compression of tests and perhaps in less elevated sutures. It should be noted, however, that the Polish specimens are similarly flattened as those from the Eocene of Spain, described by COLOM (1954) as *Cibicides cushmani* (NUTTALL).

Forms very close to the Polish ones were found in the comparative material from the Lower Eocene of France (Aquitanian Basin); these French forms may be conspecific with *Cibicides cushmani* described by SACAL and DEBOURLE (1957) from the Lower Eocene of Aquitanian Basin, as well as with those known under the name of *Cibicides mariae* (JONES, 1852); to this latter species may have been referred juvenile specimens; *Anomalia mantaensis* from the Paleocene of Polish Carpathians differs from *Cibicides mariae*, the species also known from the Paleocene of Polish Carpathians, in being more strongly flattened, always evolute on spiral side, and in having elevated sutures. It is worth to note that BYKOVA (1953) placed *Cibicides ekblomi* BROTZEN in the synonymy of *Anomalina mantaensis* GALLOWAY and MORREY.

For an adequate comparison of relationships between *Anomalina mantaensis*, *Cibicides cushmani*, and *C. ekblomi*, it seems necessary to reexamine original collections of the above species. It cannot be excluded that all the above mentioned species represent the common evolutionary series. Some differences may also be related to changes in ontogenetic development and depending on ecological conditions.

Occurrence. — The species is recorded from: Equador, Mexico, France (Aquitanian Basin), Spain, Polish Carpathians, Bulgaria, USSR (Caucasus and Turkmenia); Paleocene — Eocene.

Anomalina minor POŻARYSKA & SZCZECHURA, 1968

1968. *Anomalina minor* POŻARYSKA & SZCZECHURA; K. POŻARYSKA & J. SZCZECHURA, p. 87, Pl. 14, Figs 1-5; Text-fig. 21.
non 1972. *Gavelinella minor* (POŻARYSKA & SZCZECHURA); T. L. MOORKENS, p. 145, Pl. 17, Figs 3-4.

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

	F. XIV/249	F. XIV/250
Longest diameter . . .	0.19	0.17
Shortest diameter . . .	0.16	0.14
Height	0.12	0.11

Description as given by POŻARYSKA and SZCZECHURA (1968).

Remarks. — The Carpathian specimens are very small, but resembling the smallest specimens of this species from the Polish Lowlands in size and all the remaining features. Specimens determined by MOORKENS (1972) as *Gavelinella minor* (POŻARYSKA & SZCZECHURA, 1968) seem to represent juvenile specimens belonging to *Anomalina danica* and that is why they are excluded of the synonymy of *A. minor*.

Occurrence. — The species is found in: Polish Lowlands and Carpathians, and Belgium; Paleocene.

Anomalina umbilicata umbilicata (BROTZEN, 1948)

(Pl. XII, Figs 1-2)

1948. *Cibicides umbilicata* BROTZEN; p. 84, Pl. 13, Fig. 6.
1960. *Anomalina simplex* (BROTZEN); E. K. SCHUTZKAJA, p. 250, Pl. 3, Figs 1-2.
1961. *Gavelinella umbilicata* (BROTZEN); J. HOFKER, p. 66, Text-fig. 6.
1966. *Gavelinella umbilicata* (BROTZEN); J. HOFKER, p. 227, Pl. 42, Figs 83-84.
1968. *Anomalina umbilicata umbilicata* (BROTZEN); K. POŻARYSKA & J. SZCZECHURA, p. 89, Pl. 13, Figs 5-7.

Material. — Twenty seven specimens, in most cases badly preserved.
Dimensions of two specimens (in mm):

	F. XIV/323	F. XIV/324
Longest diameter . . .	0.31	0.42
Shortest diameter . . .	0.25	0.33
Height	0.22	0.23

Description and variation as given by POŻARYSKA and SZCZECHURA (1968).

Remarks. — The specimens from the Polish Carpathians assigned to *Anomalina umbilicata umbilicata* (BROTZEN, 1948) differ from those reported from the Paleocene of Polish Lowlands in more entire peripheral outline and less inflated chambers. The same differences are found when one compare Paleocene representatives of this species from the Carpathians and from Sweden with the forms described by PLUMMER (1926) from the Paleocene (Midway Fm.) of USA as *Anomalina midwayensis*. *Anomalina umbilicata umbilicata* from the Paleocene of the Carpathians differs from *A. midwayensis* in less rounded peripheral margin, in chambers less globular and almost flush with the surface, never thickened sutures; moreover, Polish forms are never so markedly evolute on spiral side as the American ones and particularly large (?mature) American specimens.

Occurrence. — The species is reported from: Sweden, Denmark, Belgium, Holland, England, Polish Lowlands and Carpathians; Paleocene.

Anomalina velascoensis CUSHMAN, 1925

(Pl. XXIII, Figs 3-5)

1925. *Anomalina velascoensis* CUSHMAN; J.A. CUSHMAN, p. 21, Pl. 3, Fig. 3 (see Cat. of Foram.).
1928. *Planulina velascoensis* (CUSHMAN); M.P. WHITE, p. 303, Pl. 41, Fig. 7.
non 1959. *Anomalina velascoensis* CUSHMAN; J. MORGIEL, p. 138, Pl. 14, Fig. 11.
non 1959. *Anomalina velascoensis* CUSHMAN; M.M. MOSKVIN, p. 101, Pl. 8, Fig. 3.
non 1962. *Gavelinella velascoensis* CUSHMAN; A. HILLEBRANDT, p. 104, Pl. 8, Figs 3-4.
1968. *Anomalina (Gavelinella) velascoensis* CUSHMAN; O. SAMUEL & J. SALAJ, Text-fig. 1*c*.

Material. — Eight specimens well preserved.
Dimensions of three specimens (in mm):

	F. XIV/246	F. XIV/247	F. XIV/248
Longest diameter . . .	0.33	0.40	0.60
Shortest diameter . . .	0.27	0.37	0.49
Height	0.22	0.27	0.39

Description. — Test thick, rounded or slightly ovate in outline, almost biconvex, with umbilical side flattened. Peripheral margin broadly rounded, not lobulate. Chambers — 8 to 9 in the last whorl, succeeding chambers moderately increasing in size, arranged in two whorls; inner whorl hardly visible. Spiral side with umbonal boss. Sutures limbate, strongly thickened in the central part of the umbilical side, branching from central spiral thickening surrounding the umbilicus, becoming progressively narrower towards the periphery, and finally "merging" with test surface. On spiral side, sutures flush with the surface. The surface, except for thickened sutures, more or less coarsely pitted; older chambers from spiral side less porous. Aperture slit-like, situated on the peripheral margin, at the base of the last chamber, extending from the umbilicus on umbilical side and slightly on the spiral side.

Variation significant, primarily concerning size of tests and degree of development of sutures from umbilical side which may be more or less thickened. Moreover, tests may be pitted on umbilical side only, or on both sides.

Remarks. — The Polish specimens from the Babica clays do not differ from the specimens from the Paleocene (Velasco Fm.) of Mexico, the stratum typicum of the species *A. velascoensis* CUSHMAN, 1925, nor from those found in the comparative material from Aquitanian Basin and Austria, except for somewhat coarser pores. However, sutures of the latter specimens are less oblique in edge view than the sutures of the holotype of this species figured by CUSHMAN (1925), (see Cat. of Foram.). Because of the differences in structural pattern and in morphology in comparison to the representatives of this species from the Paleocene (Velasco Fm.) of Mexico and European forms studied by the present authors, the forms described from the Paleocene of Austria by HILLEBRANDT (1962), from Poland (MORGIEL, 1959) and USSR (MOSKVIN, 1959) are excluded from this species.

Occurrence. — The species seems to be typical for Tethyan regions; it is recorded from: Mexico, Trinidad, Spain, France (Aquitanian Basin), Austrian Alps, Slovak and Polish Carpathians and USSR (Crimea); Upper Cretaceous — Paleocene.

?**Anomalina** cf. **sola** (MJATLIUK, 1970)

(Pl. XXIX, Fig. 1)

Material. — Five specimens, most of them damaged.
Dimensions of one specimen (in mm):

	F. XIV/258
Longest diameter . . .	0.66
Shortest diameter . . .	0.59
Height	0.34

Description. — Test large, solid, trochospiral with the maximum convexity in the center of spiral side, slightly concave in the center of umbilical side. Peripheral margin more or less rounded; peripheral outline almost entire. Spiral side containing more than two whorls. Chambers, about 10 in the last whorl, weakly differentiated, inflated; older chambers more inflated than younger ones. Umbilicus more or less deep, opened or filled with small plug. Sutures flush with the surface, becoming incised between the last chambers. Aperture interiomarginal, extending on the umbilical side. Surface of both test sides coarsely perforated.

Variation insignificant, concerning size of tests and mode of coiling of chambers which is occasionally irregular.

Remarks. — The specimens from the Paleocene of Polish Carpathians differ from those referred to *Pseudovalvulineria sola*, described by MJATLIUK (1970) from the Montian of Eastern Carpathians, in larger and more elevated central region of spiral side in not elevated sutures from umbilical side, as well as in the lack of any additional ornamentation. There is some similarity between the Polish specimens here assigned to ?*Anomalina* cf. *sola* and those described as *Anomalina grosserugosa* (GUEMBEL, 1868). The Polish forms primarily differ from the latter ones in more evolute and convex spiral side and more irregular coiling.

A form very similar to the Polish ones was described from the Upper Cretaceous of the western Carpathians by HANZLIKOVA (1970) as *Gavelinella involutiformis* HOFKER (1956). *Gavelinella involutiformis* differs from the Polish forms in better differentiated chambers on the umbilical side and in better marked sutures.

General appearance of the specimens included in ?*Anomalina* cf. *sola* (MJATLIUK, 1970) seems to be close to that, characteristic for the genus *Anomalina*. However, they are highly trochospiral and that is why they are only tentatively included in that genus. According to LOEBLICH and TAPPAN (1964) *Pseudovalvulineria* is an invalid genus.

Occurrence. — Polish Carpathians; Upper Paleocene.

Genus **ANOMALINOIDES** BROTZEN, 1942

Anomalinoides affinis (HANTKEN, 1875)

(Pl. XXVI, Figs 4-5; Pl. XXVII, Figs 6-7)

1875. *Pulvinulina affinis* HANTKEN; M. HANTKEN, p. 78, Pl. 10, Fig. 6 (Cat. of Foram.).
1928. *Gyroidina anomalinoides* WHITE; M.P. WHITE, p. 291, Pl. 38, Fig. 11.
1930. *Nonionina boueana* D'ORBIGNY; W.L.F. NUTTALL, p. 284, Pl. 23, Figs 11-14.
1932. *Anomalina ammonides* (REUSS); J.A. CUSHMAN & P. W. JARVIS, p. 51, Pl. 16, Fig. 1.
1948. *Anomalina affinis* HANTKEN; D. M. CHALILOV, pl. 6, Fig. 3.
1948. *Anomalinoides nobilis* BROTZEN; F. BROTZEN, p. 89, Pl. 19, Fig. 5.
1957. *Anomalinoides nobilis* BROTZEN; A. WOOD & J. HAYNES, p. 52, Pl. 5, Fig. 11; Pl. 6, Fig. 5.
1959. *Anomalina affinis* (HANTKEN); M. STANCHEVA, p. 340, Pl. 4, Fig. 4.
?1960. *Anomalinoides pseudowelleri* OLSSON; R. K. OLSSON, p. 52, Pl. 12, Figs 1-3.
1962. *Anomalinoides nobilis* BROTZEN; A. HILLEBRANDT, p. 112, Pl. 9, Fig. 7.
?1963. *Anomalina guatemalensis* BERMUDEZ; P. BERMUDEZ, p. 16, Pl. 6, Fig. 1.
1966. *Gavelinonion nobilis* (BROTZEN); J. HOFKER, p. 336, Pl. 85, Figs 225-227; p. 72, Fig. 141; p. 71, Fig. 135.
1968. *Anomalinoides nobilis* BROTZEN; O. SAMUEL & J. SALAJ, p. 91, Text-fig. 14.
1969. *Anomalinoides nobilis* BROTZEN; E. HANZLIKOVA, p. 64, Pl. 19, Fig. 2.
non 1970. *Anomalinoides nobilis* BROTZEN; Y. KIESEL, p. 304, Pl. 18, Fig. 11.
1970. *Melonis nobilis* (BROTZEN); H. J. HANSEN, p. 112, Pl. 14, Figs 8-10; Pl. 29, Figs 1-2.

Material. — Two dozens of specimens, most of them well preserved. Dimensions of two specimens (in mm):

	F. XIV/325	F. XIV/326
Longest diameter . . .	0.37	0.39
Shortest diameter . . .	0.31	0.32
Height	0.16	0.16

Description. — Test low, trochospiral, biconvex compressed, generally biumbilicate; outline entire to slight lobulate; peripheral margin rounded to somewhat compressed. More than 2 whorls are visible on spiral side; umbilical side involute, with a distinct central, opened umbilicus with flaps, especially well developed along the last chambers. Last whorl containing 8-10 chambers moderately increasing in size as added. Sutures broad, slightly depressed if ever, almost straight. Aperture — a slit extending from ventral umbilicus up to the dorsal one. Wall surface moderately perforated.

Variation insignificant. Periphery rounded or compressed. Chambers convexity varies resulting in smaller or greater depression of umbilicus from the spiral side. Aperture to a different degree extends onto the spiral side. Ventral umbilicus more or less obscured by flaps, depending of their size.

Remarks. — The specimens from the Paleocene of the Polish Carpathians, assigned to *Anomalinoides affinis* almost do not differ from that found in comparative material from the Oligocene (*Clavulina szaboi* beds) of Hungary (see Pl. XXVII, Fig. 6) and which undoubtedly represents the species described from those strata as *Pulvinulina affinis* by HANTKEN (1875). Also the topotypes of the species *Anomalinoides nobilis* BROTZEN, described by BROTZEN (1948) from the Paleocene of Sweden, which were studied by the present authors, appear to be conspecific with the specimens from the Paleocene of the Carpathians; hence, the species *A. nobilis* BROTZEN is allocated here in the synonymy of *Pulvinulina* (recte *Anomalinoides*) *affinis* (HANTKEN, 1875) as a younger synonym.

The specimens found in comparative materials from the Paleocene (Velasco Fm.) and Eocene (Aragon Fm.) of Mexico (see Pl. XXVI, Fig. 7) appear to be identical with those known from Europe, and are here assigned to the species *Anomalinoides affinis*. The specimens from the Eocene of Mexico were misinterpreted as *Nonionina boueana* D'ORBIGNY by NUTTALL (1930). The Paleocene specimens most probably represent the species described by WHITE (1928) from the Velasco Fm. under the name *Gyroidina anomalinoides*. However, the latter species is unfortunately very schematically and inadequately figured.

Forms close to *A. affinis* were described as *Anomalina guatemalis* by BERMUDEZ (1963) from the Paleocene of Guatemala and as *Anomalinoides pseudowelleri* by OLSSON (1960) from the Paleocene of North America. KIESEL (1970) figured a specimen from the Paleocene of the Germany as *Anomalinoides nobilis*; the specimen differs from the topotype of this species in coarser perforation and in elevated sutures, so it cannot be included in the synonymy of *A. nobilis* (recte *A. affinis*).

The species *Rosalina* (recte *Anomalinoides*) *ammonoides*, close to *Anomalinoides affinis*, was described by REUSS (1844) from the Cretaceous of Czechoslovakia. CUSHMAN and JARVIS (1932) adapted the name of this species for the forms recorded from the Upper Cretaceous of America; judging from the illustrations, of these latters they are undoubtedly conspecific with representatives of *A. affinis*. However, holotype of *Anomalinoides ammonoides* (REUSS) from the Cretaceous of Czechoslovakia is rather schematically drawn; thus, the relationship between *A. ammonoides* and *A. affinis* still remains unclear. It should be noted that HANZLI-

KOVA (1969) described *A. nobilis* (= *A. affinis* by the present authors) from the Cretaceous of Czechoslovakia.

Occurrence. — This cosmopolitan species is reported from: Greenland, Gulf Coast Plains of USA, Mexico, Trinidad, Guatemala, France (Aquitanian Basin), England, Denmark, Sweden, Holland, Hungary, Slovak and Polish Carpathians, Polish Lowlands, Bulgaria, Austria, USSR (Kamchatka) and found in samples from Italy (Vieste); Upper Cretaceous — Oligocene.

Anomalinoides cf. **hyphalus** (FISHER, 1969)

(Pl. XXI, Figs 6-7)

1962. *Gavelinella velascoensis* (CUSHMAN); A. HILLEBRANDT, p. 102, Pl. 8, Fig. 4 (non *Anomalina velascoensis* CUSHMAN 1925).

Material. — Five specimens, all somewhat damaged.

Dimensions of two specimens (in mm):

	F. XIV/259	F. XIV/260
Longest diameter . . .	0.54	0.59
Shortest diameter . . .	0.44	0.50
Height	0.24	0.23

Description. — Test trochospiral, almost equally biconvex; spiral side with slightly depressed umbo; periphery bluntly acute, somewhat rounded, especially along the last chambers, not lobulate. Two whorls may be seen on spiral side, the outer or which is markedly larger. Boss somewhat tuberculated, developed on umbilical side. Chambers numerous, about 14 in the last whorl, separated by sickle-shaped sutures; sutures raised, except for those separating the last chambers, and enlarging towards the central part on the umbilical side; they are flush with the surface on the spiral side. Aperture slit-like, extending on both sides, and especially on umbilical side where it joins with the furrow continuing along the base of the last chambers below weakly developed flaps. Wall distinctly perforated, particularly on the umbilical side.

Remarks. — The specimens from Polish Carpathians identified as *Anomalinoides* cf. *hyphalus* FISHER (1969) are very similar to the form described as *Anomalinoides hyphalus* from the Maastrichtian of Spain, by FISHER (1969). The restriction is made because of the fact that the holotype is very inaccurately drawn, because of some differences in morphological details of the umbilical side of the compared specimens. At the same time the form identified as *Gavelinella velascoensis* (CUSHMAN, 1925) by HILLEBRANDT (1962), and considered as conspecific with *Anomalinoides velascoensis* (CUSHMAN) by FISHER (1969) is considered by the present authors as conspecific with *A.* cf. *hyphalus* (FISHER) from the Polish Carpathians. According to the present authors, *Anomalinoides* cf. *hyphalus* and *A. velascoensis*, also recorded in the Paleocene of the Polish Carpathians and described herein, have few features in common. *Anomalinoides* cf. *hyphalus* appears to be more similar to ?*Cibicides commatus* MOROZOVA (1954); comparison of these two species is given in remarks to ?*C. commatus* (see. p. 91).

Occurrence. — Polish Carpathians; Upper Paleocene.

Genus **COLEITES** PLUMMER, 1934

Coleites reticulosus (PLUMMER, 1926)

(Pl. XX, Fig. 1)

1926. *Pulvinulina reticulosa* PLUMMER; H. J. PLUMMER, p. 152, Pl. 12, Fig. 5.
1956. *Coleites reticulosus* (PLUMMER); A.F.M. HAQUE, p. 143, Pl. 5, Figs 17-18.
1961. *Coleites crispus* VASSILENKO; V.P.VASSILENKO, p. 101, Pl. 17, Figs 5-6.

1965. *Coleites reticulosus* (PLUMMER); K. POŻARYSKA, p. 117, Pl. 20, Figs 1-2 *(here additional synonymy included)*
1968. *Coleites reticulosus* (PLUMMER); O. SAMUEL & J. SALAJ, p. 25, Text-fig. 10.
1968. *Coleites reticulosus* (PLUMMER); K. POŻARYSKA & J. SZCZECHURA, p. 90.
1970. *Coleites reticulosus* (PLUMMER); Y. KIESEL, p. 299, Pl. 17, Figs 17-18.

Material. — Twelve specimens, some of them damaged.
Dimensions of one specimen (in mm):

	F. XIV/261
Longest diameter . . .	0.70
Shortest diameter . . .	0.59
Height	0.32

Description, variation and remarks as given by POŻARYSKA (1965). It must be added here, however, that the specimens from the Paleocene of USSR, described as *Coleites crispus* by VASSILENKO (1961), seems to not differ from those recorded from the Paleocene of Poland and assigned by the present authors to *C. reticulosus*.

Occurrence. — The species is known from all Continents; Upper Cretaceous — Eocene.

Genus **GAVELINELLA** BROTZEN, 1942

Gavelinella umbilicatula (MJATLIUK, 1942)

(Pl. XXVIII, Fig. 1)

1934. *Anomalina ammonoides* (REUSS); L.G. DAIN, p. 43, Pl. 5, Fig. 50.
1937. *Anomalina pertusa* (MARSSON, 1878); N.A. KALININ, p. 54, Pl. 7, Figs 112-117.
1942. *Gavelinella costata* BROTZEN; F. BROTZEN, p. 43, Pl. 1, Fig. 3.
1947. *Anomalina ammonoides* var. *umbilicatula* MJATLIUK; V.P. VASSILENKO & E. V. MJATLIUK, p. 208, Pl. 1, Fig. 8.
1954. *Anomalina (Gavelinella) umbilicatula* MJATLIUK; V. P. VASSILENKO, p. 78, Pl. 7, Fig. 4.
1959. *Anomalina umbilicatula* MJATLIUK; M.M. MOSKVIN, p. 100, Pl. 6, Fig. 7.
1960. *Gavelinella limbata* OLSSON; R.K. OLSSON, p. 35, Pl. 5, Figs 17-19.
1961. *Gavelinella umbilicatula* MJATLIUK; E. WITWICKA, p. 126, Pl. 3, Fig. 5.

Material. — Twelve specimens in most cases somewhat damaged.
Dimensions of one specimen (in mm):

	F. XIV/262
Longest diameter . . .	0.44
Shortest diameter . . .	0.38
Height	0.21

Description. — Test trochospiral, weakly lobulate in general outline, with flattened spiral side and elevated umbilical side. Peripheral margin slightly acute. Chambers, arranged in more than two whorls; the last whorl, the only seen on umbilical side, contains about 9 chambers. Successive chambers rather rapidly increasing in size, and particularly in height, what is more distinct on the umbilical side. Chambers with narrow, costae-like inflation, better pronounced on spiral side. Umbilicus large, opened. Sutures depressed. Test surface coarsely perforated. Aperture slit-like, internal, marginal, extending up to the umbilicus.

Variation primarily concerning the size of chambers and depth of the umbilicus.

Remarks. — The Polish specimens are almost identical with those included into the synonymy. The Polish specimens differ from those figured by BROTZEN (1942) in higher chambers, but equally high chambers are found in forms described as *Anomalina ammonoides* by DAIN (1934) and as *Anomalina pertusa* by KALININ (1937), both species allocated in the

synonymy of *Gavelinella costata* by BROTZEN (1942). Relationships between the *G. costata* BROTZEN and *A. umbilicatula* MJATLIUK, 1942, were discussed by VASSILENKO (1954, p. 78). Species in question seems to be related to *Discorbina* (recte *Gavelinella*) *pertusa* MARSSON, 1878, the species described from the Cretaceous of Rügen from which it differs in smaller number of chambers and not elevated sutures. The species differs from *Gavelinella lellingensis* BROTZEN (1948), described from the Paleocene of Sweden, in less globulous but rather marginally acute chambers.

Occurrence. — The species is known from: Sweden, Germany, Polish Lowlands and Carpathians, USSR (Russian Platform, Caucasus and Mangyshlak) and New Jersey Coastal Plain (USA); Upper Cretaceous — Paleocene.

Genus **HANZAWAIA** ASANO, 1944

Hanzawaia bundensis bundensis (VAN BELLEN, 1946)

(Pl. XXII, Figs 4-7)

1946. *Anomalina bundensis* BELLEN; R. C. VAN BELLEN, p. 73, Pl. 11, Figs 1-3.
1958. *Anomalina subekblomi* SCHUTZKAJA; E. K. SCHUTZKAJA, p. 208, Pl. 5, Figs 1-2.
1959. *Cibicides* sp.; J. MORGIEL, p. 138, Pl. 14, Fig. 13.
?1962. *Cibicides* cf. *laurisae* MALLORY; A. HILLEBRANDT, p. 114, Pl. 10, Fig. 7.
1966. *Anomalinoides bundensis* (BELLEN); J. HOFKER, p. 258, Pl. 56, Fig. 106.
1968. *Cibicides aurouzae* ROUVILLOIS; K. POŻARYSKA & J. SZCZECHURA, p. 74, Pl. 10, Figs 8-12.
?1968. *Anomalinoides aspera* BROTZEN; O. SAMUEL & J. SALAJ, Text-fig. 2*a*, *b*.

Material. — Some dozens of specimens, almost all damaged.
Dimensions of three specimens (in mm):

	F. XIV/263	F. XIV/264	F. XIV/266
Longest diameter . . .	0.39	0.66	0.49
Shortest diameter . . .	0.31	0.53	0.39
Height	0.19	0.30	0.22

Description as given by POŻARYSKA and SZCZECHURA (1968).

Variation significant, discussed previously by SCHUTZKAJA (1958), HOFKER (1966), POŻARYSKA and SZCZECHURA (1968), and SZCZECHURA and POŻARYSKA (1971).

Remarks concerning the systematic position of *Hanzawaia bundensis* and its relation to other species were given in the previous papers of the present authors (POŻARYSKA & SZCZECHURA, 1968; SZCZECHURA & POŻARYSKA, 1971). Representatives of this species were presumably misidentified by HILLEBRANDT (1962) as *Cibicides* cf. *laurisae*; however, the forms figured by HILLEBRANDT (1962) appear hardly comparable with actual representatives of *Hanzawaia bundensis* found in the comparative material from Austria (Reichenhall). The specimens well matching the diagnosis of the species in question were more recently described by SAMUEL and SALAJ (1968) from the Paleocene of Slovak Carpathians as *Anomalinoides aspera* BROTZEN. It should be noted that HOFKER (1966) placed *Anomalinoides aspera* BROTZEN (1948) in the synonymy of *Anomalinoides* (recte *Hanzawaia*) *bundensis*.

In the present paper a new subspecies, *Hanzawaia bundensis karpatica* subsp. n. is proposed.

Occurrence. — The species occurs in: Holland, Belgium, France (Paris Basin), Italy (Vieste), Austrian Alps (?Reichenhall and Kroisbach), Polish Lowlands and Carpathians, USSR (Crimea); Paleocene — Lower Eocene.

Hanzawaia bundensis karpatica n. subsp.

(Pl. XXII, Figs 1-3)

?1963. *Anomalinoides bundensis* (BELLEN); J. E. HINTE, p. 126, Pl. 17, Fig. 1.
Holotypus: Specimen presented on Pl. XXII, Fig. 1, (F. XIV/267).
Paratypi: Specimens presented on Pl. XXII, Figs 2-3, (F. XIV/268/269).
Stratum typicum: Thanetian.
Locus typicus: Babica near Rzeszów (Polish Eastern Carpathians).
Derivatio nominis: karpatica — after Carpathians (Karpaty Mts. in Polish).

Material. — Some dozens of specimens, in most cases damaged. Dimensions of two specimens (in mm):

	F. XIV/267	F. XIV/268
Longest diameter . . .	0.47	0.61
Shortest diameter . . .	0.38	0.50
Height	0.21	0.25

Description. — Test trochoidal, plano-convex, generally involute on both sides, somewhat evolute ventrally. Umbilical side strongly convex, markedly depressed in the middle; dorsal side flat to slightly concave. Periphery angulate, with more or less developed keel. Chambers distinct, slightly inflated on ventral side, up to 10 in number in the last whorl. Sutures strongly curved, those separating early chambers are raised and thickened, while those separating the last chambers — gently depressed. Umbilicus filled by tuberculated boss on dorsal side; the bose usually connected with thickened sutures. Aperture arcuate, situated on the periphery of the last chamber, somewhat extending on the convex side as well as on the flattened side, under central flaps of the last chambers. Walls coarsely perforated on both sides, resulting in their variable roughness.

Variation significant, primarily concerning the size, shape, and degree of development of ornamentation. Variation in tests outline and ornamentation is similar to that found in the nominal subspecies, *Hanzawaia bundensis bundensis*.

Remarks. — The new erected subspecies, *Hanzawaia bundensis karpatica* n. subsp., differs from *Hanzawaia bundensis bundensis* primarily in filled and ornamented central part of the flattened side, while in the latter subspecies the central part of the flattened side is closed by tena of the last chambers approximating to one another, but sometimes it is open. Moreover, the newly erected subspecies differs from the nominal subspecies in always more elevated sutures and in coarser perforation resulting in roughness of the tests.

The specimen from the Lower Eocene of Austria, allocated by HINTE (1963) in *Anomalinoides bundensis* (BELLEN), seems to be related to the new subspecies; however, HINTE identified the Austrian form with *Anomalina auris* LE CALVEZ, essentially differing from the new subspecies, thus the forms in question are considered as conspecific with restriction.

Occurrence. — Polish Carpathians; Upper Paleocene.

Genus **KARRERIA** RZEHAK, 1891

Karreria fallax RZEHAK, 1891

(Pl. XVIII, Figs 1-5)

1891. *Karreria fallax* RZEHAK; A. RZEHAK, p. 4, Pl. 7, Figs 7-8.
1895. *Truncatulina Rzehaki* GRZYBOWSKI; J. GRZYBOWSKI, p. 202, Pl. 5, Figs 3-4.
1928. *Karreria fallax* RZEHAK; M. P. WHITE, p. 299, Pl. 41, Fig. 2.

1961. *Karreria fallax* RZEHAK; J. P. H. KAASSCHIETER, p. 231, Pl. 14, Fig. 16.
1965. *Karreria fallax* RZEHAK; K. POŻARYSKA, p. 138, Pl. 19, Figs 3-4 *(here additional synonymy included)*.
1966. *Karreria fallax* RZEHAK; J. HOFKER, p. 193, 202, 217, 240, 334; Pl. 37, Fig. 46; Pl. 38, Figs 38-39; Pl. 44, Figs 113-115; Pl. 45, Fig. 127; Pl. 48, Figs 40-41; Pl. 84, Figs 213-215.
1968. *Karreria fallax* RZEHAK; K. POŻARYSKA & J. SZCZECHURA, p. 91, Text-fig. 22.
1970. *Karreria fallax* RZEHAK; E. K. SCHUTZKAJA, Pl. 6, Fig. 11; Pl. 13, Fig. 2.
1970. *Karreria fallax* RZEHAK; Y. KIESEL, p. 315, Pl. 19, Fig. 3.

Material. — Five specimens, most of them damaged.
Dimensions of two specimens (in mm):

	F. XIV/270	F. XIV/271
Longest diameter . . .	0.34	0.54
Shortest diameter . . .	0.25	0.45
Height	0.22	0.33

Description and remarks as given by POŻARYSKA and SZCZECHURA (1968).
Variation considerable, primarily concerning general shape and size of tests which was figured by POŻARYSKA and SZCZECHURA (1968, p. 92).
Occurrence. — This cosmopolitan species occurs in all continents; Upper Cretaceous — Lower Eocene.

Genus **PULSIPHONINA** BROTZEN, 1948

Pulsiphonina prima (PLUMMER, 1926)

1926. *Siphonina prima* PLUMMER; H. J. PLUMMER, p. 148, Pl. 12, Fig. 4.
1948. *Pulsiphonina elegans* BROTZEN; F. BROTZEN, p. 104, Pl. 17, Fig. 4.
1953. *Siphonina prima* PLUMMER; E. V. MJATLIUK, p. 231, Pl. 8, Fig. 3.
1965. *Pulsiphonina prima* (PLUMMER); K. POŻARYSKA, p. 111, Pl. 16, Figs 3, 6.
1968. *Pulsiphonina prima* (PLUMMER); K. POŻARYSKA & J. SZCZECHURA, p. 92.
1970. *Pulsiphonina prima* PLUMMER; Y. KIESEL, p. 300, Pl. 18, Fig. 4.

Material. — Five specimens rather well preserved.
Dimensions of two specimens (in mm):

	F. XIV/274	F. XIV/275
Longest diameter . . .	0.21	0.26
Shortest diameter . . .	0.18	0.22
Height	0.11	0.11

Description and remarks as given by POŻARYSKA (1965); however, it should be added here that the Carpathian specimens are markedly smaller than those from the Paleocene of Polish Lowlands and Paleocene (Midway Fm.) of Texas (USA).
Occurrence. — The species is known from: North America (Gulf Coast Plains of USA), Europe (Sweden, Holland, Austria, Germany, Denmark, England, Polish Lowlands and Carpathians, and USSR (Russian Platform, Caucasus, Crimea); Upper Cretaceous — Paleocene.

Genus **STENSIOEINA** BROTZEN, 1936

Stensioeina avnimelechi (REISS, 1952)

(Pl. XVII, Figs 5-6)

1952. *Pseudovalvulineria avnimelechi* REISS; Z. REISS, p. 269, Fig. 2.
1953. *Stensiöina whitei* MOROZOVA; E. V. MJATLIUK, p. 73, Pl. 7, Figs 5, 6

1961. *Stensiöina whitei* MOROZOVA; V. P. VASSILENKO, p. 73, Pl. 13, Fig. 1.
1963. *Pseudovalvulineria avnimelechi* REISS; P. J. BERMUDEZ, p. 48, Pl. 6, Figs 19-21.
1968. *Gyroidina*? *whitei* (MOROZOVA); O. SAMUEL & L. J. SALAJ, p. 54, Text-fig. 6.

Material. — Eight specimens in most cases damaged.
Dimensions of two specimens (in mm):

	F. XIV/276	F. XIV/277
Longest diameter . . .	0.44	0.46
Shortest diameter . . .	0.36	0.44
Height	0.24	0.25

Description. — Test plano-convex or inequally biconvex, with more inflated umbilical side, flattened or elevated close to the centre on spiral side. Peripheral outline entire, rarely lobulate along the last formed chambers; peripheral margin sharply angled or somewhat rounded. The last whorl, the only one seen on umbilical side, containing about 8 chambers; about $2\frac{1}{2}$ whorls are observable on spiral side. Sutures thickened, elevated, particularly the spiral ones, on the spiral side, while radial, elevated, and enlarging towards closed umbilicus on the umbilical side; these latters occasionally incised along younger chambers. Aperture somewhat oblique, interiomarginal, situated between periphery and umbilicus. Surface of inter-suture coarsely perforated on umbilical side. Dorsal side quite smooth, non-perforated.

Variation insignificant. Small specimens are proportionally lower than big specimens. Spiral side evolute to a different degree; there are also some differences in elevation of spiral sutures and in convexity of central part of spiral side.

Remarks. — Identification of that species is based on comparisons with the topotypes of *S. whitei* kindly supplied by Dr. V. G. MOROZOVA. The specimens from the Paleocene of Polish Carpathians are undoubtedly conspecific with those described by MOROZOVA and do not differ from those previously described from the Paleocene of Israel by REISS (1952) as *Pseudovalvulineria avnimelechi*, as well as from those from the Paleocene of Guatemala, assigned to this species by BERMUDEZ (1963).

The species seems to be restricted to Tethyan regions; it is recorded from: Guatemala, Israel, Slovak and Polish Carpathians, Crimea, Caucasus and south-western, Asiatic part of USSR; found also in samples from Italy (Vieste) and Austrian Alps (Kroisbach); Paleocene.

Stensioeina beccariiformis (WHITE, 1928)

(Pl. XXIV, Figs 1-7; Pl. XXVII, Figs 4, 5)

1928. *Rotalia beccariiformis* var. WHITE; M. P. WHITE, p. 287, Pl. 39, Fig. 4 (non Fig. 3).
1936. *Gyroidina caucasica* SUBBOTINA; N. N. SUBBOTINA, Pl. 2, Figs 14-16.
?1943. *Rotalia* sp. cf. *R. beccariiformis* WHITE; L. FRIZZELL, p. 351, Pl. 57, Fig. 9.
1944. *Rotalia parvula* TEN DAM; A. TEN DAM, p. 121, Pl. 4, Fig. 1.
?1945. *Pseudovalvulineria vombensis* BROTZEN; F. BROTZEN, p. 50, Pl. 1, Figs 12-13; Text-fig. 9.
non 1946. *Anomalina beccariiformis* (WHITE); J. A. CUSHMAN & H. H. RENZ, p. 48, Pl. 8, Figs 21, 22.
1947. *Gyroidina caucasica* SUBBOTINA; N. N. SUBBOTINA, p. 100, Pl. 3, Figs 23-25.
1948. *Gyroidina caucasica* SUBBOTINA; D. M. CHALILOV, p. 37, Pl. 4, Fig. 2.
1948. *Gyroidina caucasica* SUBBOTINA; D. M. CHALILOV, p. 39, Pl. 4, Fig. 2.
1953. *Stensiöina caucasica* (SUBBOTINA); E. V. MJATLIUK, p. 74, Pl. 6, Figs 1, 2.
1953. *Gyroidina beccarii* (WHITE); N. K. BYKOVA, p. 45.
1959. *Stensiöina caucasica* (SUBBOTINA); N. I. MASLAKOVA, p. 98, Pl. 5, Fig. 2.
1959. *Pseudovalvulineria vombensis* BROTZEN; J. LISZKOVA, p. 73, Pl. 4, Fig. 5.
1961. *Stensiöina caucasica* (SUBBOTINA); W. P. VASSILENKO, p. 72, Pl. 12, Fig. 4.
1962. *Gavelinella beccariiformis* (WHITE); A. HILLEBRANDT, p. 101, Pl. 8, Fig. 2.

1965. *Pseudovalvulineria* sp. n.; B. McGowran, p. 49, Pl. 3, Fig. 4.
1966. *Discorynopsis parvula* (Ten Dam); J. Hofker, p. 312, Pl. 72, Fig. 151; Pl. 85, Fig. 243; Pl. 86, Figs 242, 243.
1968. *Stensiöina*? *caucasica* Subbotina; O. Samuel & J. Salaj, p. 95, Text-fig. 15c.
1969. *Stensiöina caucasica* (Subbotina); E. J. Kraeva & B. F. Zernetzkij, p. 75, Pl. 26, Fig. 6.
1970. *Anomalina praeacuta* Vassilenko; Y. Kiesel, p. 302, Pl. 18, Fig. 10.
1970. *Stensiöina causacica* (Subbotina); E. V. Mjatliuk, p. 127, Pl. 37, Fig. 1.

Material. — Nine specimens, in most cases well preserved.
Dimensions of two specimens (in mm):

	F. XIV/278	F. XIV/279
Longest diameter . . .	0.33	0.37
Shortest diameter . . .	0.28	0.32
Height	0.17	0.21

Description. — Test trochospiral, biconvex to plano-convex. Peripheral margin rounded to angulated; peripheral outline almost entire or lobulate. Spiral side evolute, consisting of at least two whorls; sutures curved, flush with the surface or depressed, thickened. Umbilical side convex, formed of 8-10 chambers separated by more or less visible sutures; sutures rather depressed at the margin, becoming thickened close to the umbilicus. Umbilicus small, opened, shallow, occasionally covered by flap; flap formed by extension of the base of the last chamber. Umbilicus occasionally bordered by characteristic irregular dentations at the extension of sutures. Wall distinctly perforated on both sides. Aperture interiomarginal, extending up to the umbilicus.

Variation considerable, primarily concerning the general shape or tests and evolutness of spiral side. Moreover, sutures are sometimes poorly visible on both sides or even completely obscured on spiral side. There may also be differences in the development of umbilicus, and particularly of its indentation.

Remarks. — Numerous representatives of this species, *Rotalia* (recte *Stensioeina*) *beccariiformis* White, were found by the present authors in comparative materials from the Paleocene (Velasco Fm.) of Mexico, the type locality of this species (see Pl. XXVII, Figs 4, 5). The studies of the comparative material showed that this species appears highly variable, so it was not justified to separate it into numerous subspecies. Moreover, the studies showed that the Polish material described herein is undoubtedly conspecific with the Mexican forms. Martin (1964) proposed a new species *Anomalina whitei* (see Cat. of Foram.) and also Hanzlikova (1964) on the basis of the material from the Upper Cretaceous of America (California), placed *Rotalia beccariiformis* var. White (1928) into its synonymy. Conspecific relation of both species is accepted by Hanzlikova (1972). This, however, appears invalid in the light of the above data.

The form figured as *A. beccariiformis* by Cushman and Renz (1946) from the Paleocene (Lizard Spring Fm.) of Trinidad markedly differs from the typical representatives of this species from Mexico and Poland and so it is excluded from the synonymy.

The authors also had at their disposal comparative materials from the Paleocene of Denmark, comprising forms conspecific with those described as *Discorynopsis parvula* (Ten Dam) by Hofker (1966) (see Pl. XXIV, Figs 5-7), as well as from the Paleocene of Crimea, yielding topotypes of *Stensioeina caucasica* (Subbotina, 1936) (see Pl. XXIV, Figs 1, 3). The Danish and Crimean forms appear conspecific with the Mexican and Polish ones, particularly when the large variation of this species is taken into account.

It should be noted that the conspecific status of *S. caucasica* (Subbotina) and *S. beccariiformis* (White) was already suggested by Bykova (1953), who reported *Gyroidina beccarii*

(recte *Stensioeina beccariiformis*) from the Paleocene of Tadzhik Depression. Also McGowran (1965) in his discussion of affinities of *Pseudovalvulineria* sp. from the Paleocene of Australia noted its resemblance to both *S. beccariiformis* and *S. caucasica*, and made a remark on similarity of the latter two species.

The froms described from Polish Babica clays by Morgiel (1959) and from the Carpathian Flysch from the beds with exotics outcropping at Bachowice by Liszkowa (1959) as *Gavelinella vombensis* (Brotzen) actually belong to *Stensioeina beccariiformis*. *Gavelinella vombensis* described by Brotzen (1945) differs from *Stensioeina caucasica* (Subbotina) in being more strongly biconvex and more compressed; it may be conspecific with *Stensioeina precaucasica*, described by Vassilenko (1961) from the Maastrichtian of Mangyshlak, and probably represents a parent form of *Stensioeina beccariiformis* discussed herein.

The specimens described from the Paleocene of Germany as *Anomalina praeacuta*, Vassilenko by Kiesel (1970), actually belong to *Stensioeina beccariiformis*.

Occurrence. — The species occurs in: Peru, Trinidad, Mexico, France (Aquitanian Basin), Germany, Holland, Denmark, Sweden, Italy (Vieste), Austrian Alps, Slovak, Polish, Soviet and Rumanian Carpathians, USSR (Crimea, Caucasus, Tadjikistan), Western Pakistan, Australia and New Zealand; Upper Cretaceous — Paleocene.

Family **CERATOBULIMINIDAE** Cushman, 1927

Genus **CERATOBULIMINA** Toula, 1915

Ceratobulimina perplexa (Plummer, 1926)

(Pl. XI, Fig. 6)

1926. *Rotalia perplexa* Plummer; H. J. Plummer, p. 156, Pl. 12, Fig. 2.
1948. *Ceratobulimina perplexa* Plummer; F. Brotzen, p. 123, Pl. 19, Fig. 1.
?1966. *Lamarckina pseudoperplexa* Hofker; J. Hofker, p. 339, Pl. 82, Figs 179, 183, 185.

Material. — Twenty three specimens, all of them damaged.
Dimensions of two specimens (in mm):

	F. XIV/285	F. XIV/286
Longest diameter . . .	0.37	0.54
Shortest diameter . . .	0.29	0.44
Height	0.20	0.34

Description. — Test subglobular, more convex on umbilical side, with somewhat ovate, entire outline; peripheral margin broadly rounded. The last whorl, the only one seen on umbilical side, consisting of 6-7 chambers. Sutures slightly curved and more or less thickened, particularly on umbilical side, where they somewhat enlarge towards umbilicus. Umbilicus deep, opened. Aperture not known. Surface of the test smooth, glossy.

Variation difficult to evaluate because of poorly preserved material.

Remarks. — The specimens from the Paleocene of Polish Carpathians, assigned to *Ceratobulimina perplexa* (Plummer) do not differ from the typical representatives of this species described by Plummer (1926) from the Paleocene (Midway Fm.) of USA (Texas) or those found in the type locality. *Ceratobulimina perplexa* (Plummer) was also reported by Brotzen (1948) from the Paleocene of Sweden. The forms assigned by Brotzen (1948) to this species were subsequently placed by Hofker (1966) in his new species *Lamarckina*

pseudoperplexa, as according to HOFKER (1966) the American form does not occurs in Europe. According to the present authors, various species of the genus *Ceratobulimina* described from Europe, as for example *Ceratobulimina inflata* described by TEN DAM (1944) from the Paleocene and Early Eocene of Holland, *Ceratobulimina (Ceratolamarckina) jutlandica* described by TROELSEN (1954) from the Paleocene of Denmark, *Ceratobulimina tuberculata* described by BROTZEN (1948) from the Paleocene of Sweden, as well as *Lamarckina pseudoperplexa* HOFKER (1966) are at least closely related. Establishment of actual taxonomic relationships among the above listed species requires further studies based on comparative materials. The studies on the variation of these species is of primary importance.

Lamarckina pseudoperplexa HOFKER (1966) is placed in the synonymy of *Ceratobulimina perplexa* (PLUMMER) with reservation, because the present authors have considered only the external morphology of the specimens from the Paleocene of America and Europe, and neglected the differences in internal structure of these species, claimed by HOFKER (1966). General appearance of the species described from America and Europe validates treating them even as conspecific. Morphological overlaping of *Ceratobulimina perplexa*, *C. tuberculata*, and *C. westraliensis*, described by PARR (1938) from the Paleocene of Australia, was already previously noted by MCGOWRAN (1965).

According to HOFKER (1966) some species assigned to the genus *Ceratobulimina*, such as *Ceratobulimina perplexa*, *C. tuberculata*, *C. inflata*, and others, actually belong to the genus *Lamarckina*; this is evidenced by the type of aperture typical of the latter genus. The specimens from the Paleocene of Polish Carpathians are poorly preserved so the present authors neglect in their taxonomic considerations such diagnostic feature of this group of foraminifers as the type of aperture and they follow BROTZEN (1948) in placing the species in question in the genus *Ceratobulimina*.

Ceratobulimina tuberculata Brotzen, 1948, described by POŻARYSKA (1965) and POŻARYSKA and SZCZECHURA (1968) from the Paleocene of Polish Carpathians differs from *Ceratobulimina perplexa* described herein from contemporaneous strata of Polish Carpathians in tuberculation of umbilicus and in usually not thickened sutures. However, if the variation of both of these species and poor preservation of the latter forms are taken into account, is not excluded that these two species may be conspecific.

Occurrence. — The species is reported from: USA (Texas), France (Aquitanian Basin), Sweden, Denmark, Holland, Polish Lowlands and Carpathians, and Austria (found in samples from Austrian Alps (Kroisbach)); Middle and Upper Paleocene.

Genus **LAMARCKINA** BERTHELIN, 1881

Lamarckina naheolensis CUSHMAN & TODD, 1942

(Pl. VIII, Fig. 6)

1942. *Lamarckina naheolensis* CUSHMAN & TODD; J.A. CUSHMAN & R. TODD, p. 39, Pl. 7, Figs 5-7.
1951. *Lamarckina naheolensis* CUSHMAN & TODD; J.A. CUSHMAN, p. 49, Pl. 14, Figs 4-6.
1965. *Lamarckina naheolensis* CUSHMAN & TODD; K. POŻARYSKA, p. 115, Pl. 20, Fig. 5.
1965. *Lamarckina naheolensis* CUSHMAN & TODD; B. MCGOWRAN; p. 56, Pl. 5, Fig. 8.
1972. *Lamarckina naheolensis* CUSHMAN & TODD; T.L. MOORKENS, p. 150, Pl. 11, Fig. 5.

Material. — Four damaged specimens.

Dimensions of one specimen (in mm):

	F. XIV/287
Longest diameter . . .	0.33
Shortest diameter . . .	0.23
Height	0.16

Description as given by POŻARYSKA (1965). It should be added that the specimens from the Polish Carpathians are characteristized by finely spinous spiral side, whereas tests from the Polish Lowlands are smooth. Varying ornamentation of Polish representatives of *L. naheolensis* mentioned above is known within that species described from elsewhere (see MCGOWRAN, 1965).

Variation not significant primarily concerning thickness of raised sutures from the spiral side.

Remarks. — The specimens from the Polish Carpathians differ from those reported from Central Poland mostly in somewhat smaller size. The Polish specimens are undoubtedly conspecific with those known from the Paleocene of America and Australia.

Occurrence. — The species is recorded from: USA (Gulf Coastal Region), Sweden, Belgium, Poland (Polish Lowlands and Carpathians) and Australia; Middle and Upper Paleocene (?Eocene).

Lamarckina sp.

(Pl. X, Fig. 1)

Material. — Four specimens, of which only a single is complete.

Dimensions of one specimen (in mm):

	F. XIV/288
Longest diameter . . .	0.34
Shortest diameter . . .	0.30
Height	0.29

Description. — Test trochospiral, almost globular in shape, with only slightly flattened spiral side. Chambers rapidly and asymetrically growing in size as added, inflated, coiled in at least 2 whorls, of which the outer one consists of 5 chambers; sutures weakly incised, oblique. Almost the whole test surface, except for the small polished, protruding rim around the umbilicus, is ornamented by spiny tubercles. Umbilicus deep, opened, situated marginally near the inner whorl. Aperture — a low slit within umbilicus.

Remarks. — Specimens included into *Lamarckina* sp. are most similar to the *Lamarckina rugulosa* PLUMMER (1926), the species occurring among others in Polish Lowland (POŻARYSKA, 1965; POŻARYSKA and SZCZECHURA, 1968). From this latter *Lamarckina* sp. differs mainly in more globulous shape and ornamentation; in *Lamarckina* sp. representatives ornamentation appears in short distance from umbilicus, while in *L. rugulosa* whole, rather large umbilical part is quite smooth and glossy, and it has no elevated rim around the umbilicus.

Occurrence. — Polish Carpathians; Upper Paleocene.

Genus **EPISTOMINA** TERQUEM, 1883

Epistomina scalaris (FRANKE, 1927)

(Pl. XXI, Figs 2, 3)

1926. *Pulvinulina partschiana* (D'ORBIGNY); H. J. PLUMMER, p. 153, Pl. 11, Fig. 5.
1927. *Epistomina scalaris* FRANKE; A. FRANKE, p. 39, Pl. 4, Fig. 6.
1948. *Hoeglundina scalaris* (FRANKE); F. BROTZEN, p. 94, Pl. 15, Figs 2, 3.
1954. *Hoeglundina scalaris* (FRANKE); J. HOFKER, p. 198, Text-fig. 43.
1965. *Hoeglundina scalaris* (FRANKE); K. POŻARYSKA, p. 115, Pl. 19, Fig. 2.

1965. *Hoeglundina scalaris* (FRANKE); B. MCGOWRAN, p. 57.
1966. *Hoeglundina scalaris* (FRANKE); J. HOFKER, p. 292, Pl. 65, Fig. 143; p. 340, Pl. 82, Figs 189-190.
1967. *Epistomina scalaris* (FRANKE); U. OHM, p. 156, Pl. 29, Fig. 9, Text-fig. 50.
1970. *Epistomina scalaris* FRANKE; Y. KIESEL, p. 319, Pl. 21, Fig. 5.

Material. — Eighteen specimens poorly preserved.
Dimensions of two specimens (in mm):

	F. XIV/289	F. XIV/290
Longest diameter . . .	0.38	0.58
Shortest diameter . . .	0.34	0.54
Height	0.20	0.34

Description as given by POŻARYSKA (1965).

Variation significant, concerning size of specimens and number of chambers in the last whorl which varies from 7 to 9.

Remarks. — The specimens from the Paleocene of the Polish Carpathians have more numerous chambers than those reported from the Montian of the Polish Lowlands; however, they fall within the limits of variability of representatives of this species known from the Paleocene of Denmark, Sweden, and extra-European Paleocene. The forms assigned to *Epistomina scalaris* by FRANKE (1927) are very similar to *Epistomina elegans* (D'ORBIGNY, 1826) and *E. partschiana* (D'ORBIGNY, 1846) described from the Neogene of the western Europe, being only somewhat lower and more strongly keeled. Some authors, as e.g. CUSHMAN (1936), regard all these three species as conspecific. According to the present authors, *Epistomina scalaris* is the ancestral species for *E. elegans* (D'ORBIGNY).

Occurrence. — The species seems to be typical for epicontinental facies; it is reported from: North America (Gulf Coastal Region of USA), Europe (Germany, Holland, Sweden, Austria, Polish Lowlands and Carpathians) and Australia; Upper Cretaceous — Eocene.

Epistomina cf. **juliae** MJATLIUK, 1949

(Pl. XXVIII, Figs 3-5)

Material. — Seven specimens, most of them well preserved.
Dimensions of three specimens (in mm):

	F. XIV/291	F. XIV/292	F. XIV/293
Longest diameter . . .	0.51	1.04	0.61
Shortest diameter . . .	0.47	1.03	0.53
Height	0.28	0.53	0.34

Description. — Test large, massive, solid, trochospiral, almost equally biconvex. Peripheral outline more or less lobulate; peripheral margin acute, with slit-like accessory apertures on umbilical side. On spiral side at least 2 whorls may be found, the outer one of which contains 5-6 chambers; on the umbilical side only chambers of the last whorl surrounding closed umbilical area are found. On umbilical side, sutures almost radial, strongly thickened and highly raised, joing ovate, elevated ridge in the middle. On spiral side, sutures limbate, more or less irregularly ornamented, and protruding to a different degree; sutures from spiral side generally more elevated than those from umbilical side. Test surface in inter-sutural spaces smooth, spiny nodose or rugose. Aperture slite-like, at the base of the last chamber on umbilical side; accessory lateromarginal apertures particularly well-developed along younger chambers where they are parallel to the periphery and bordered by prominent rims.

Variation significant, concerning the size of tests and most probably related to different stages of ontogenetic development. Test ornamentation also appears highly variable; besides differences in test ornamentation and projection of sutures, which were mentioned above, it should be noted that ribs following the course of sutures may be sometimes enlarged and pitted, as in the case of the holotype of *E. juliae*, figured by MJATLIUK (1949). Moreover, ribs continuing across inter-suture spaces may form reticulate network-like ornamentation, which passes into rugose relief of the test.

Small-size specimens, presumably representing juvenile forms, have more lobate peripheral outline and more regular but simpler ornamentation than large, presumably adult forms. The specimens here refered to *Epistomina* cf. *juliae* may represent more than one species, but their number is too small and the state of preservation insufficient for any further identifications.

The specimens from the Paleocene of the Carpathians are very close to those assigned to *E. juliae* by MJATLIUK (1949), described from the Lower Cretaceous of the south-western USSR (Caspian sea region) and also reported from the Lower Cretaceous of Poland (GAWOR-BIEDOWA, 1972), mainly differing from them in richer ornamentation, and particularly in granose or rugose test surface. The species *E. juliae* MJATLIUK seems to be conspecific with *E. colomi* SIGAL, 1949, described from the Albian of Algeria; however, the comparison is based on rather schematic figure of the latter species, hence cannot be univocal. *Epistomina charlottae* VIEAUX (1941) (see Cat. of Foram.) from the Lower Cretaceous of the USA (Texas) resembles the above two species, but according to the figure given by its author, it differs from these species in more regular and simpler ornamentation and in poorly developed peripheral apertures.

It should be mentioned that recently DAIN (1970) included the species *E. juliae* together with a number of other species to his new genus, *Mironovella*, which, according to the present authors, is congeneric with *Epistomina*. Others synonyms of the genus *Epistomina* were discussed by LOEBLICH and TAPPAN (1964).

Occurrence. — The species occurs in Polish Carpathians and Austrian Alps (Graben loc.); Paleocene; Similar forms occur in beds no younger than Lower Cretaceous.

Genus **STOMATORBINA** DORREEN, 1948

Stomatorbina cf. **torrei** (CUSHMAN & BERMUDEZ, 1937)

(Pl. XXXVI, Fig. 5)

?1972. *Stomatorbina* cf. *torrei* CUSHMAN & BERMUDEZ; Y. TAMBAREAU, p. 231, Pl. 11, Figs 1, 2.

Material. — One specimen poorly preserved.

Dimensions of one specimen (in mm):

	F. XIV/294
Longest diameter . . .	0.74
Shortest diameter . . .	0.33
Height	0.88

Description. — Test solid, plano-convex, compressed. Spiral side with slightly elevated inner whorl and inflated last chambers of outer whorl; umbilical side somewhat concave, umbilicate. Peripheral outline almost entire; peripheral margin narrowly rounded, thickened. The last whorl, the only one visible on umbilical side, consisting of 7 chambers; chambers

rather slowly increasing in size as added. Peripheral thickening, particularly well-marked on spiral side, passing there into sutural thickening. Sutures curved on spiral side, while almost radial and flush with the surface on umbilical side. Clear space on umbilical side of each chamber, typical of the genus *Stomatorbina*, well-visible. Aperture slit-like, situated at the base of the last chamber on umbilical side, extending to the umbilicus. Umbilicus with flaps overlapping one another.

Remarks. — The specimen here assigned to *Stomatorbina* cf. *torrei* (CUSHMAN & BERMUDEZ) resembles the figured representative of *Lamarckina* (recte *Stomatorbina*) *torrei* CUSHMAN and BERMUDEZ (1937), described from the Eocene of Cuba. However, there may be some differences in the development of umbilical side; the umbilical side of the Cuban specimen was not figured and CUSHMAN and BERMUDEZ (1937) did not mention flaps surrounding umbilicus, which occur in the Polish specimen. Moreover, there are 5-6 chambers in the last whorl of the Cuban specimen, in comparison with 7 found in the last whorl of the Polish specimen.

Lamarckina torrei CUSHMAN & BERMUDEZ (1937) was emended by DORREEN (1948) who erected the genus *Stomatorbina* on the basis of this species. The specimens from the Eocene of New Zealand, assigned by DORREN (1948) to *S. torrei* differ from the Cuban and Polish ones in being more biconvex and in having more prominent thickening on spiral side. Those features fring DORREN'S specimens closer to the specimen figured and described from the Paleocene of Polish Lowlands as *Stomatorbina* sp. by POŻARYSKA and SZCZECHURA (1968).

A specimen transitional between the specimens of CUSHMAN & BERMUDEZ, and DORREN in general test outline and in development of sutures, and having 7 chambers in the last whorl was described as *Stomatorbina torrei* by HINTE (1963) from the Paleocene of Austria. The Austrian form differs from the Polish one in less inflated last chamber, not elevated internal whorl, and in deeper and more widely open umbilicus. *Stomatorbina* cf. *torrei* may be related to *Discorbis* (recte *Stomatorbina*) *magna* VIALLI var. *aequitanica* NEUMANN and BOULANGER, 1954, the species described from the Miocene of France, and to *Stomatorbina ranikotensis* HAQUE (1956) the species described from the Paleocene of Pakistan. The last two species were compared with *Stomatorbina torrei* (CUSHMAN & BERMUDEZ) by HINTE (1963).

The specimens from the Upper Cretaceous and Danian of Holland and Danian of Denmark, referred by HOFKER (1966) to *Mississipina binkhorsti* (REUSS, 1962) seem to belong to the genus *Stomatorbina*, as they have supplementary apertures on the umbilical side instead of peripheral aperture. Thus, it may even be supposed that these specimens are related to the *Stomatorbina torrei* group. Original *Rosalina* (recte *Discorbinella*) *binkhorsti* REUSS (1862) is devoid of bands of clear shell material on the umbilical side, which are visible in HOFKER'S (1966) specimens, and is not related to the *Stomatorbina torrei* group.

Stomatorbina cf. *torrei* (CUSHMAN & BERMUDEZ) figured by TAMBAREAU (1972) from the Thanetian of France (Pyrrennes) differs from the Polish specimen only in the number of chambers in the last whorl; so these two forms may be at least closely related.

Occurrence. — Polish Carpathians; Upper Paleocene; *Stomatorbina torrei* occurs in Upper Cretaceous — Lower Paleocene sediments.

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Systematic names cited only are indicated by *italic*, and names accompanied by descriptions are indicated by roman letters.

Numerals which indicate the page, on which the species is cited only, are standart; numerals which indicate pages with descriptions, are **bold.**

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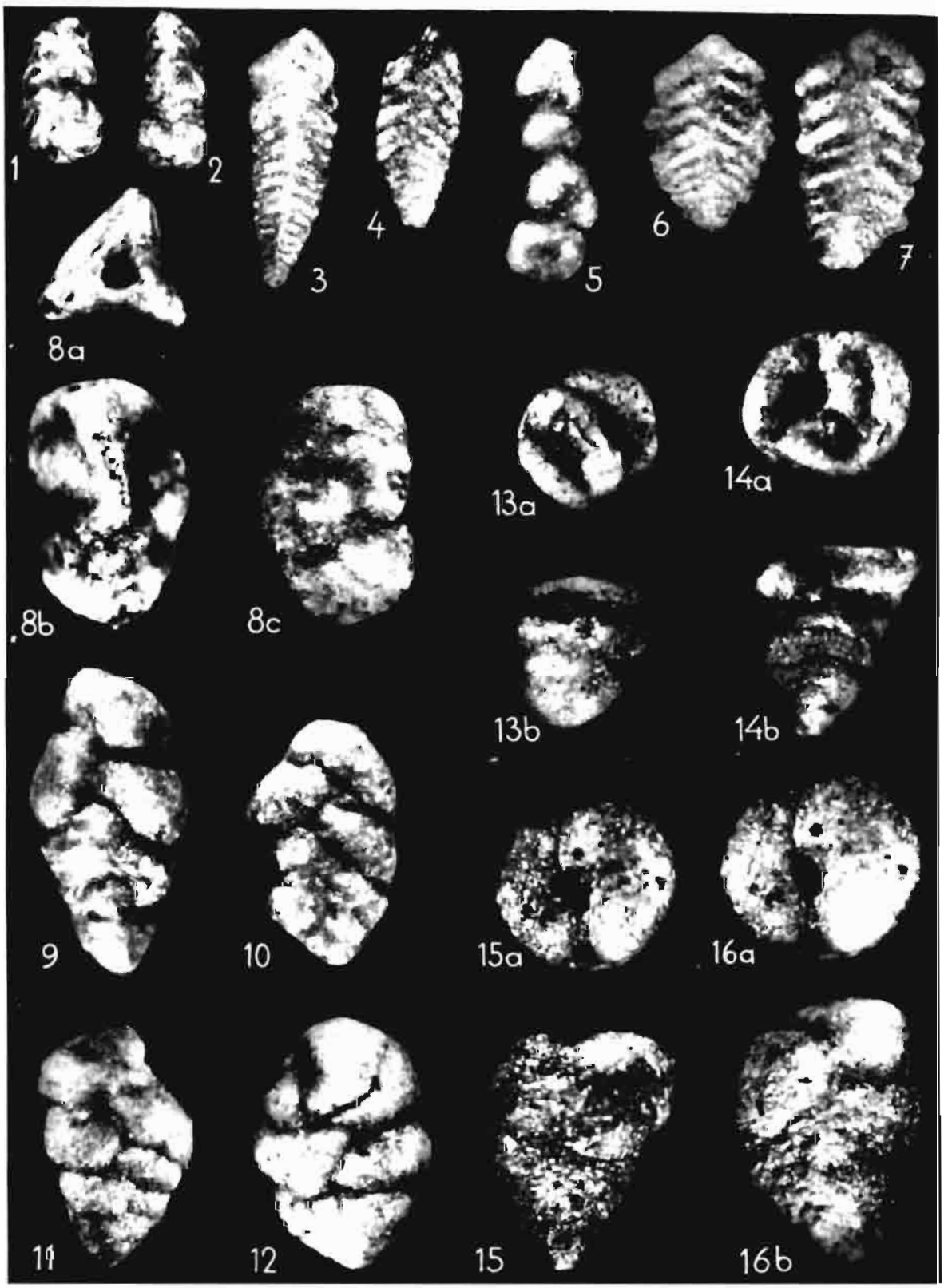
PLATES

Palaeontologia Polonica, No. 31, 1974

PLATE I

All specimens from Babica clays, Babica loc.



J. SZCZECHURA & K. POŻARYSKA: PALEOCENE FORAMINIFERS OF CARPATHIANS

PLATE II

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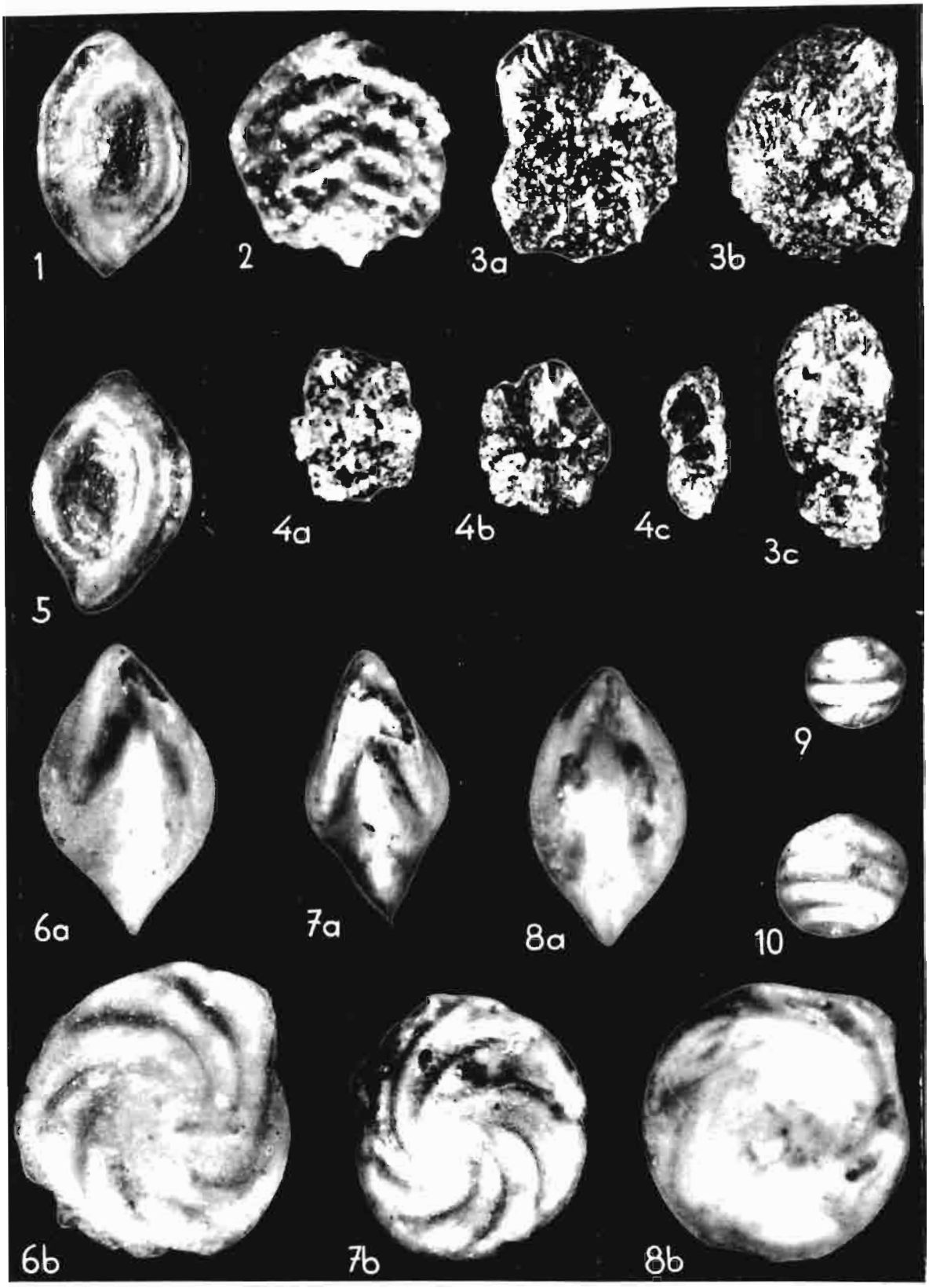
All specimens from the Babica clays, Babica loc.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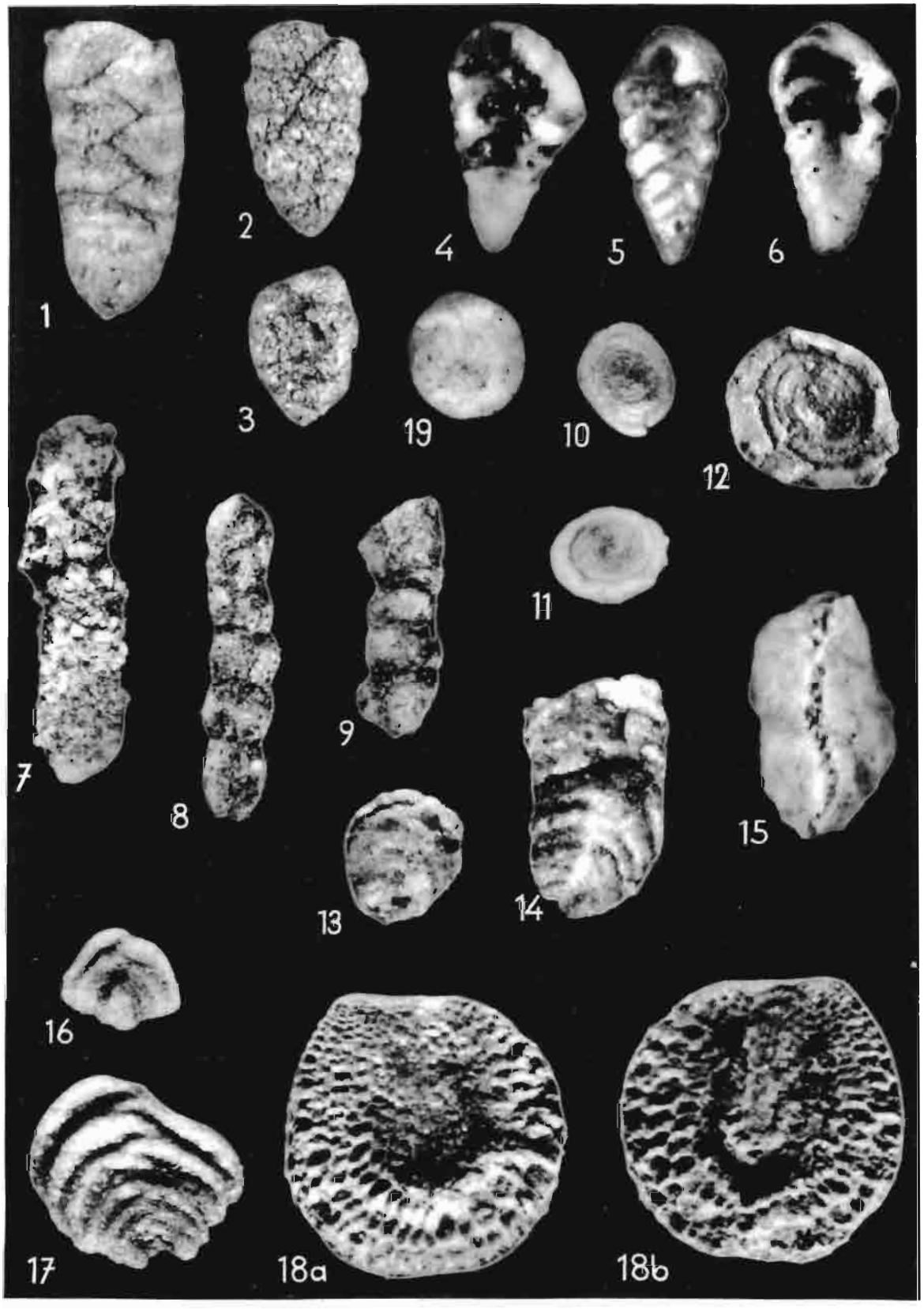
(F. XIV/7), side view, approx. × 40.

All specimens from Babica clays, Babica loc.



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Figs 1-4. *Pseudonodosaria manifesta* (REUSS, 1851) 45
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Figs 10-12. *Frondicularia biformis* MARSSON, 1878 42
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Fig. 19. *Vaginulina* sp. 46
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Fig. 20. *Lenticulina velascoensis* (WHITE, 1928) 42
(F. XIV/51), approx. × 130; Fig. 20*a* — peripheral view; Fig. 20*b* — side view.

All specimens from Babica clays, Babica loc.

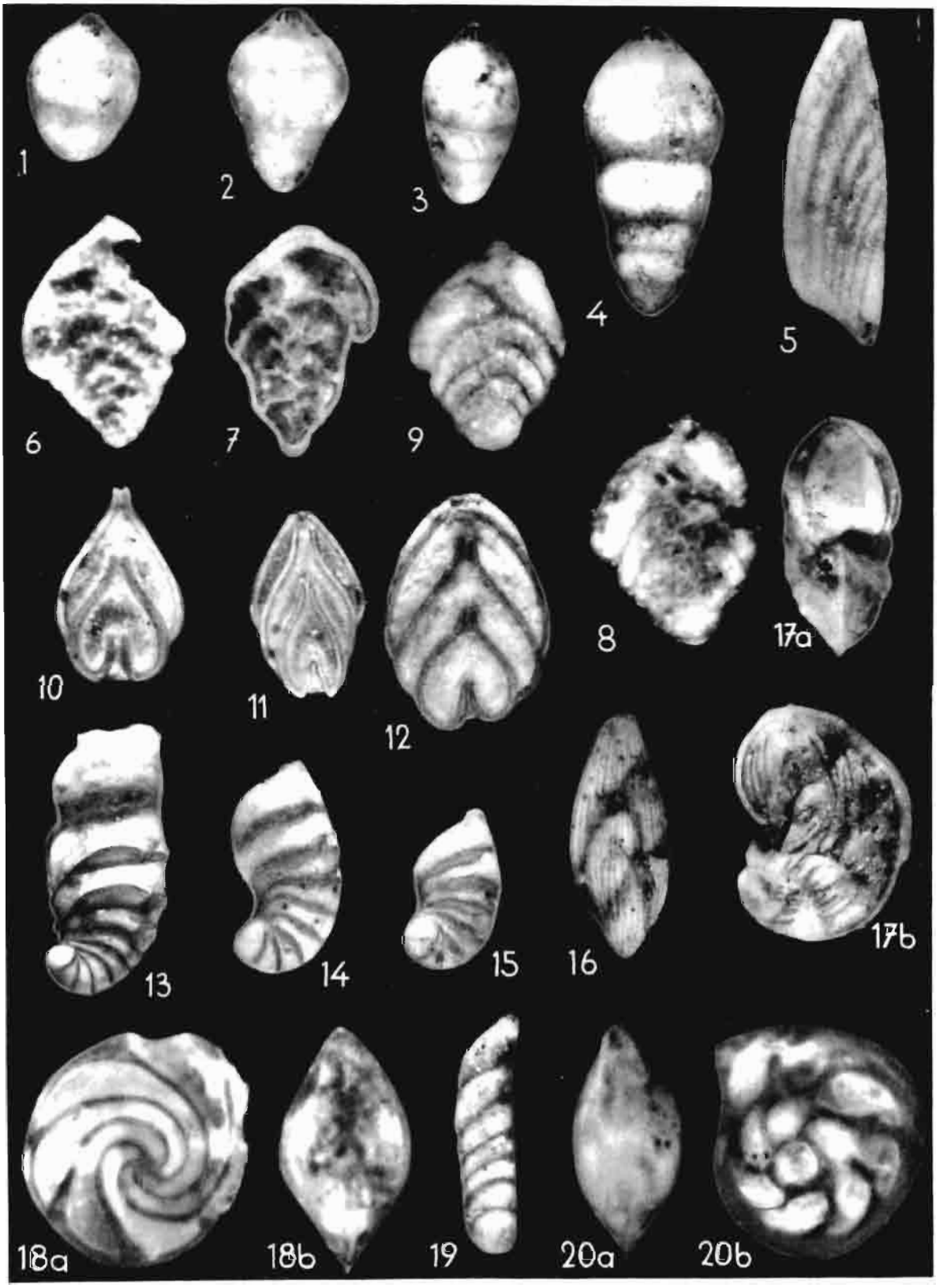
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PLATE V

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Figs 1-4. *Loxostomoides applinae* (PLUMMER, 1926) 50
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Figs 10-12. *Bulimina velascoensis* WHITE, 1929 54
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Figs 14, 15. *Pyramidina crassa* BROTZEN, 1948 47
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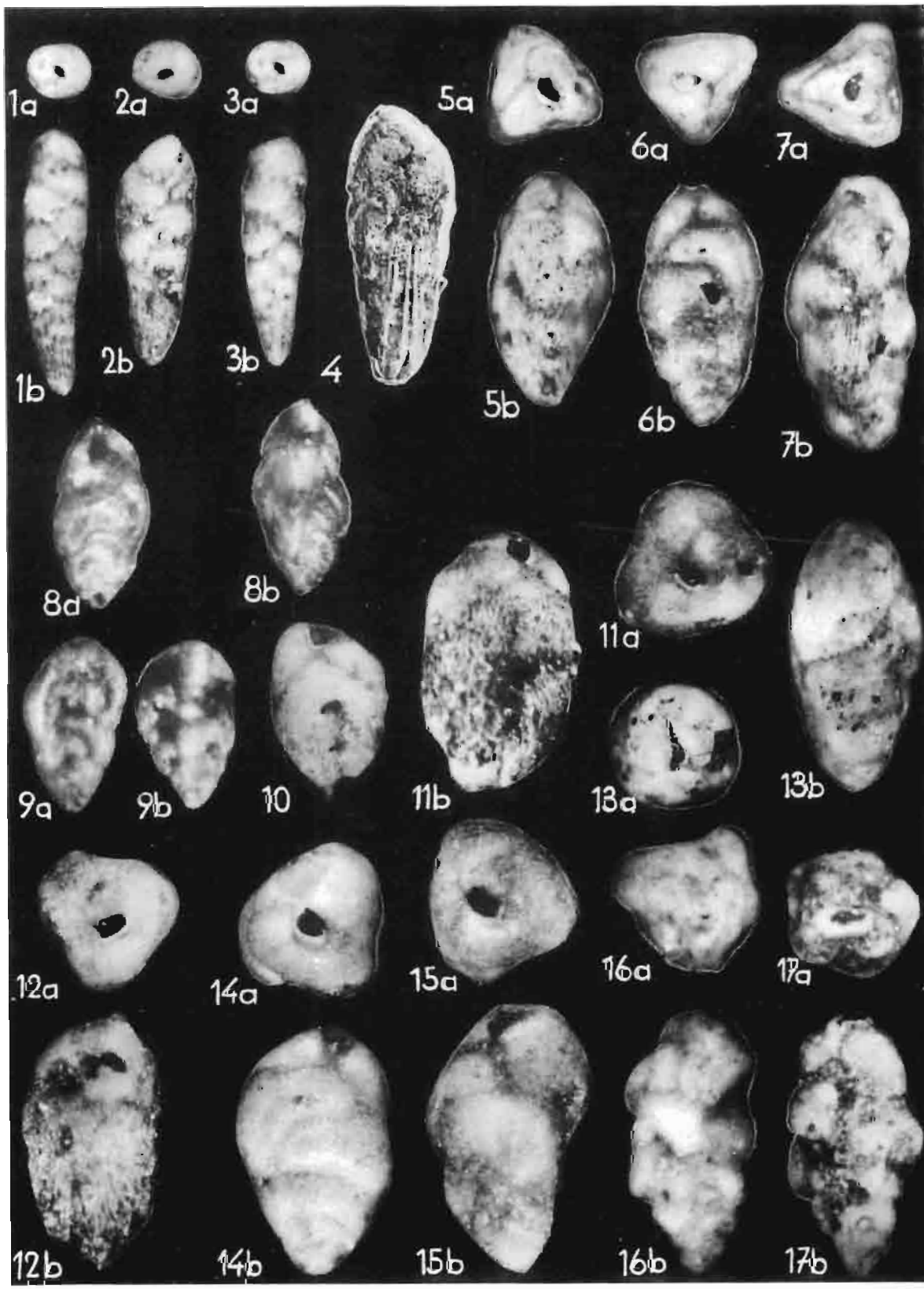
All specimens from Babica clays, Babica loc., except for those on Figs 2, 3, which are from Paleocene (Midway Fm.), Texas.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Figs 2-7. *Bulimina midwayensis* CUSHMAN & PARKER, 1936 52
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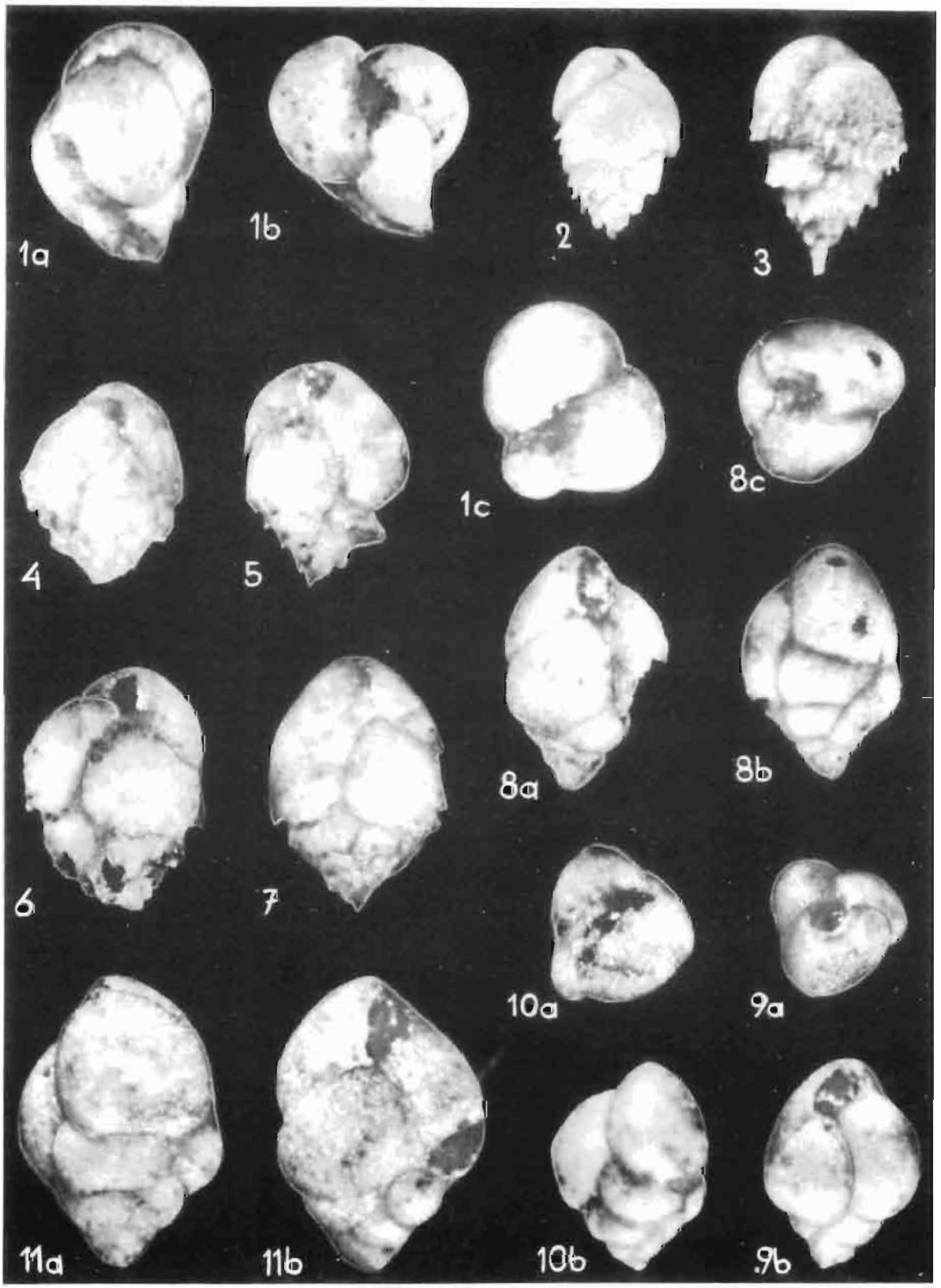
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Figs 1, 2, 6-9. *Asterigerina* cf. *noervangi* BROTZEN, 1948 59
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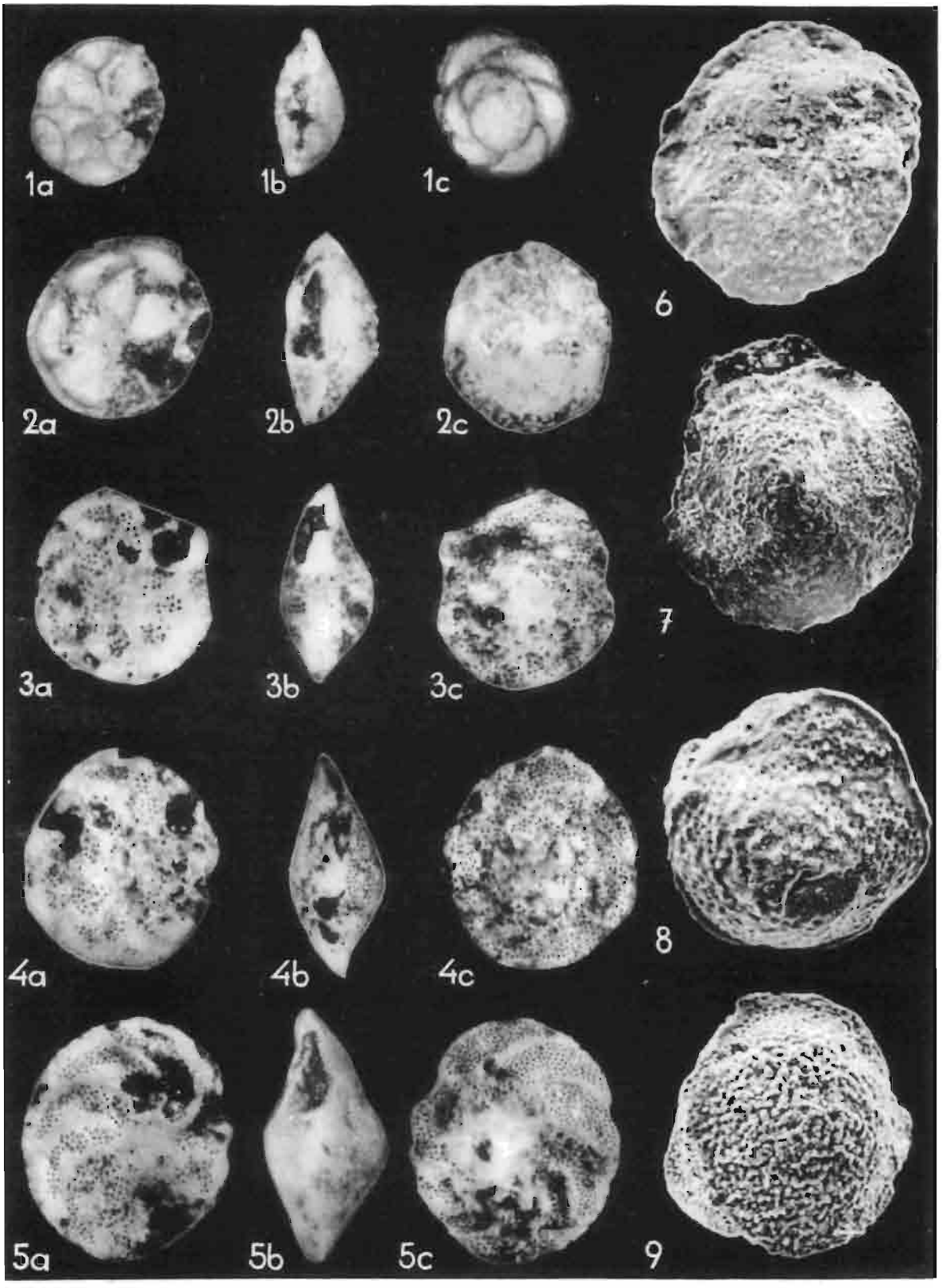
All specimens from Babica clays, Babica loc.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Figs 1, 2. *Epistominella* cf. *limburgensis* (VISSER, 1951) 58
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Fig. 5. *Cibicides sahlstroemi* BROTZEN, 1948 89
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Fig. 6. *Lamarckina naheolensis* CUSHMAN & TODD, 1942 119
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All specimens from Babica clays, Babica loc.

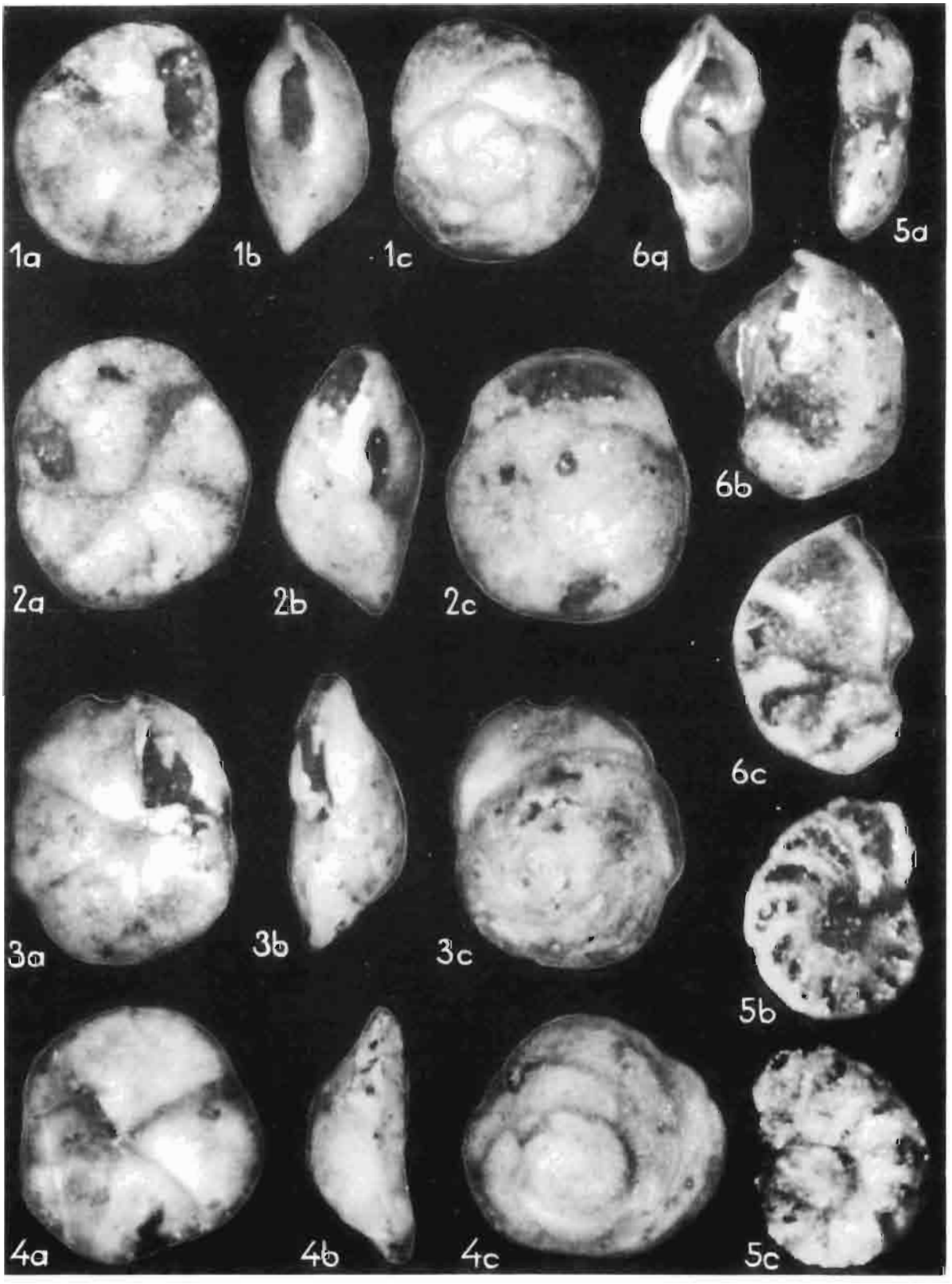
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Fig. 1. *Pullenia coryelli* WHITE, 1929 95
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Figs 2-4. *Alabamina* cf. *wilcoxensis* TOULMIN, 1941 97
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Fig. 5. *Pullenia quinqueloba* (REUSS, 1851) 96
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Fig. 6. *Gyroidinoides pontoni* BROTZEN, 1948 102
(F. XIV/241), approx. × 130; Fig. 6*a* — spiral side; 6*b* — umbilical side; 6*c* — peripheral view.

All specimens from Babica clays, Babica loc.

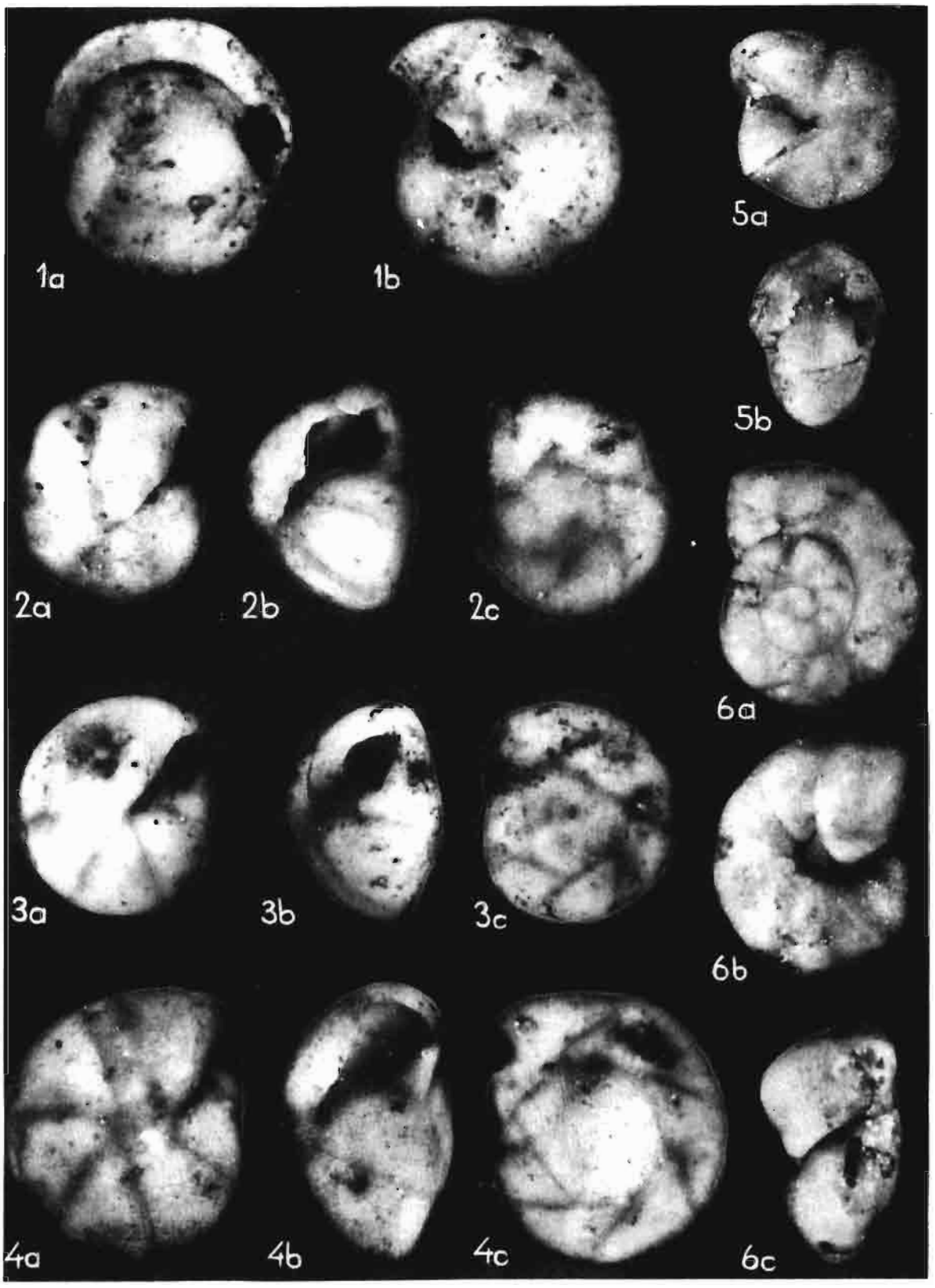

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Fig. 1. *Lamarckina* sp. 120
(F. XIV/288), approx. × 120; Fig. 1*a* — somewhat oblique, umbilical side; Fig. 1*b* — spiral side; Fig. 1*c* — peripheral view with partly seen umbilical side.

Fig. 2. *Gyroidinoides girardana* (REUSS, 1851) 101
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Figs 3-5. *Osangularia plummerae* BROTZEN, 1940 100
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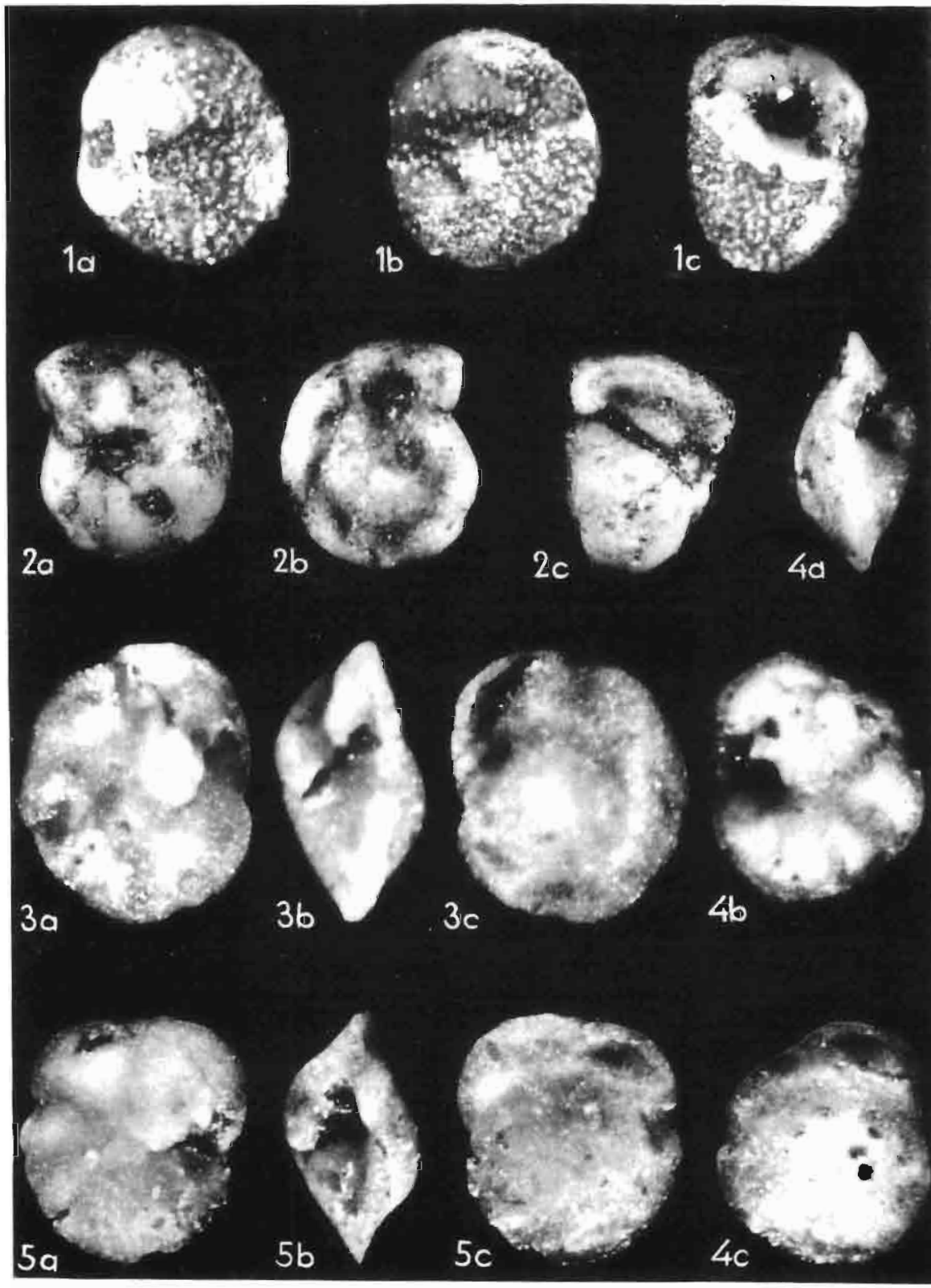
All specimens from Babica clays, Babica loc.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Figs 1, 2. *Nuttalides truempyi* (NUTTALL, 1930) 62
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Figs 3-5. *Valvulineria alpina* HILLEBRANDT, 1962 62
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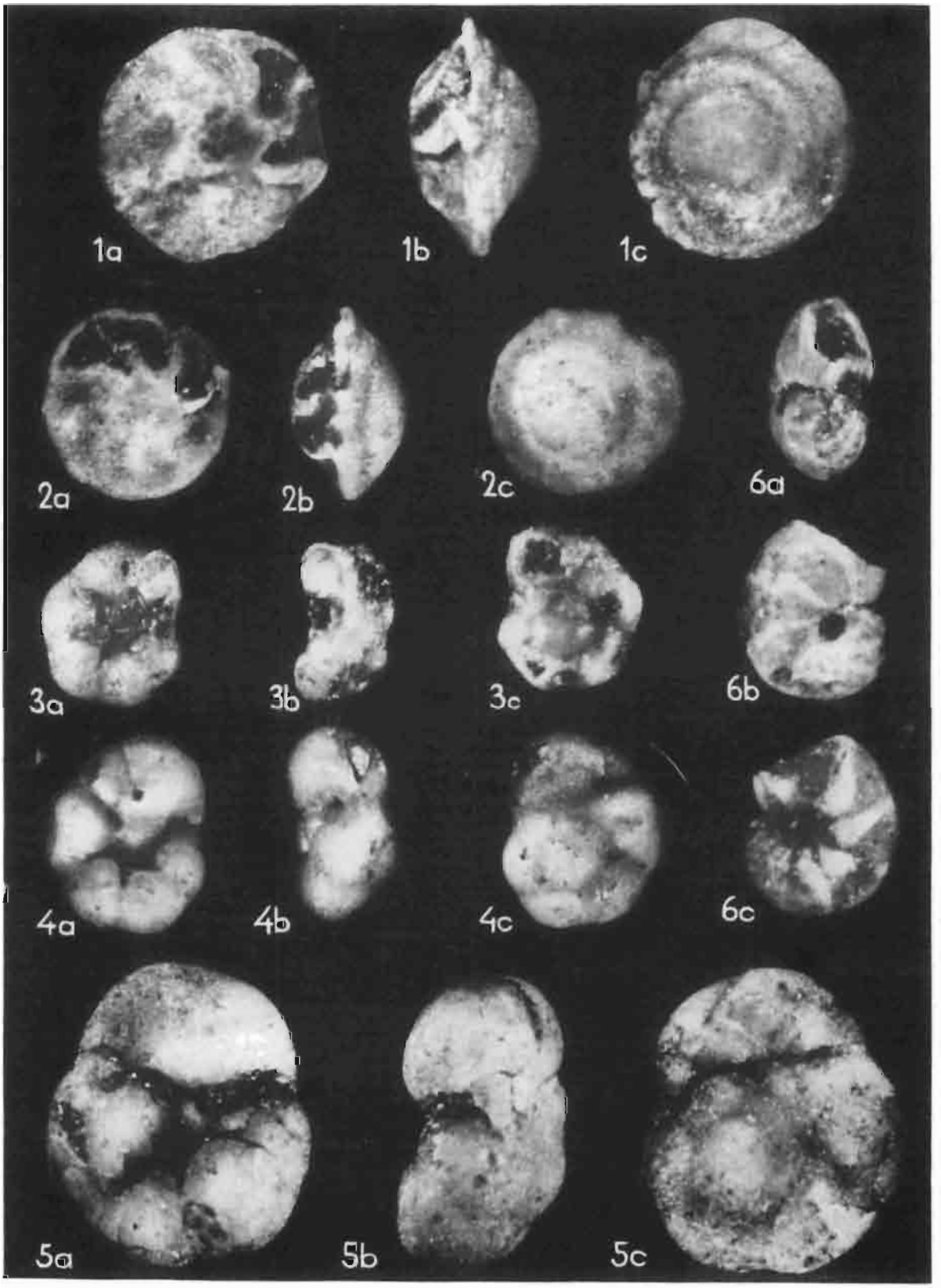
Fig. 6. *Ceratobulimina perplexa* (PLUMMER, 1926) 118
(F. XIV/285), approx. × 80; Fig. 6*a* — peripheral view; Fig. 6*b* — spiral side; Fig. 6*c* — umbilical side.

All specimens from Babica clays, Babica loc.



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Figs 1, 2. *Anomalina umbilicata umbilicata* (BROTZEN, 1948) 107
(F. XIV/324, 323), approx. × 120; Figs 1*a*, 2*a* — spiral sides; Figs 1*b*, 2*b* — umbilical sides; Figs 1*c*, 2*c* — peripheral views.

Figs 3, 4. *Osangularia* cf. *crassaformis* (CUSHMAN & SIEGFUS, 1935) 100
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Figs 5-7. *Rotalia saxorum* D'ORBIGNY 1850 65
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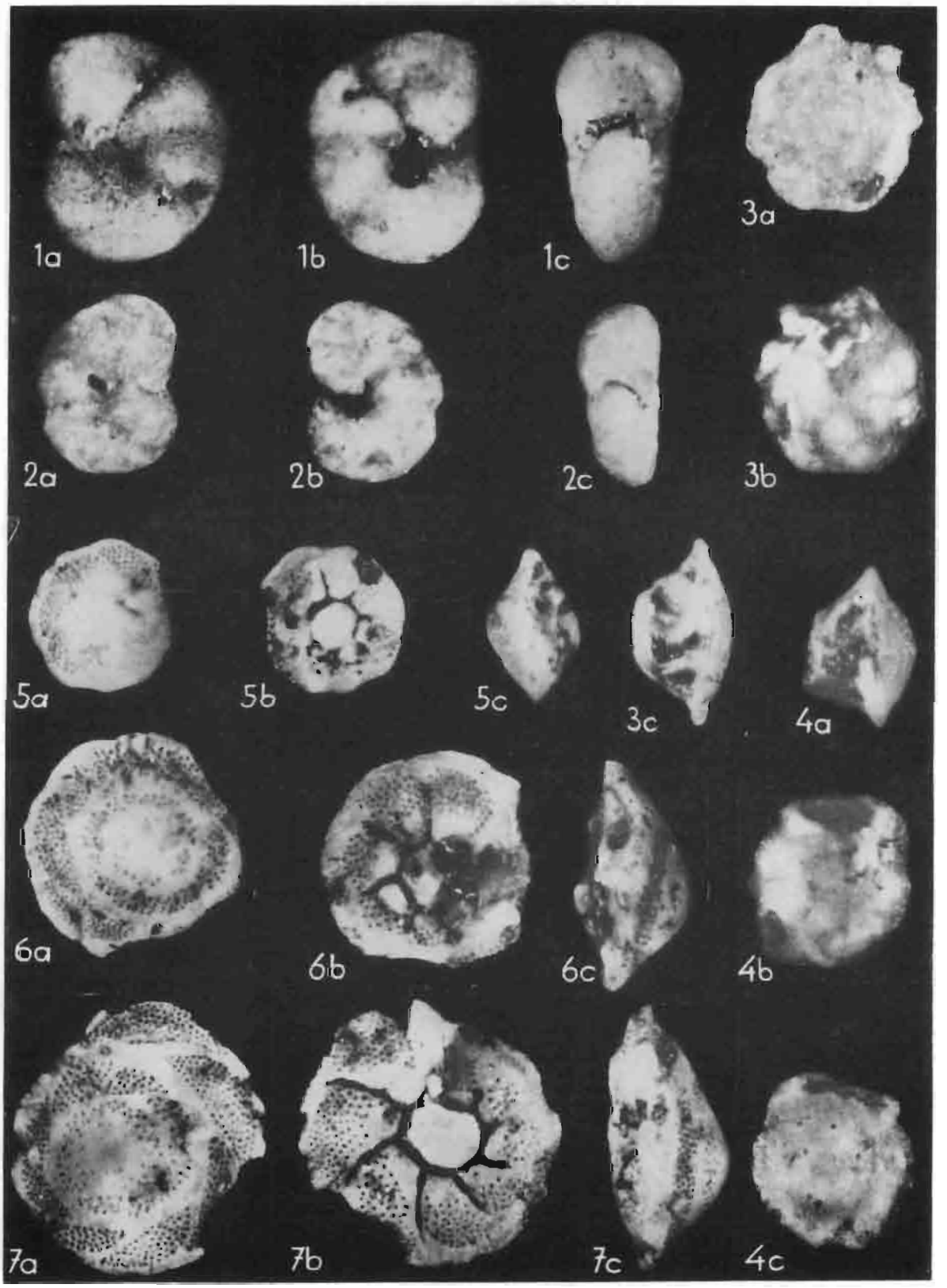
All specimens from Babica clays, Babica loc.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Figs 1, 2, 4. *Pararotalia tuberculifera* (REUSS, 1862) 67
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Figs 3, 5-8. *Rotalia lithothamnica* UHLIG, 1886 64
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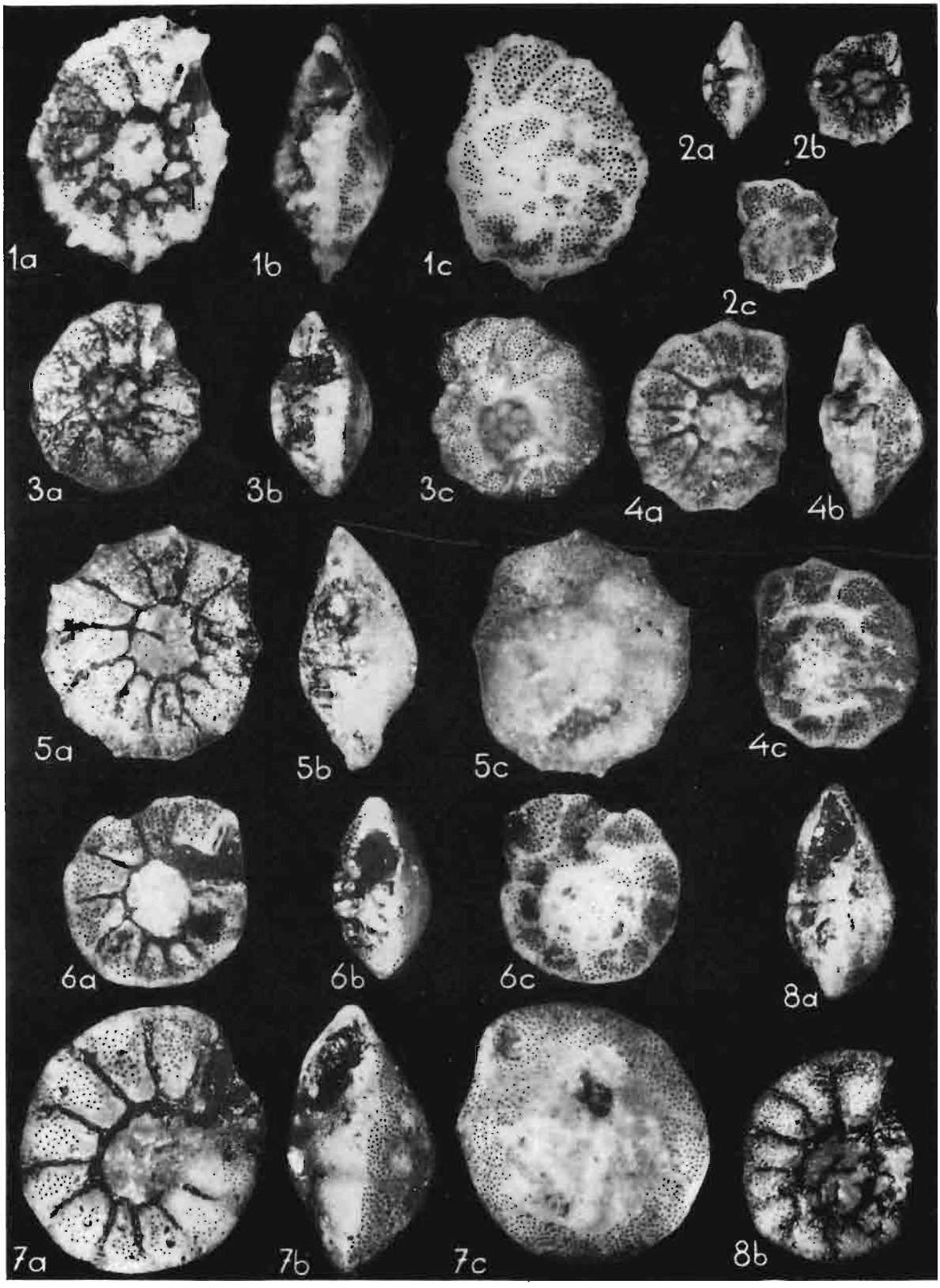
All specimens from Babica clays, Babica loc.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Figs 1-3. *Pararotalia globigeriniformis* (VAN BELLEN, 1946) 66
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Figs 4-7. *Pararotalia minimalis* HOFKER, 1966 66
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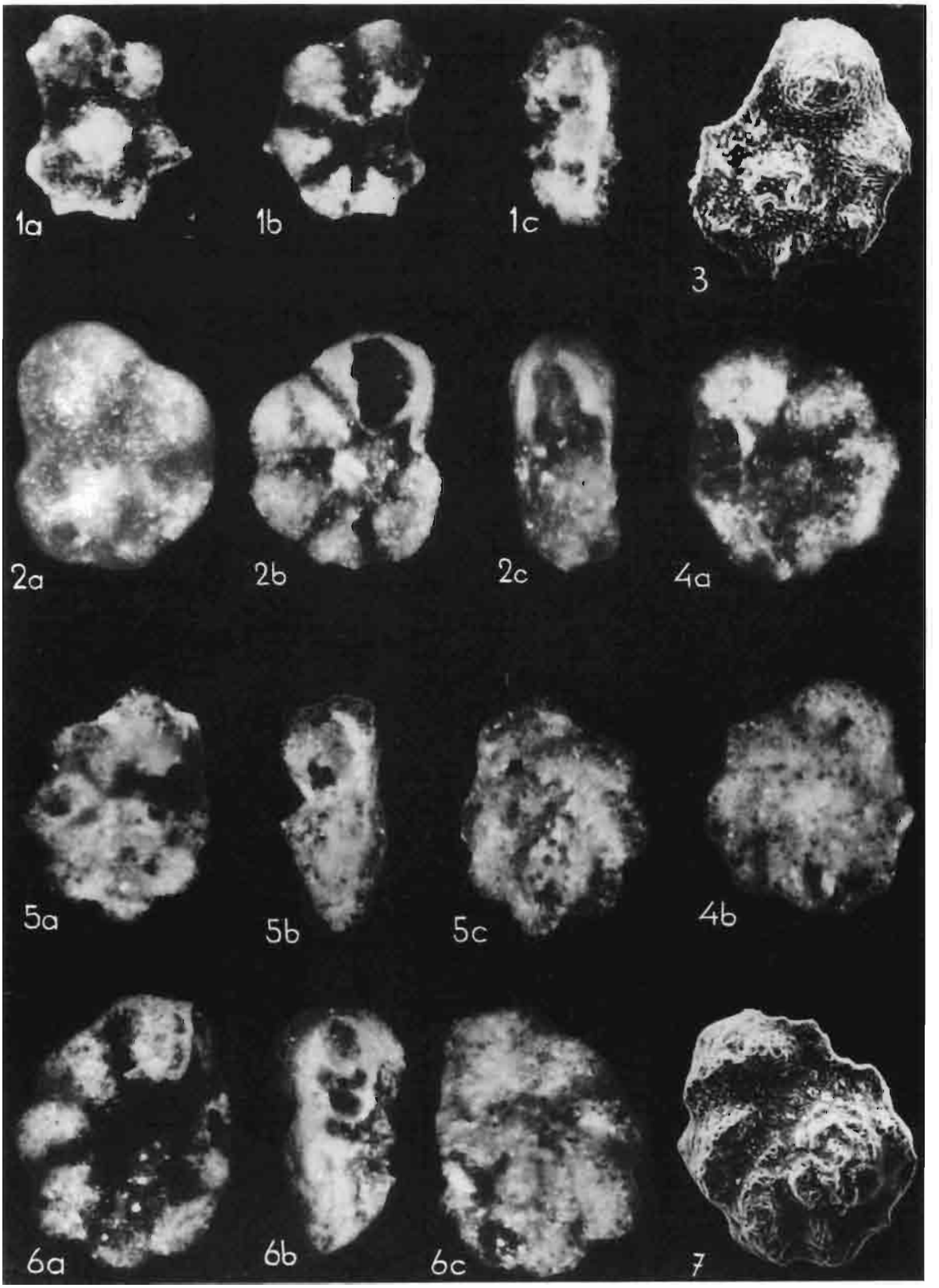
All specimens from Babica clays, Babica loc.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Figs 1-4. *?Pararotalia* cf. *minuta* (COLOM, 1954) 68
(F. XIV/310, 136, 311, 312), approx. × 100 (for SEMicrographs, Figs 1, 2, approx. × 170); Figs 1, 2*b*, 3, 4*c* — spiral sides; Figs 2*a*, 4*b* — peripheral views; Fig. 4*a* — umbilical side.

Figs 5, 6. *Rosalina parisiensis* D'ORBIGNY, 1826 61
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Figs 7-10. *?Neoeponides* cf. *acria* (LOEBLICH & TAPPAN, 1946) 85
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Fig. 11. *Planispirillina striatogranulosa* (TERQUEM, 1882) 63
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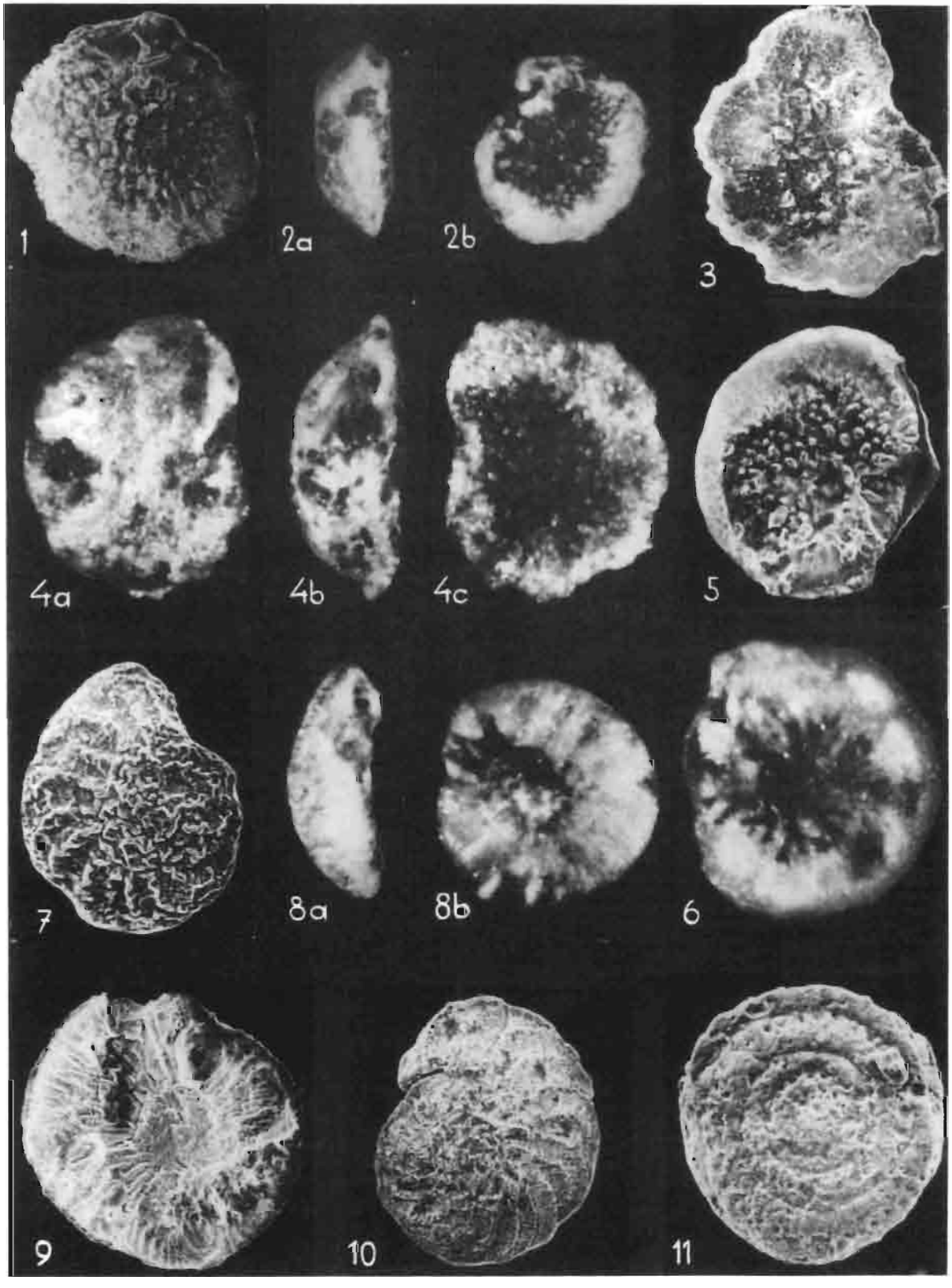
All specimens from Babica clays, Babica loc.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Figs 1, 2. *Eponides subcandidulus* (GRZYBOWSKI, 1896) 84
(F. XIV/179, 180), approx. × 60; Figs 1*a*, 2*a* — umbilical sides; Figs 1*b*, 2*b* — peripheral views; Figs 1*c*, 2*c* — spiral sides.

Figs 3, 4. *Gyroidinoides* cf. *globosa* (HAGENOW, 1842) 103
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Figs 5-7. *Eponides megastomus* (RZEHAK, 1838) 83
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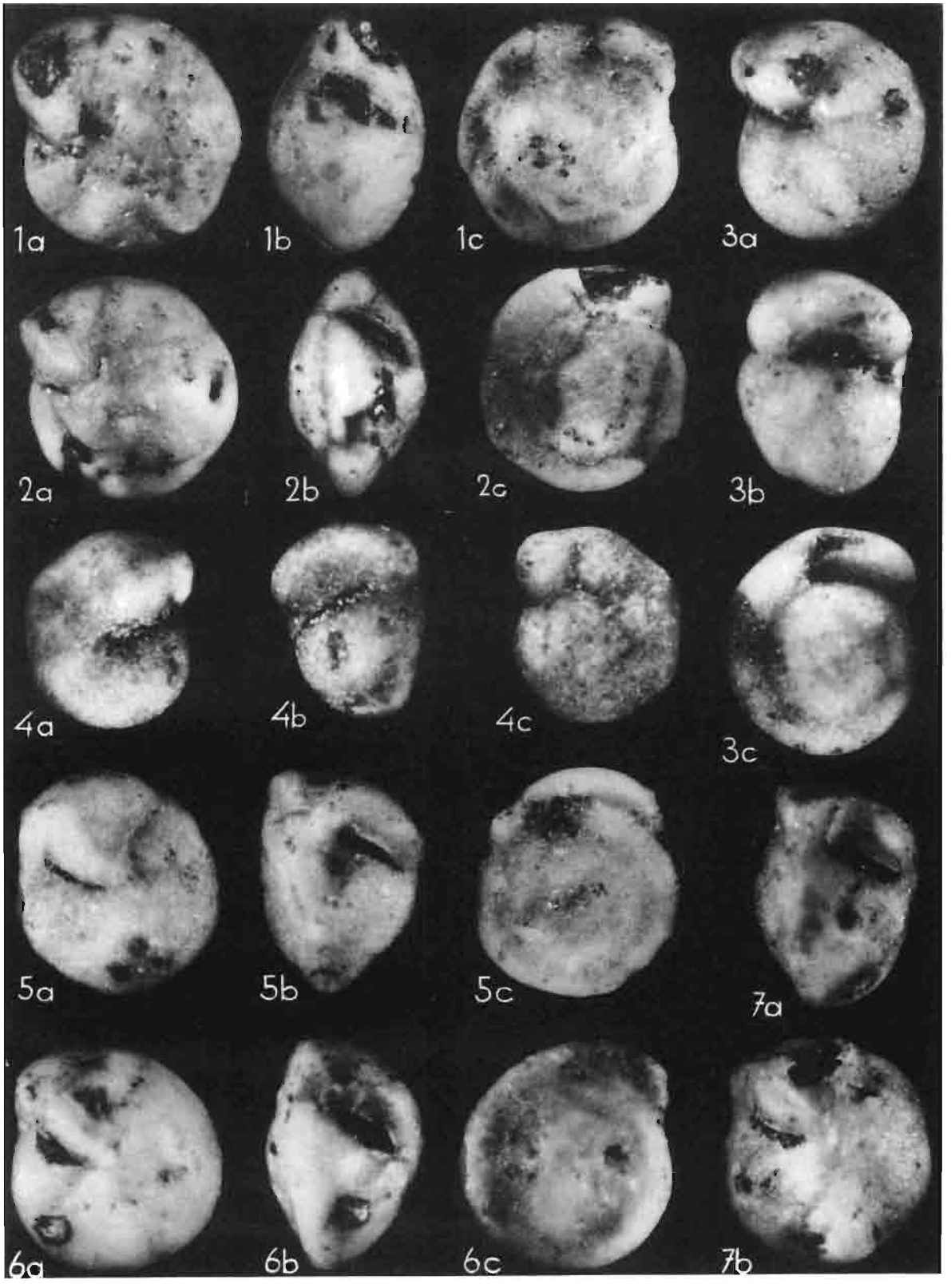
All specimens from Babica clays, Babica loc.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Figs 1, 2. *Eponides umbonatus* (REUSS, 1851) 84
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Figs 3, 4. *Gyroidina babicensis* n. sp. 98
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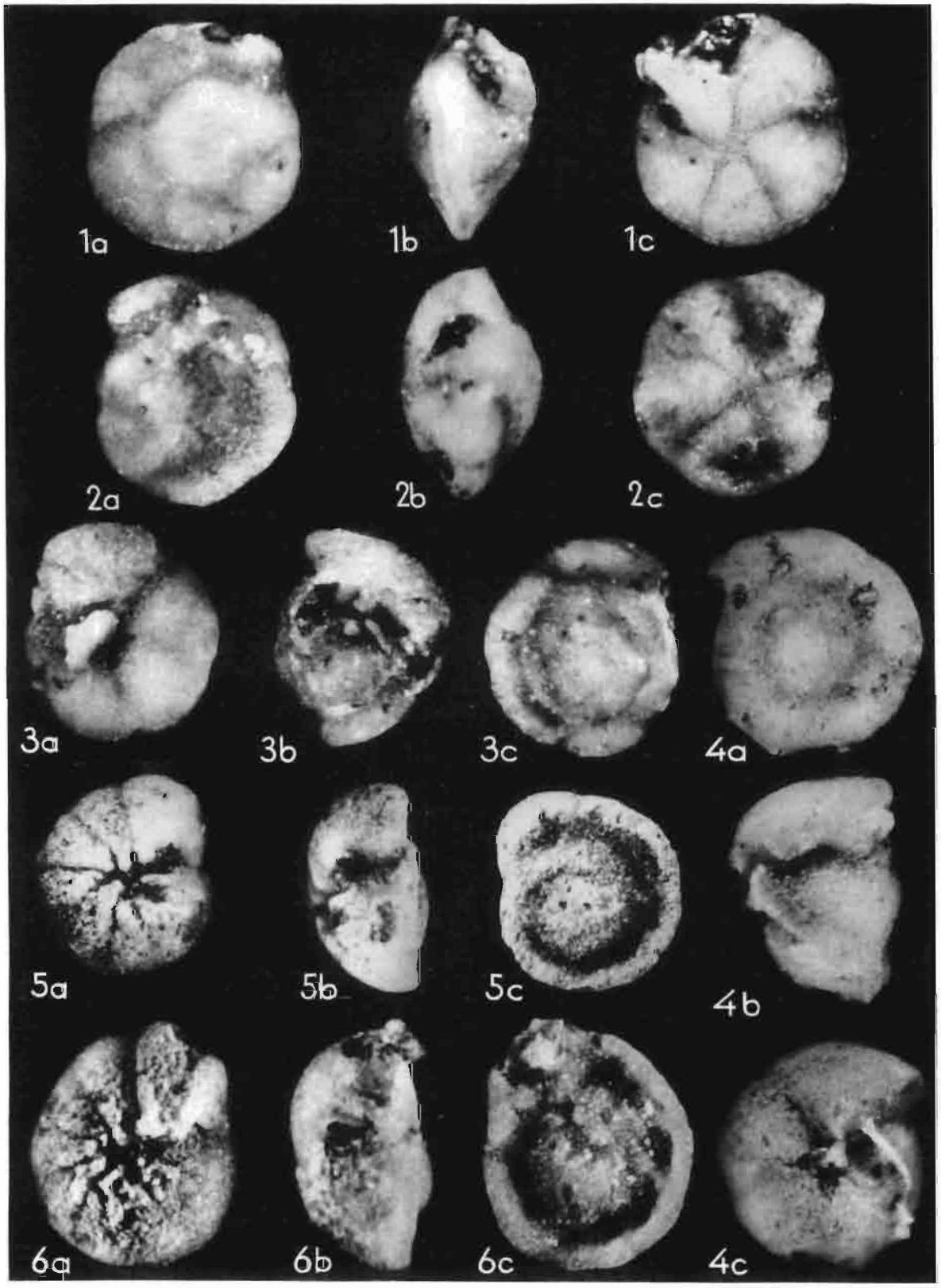
Figs 5, 6. *Stensioeina svnimelechi* (REISS, 1952) 115
(F. XIV/277, 276), approx. × 90; Figs 5*a*, 6*a* — umbilical sides; Figs 5*b*, 6*b* — peripheral views; Figs 5*c*, 6*c* — spiral sides.

All specimens from Babica clays, Babica loc.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Figs 1, 5. *Karreria fallax* RZEHAK, 1891 114
(F. XIV/270, 271), approx. × 80; Figs 1*a*, 5*c* — peripheral views; Figs 1*b*, 5*a* — spiral sides; Figs 1*c*, 5*b* — umbilical sides.

Figs 2-4. *Paralabamina toulmini* (BROTZEN, 1948) 97
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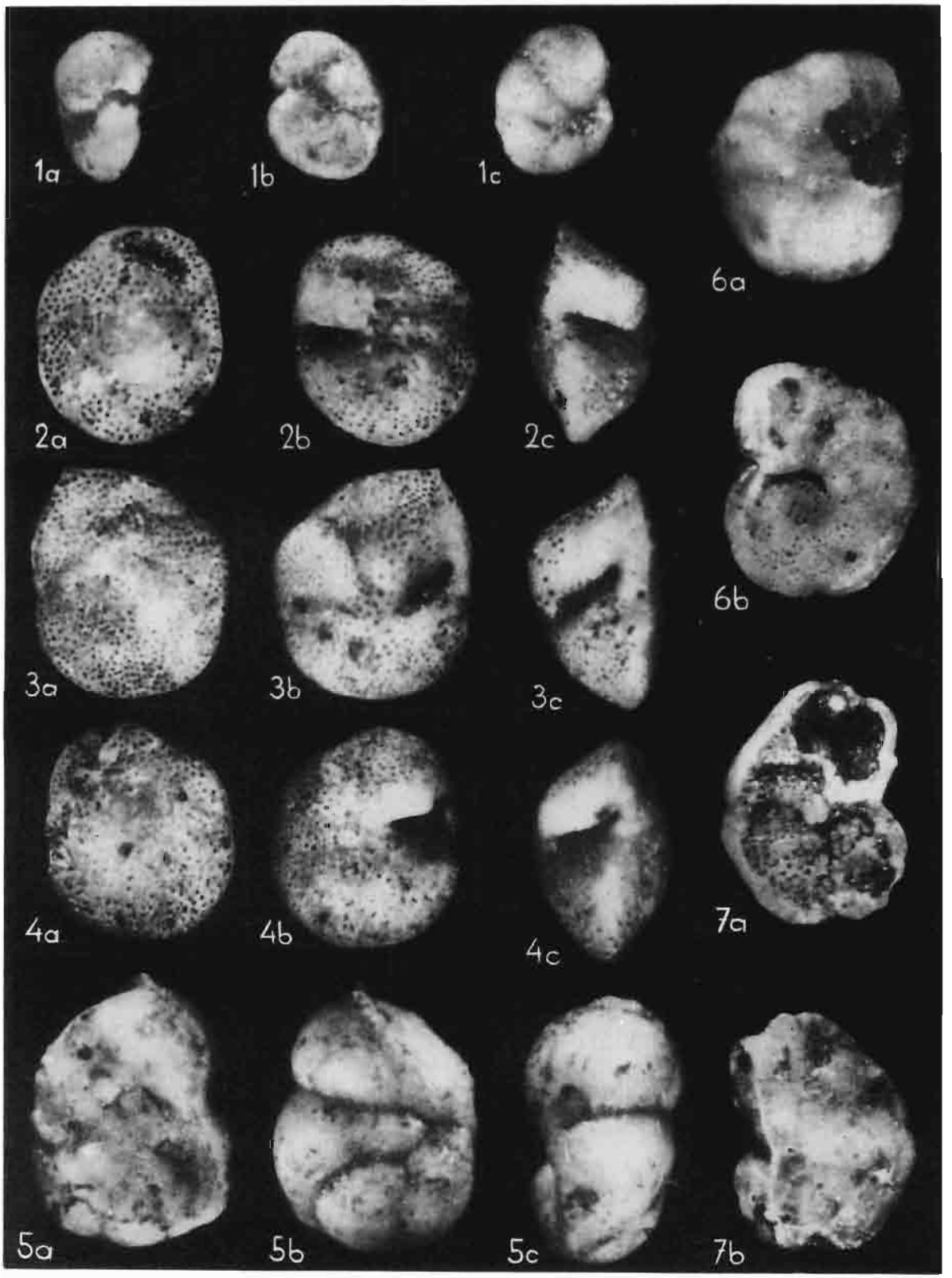
Figs 6, 7. *Cibicides carinatus* (TERQUEM, 1882) 86
(F. XIV/187, 188), approx. × 100; Figs 6*a*, 7*b* — umbilical sides; Figs 6*b*, 7*a* — spiral sides.

All specimens from Babica clays, Babica loc.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Figs 1, 2. *Cibicides succedens* BROTZEN, 1948 89
(F. XIV/203, 204), approx. × 75; Figs 1*a*, 2*a* — umbilical sides; Figs 1*b*, 2*b* — peripheral views; Figs 1*c*, 2*c* — spiral sides.

Figs 3-5. *Cibicides proprius* (BROTZEN, 1948) 88
(F. XIV/199, 197, 198), approx. × 60; Figs 3*a*, 4*a*, 5*c* — umbilical sides; Figs 3*b*, 5*a* — peripheral views; Figs 3*c*, 4*b*, 5*b* — spiral sides.

Figs 6, 7. *Cibicides* cf. *tezhevaensis* MOROZOVA & KURILEVA, 1967 90
(F. XIV/205, 206), approx. × 57; Figs 6*a*, 7*a* — umbilical sides; Figs 6*b*, 7*b* — peripheral views; Figs 6*c*, 7*c* — spiral sides.

All specimens from Babica clays, Babica loc.

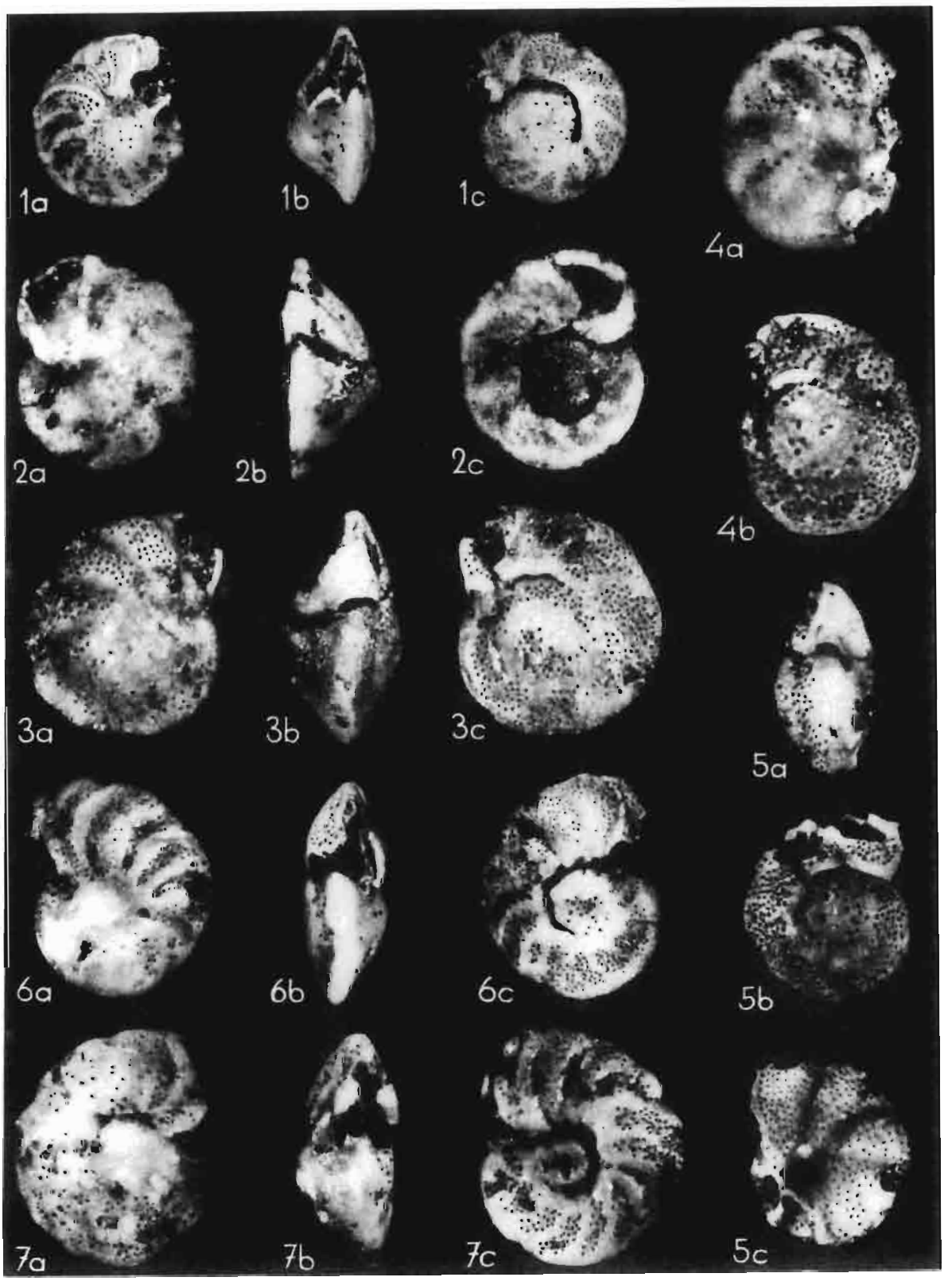
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Fig. 1. *Coleites reticulosus* (PLUMMER, 1926) 111
(F. XIV/261), approx. × 64; Fig. 1*a* — umbilical side; Fig. 1*b* — peripheral view; Fig. 1*c* — spiral side.

Figs 2, 3. Specimens tentatively assigned to *Cibicides proprius* (BROTZEN, 1948) 88
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All specimens from Babica clays, Babica loc.

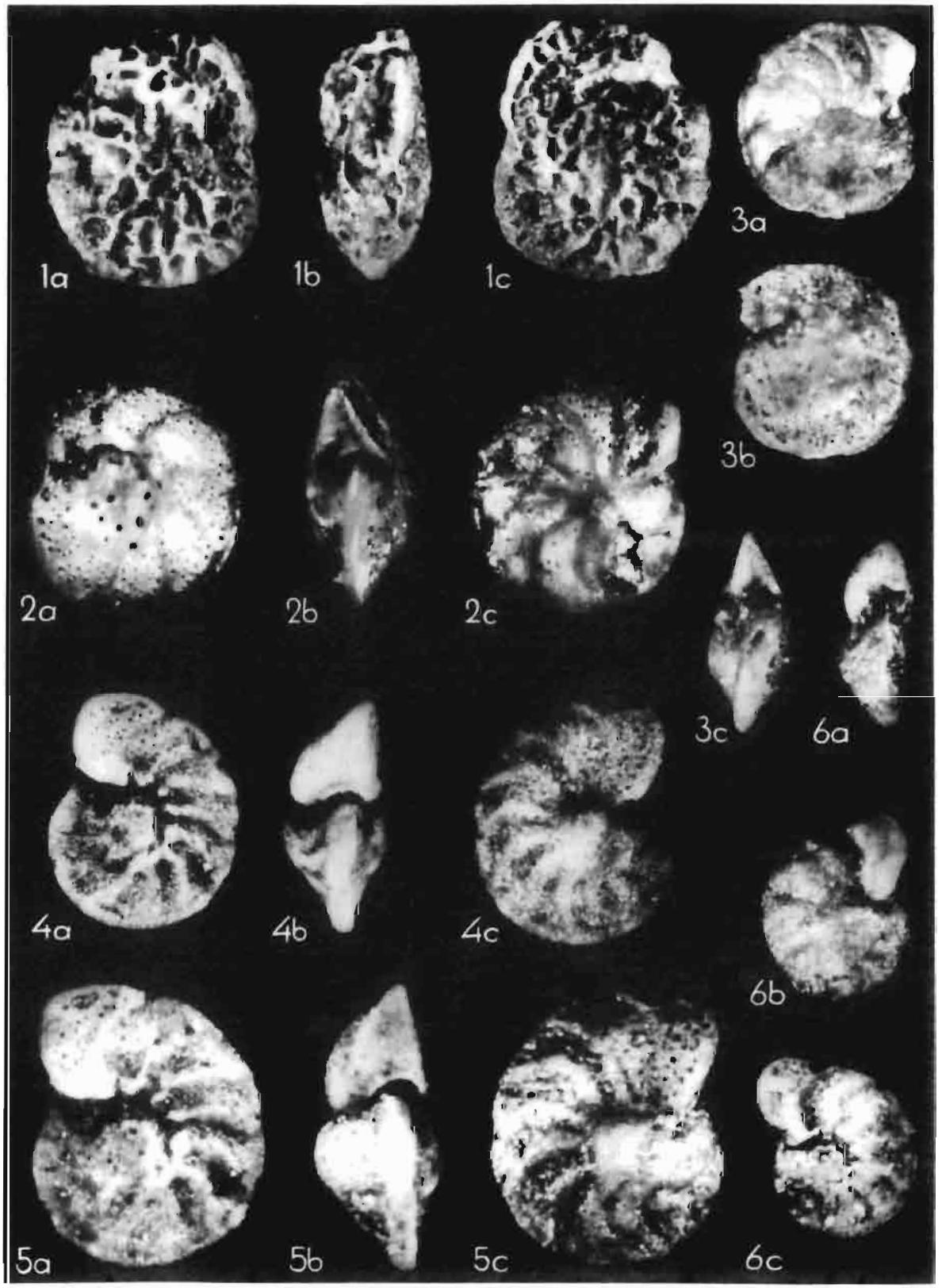
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Fig. 1. *Osangularia cordieriana navarroana* (CUSHMAN, 1938) 99
(F. XIV/233), approx. × 30; Fig. 1*a* — spiral side; Fig. 1*b* — umbilical side.

Figs 2, 3. *Epistomina scalaris* (FRANKE, 1927) 120
(F. XIV/289, 290), approx. × 80; Figs 2*a*, 3*a* — peripheral views; Figs 2*b*, 3*c* — umbilical sides; Figs 2*c*, 3*b* — spiral sides.

Figs 4, 5. ?*Cibicides commatus* MOROZOVA, 1954 91
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Figs 6, 7. *Anomalinoides* cf. *hyphalus* (FISHER, 1969) 111
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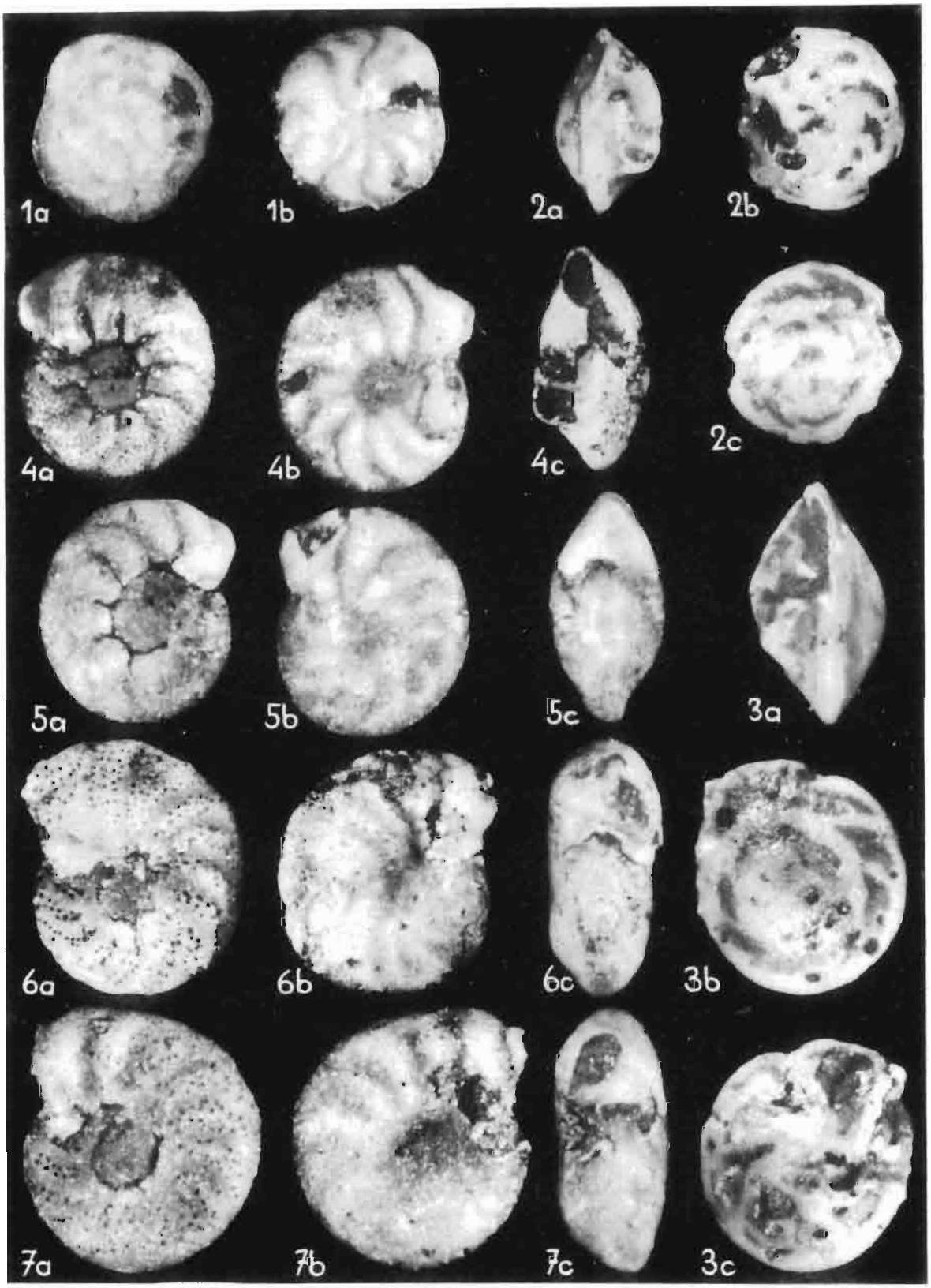
All specimens from Babica clays, Babica loc.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Figs 1-3. *Hanzawaia bundensis karpatica* n. subsp. 114
(F. XIV/267-269), approx. × 75; Figs 1*a*, 2*a*, 3*b* — umbilical sides; Figs 1*b*, 2*b*, 3*a* — spiral sides; Figs 1*c*, 2*c* — peripheral views; Fig. 1 — holotypus; Figs 2, 3 — paratypi.

Figs 4-7. *Hanzawaia bundensis bundensis* (VAN BELLEN, 1946) 113
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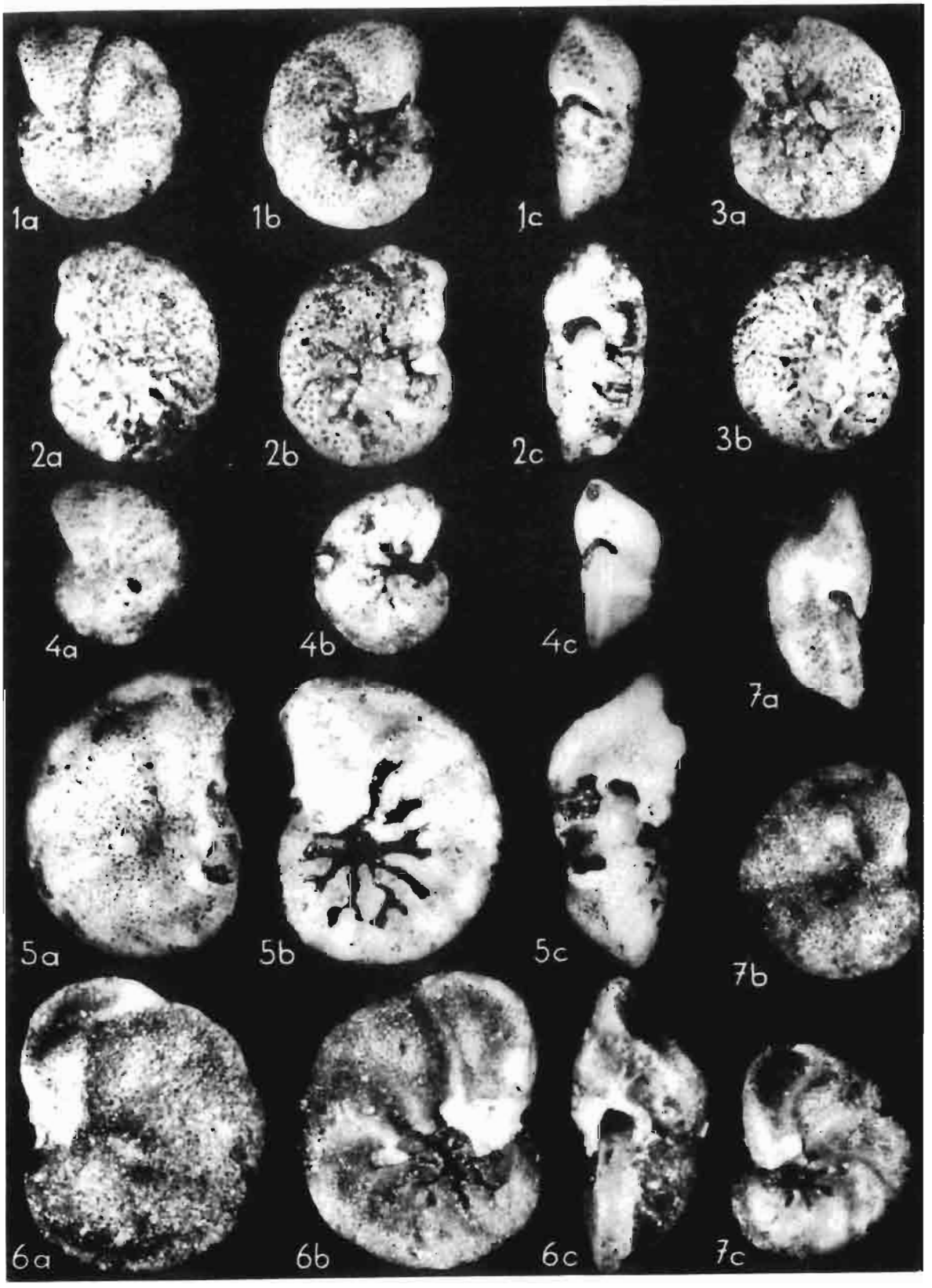
All specimens from Babica clays, Babica loc.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(F. XIV/186, 185); approx. × 127; Figs 1*a*, 2*a* — umbilical sides; Figs 1*b*, 2*b* — spiral sides; Figs 1*c*, 2*c* — peripheral views.

Figs 3-5. *Anomalina velascoensis* CUSHMAN, 1925 108
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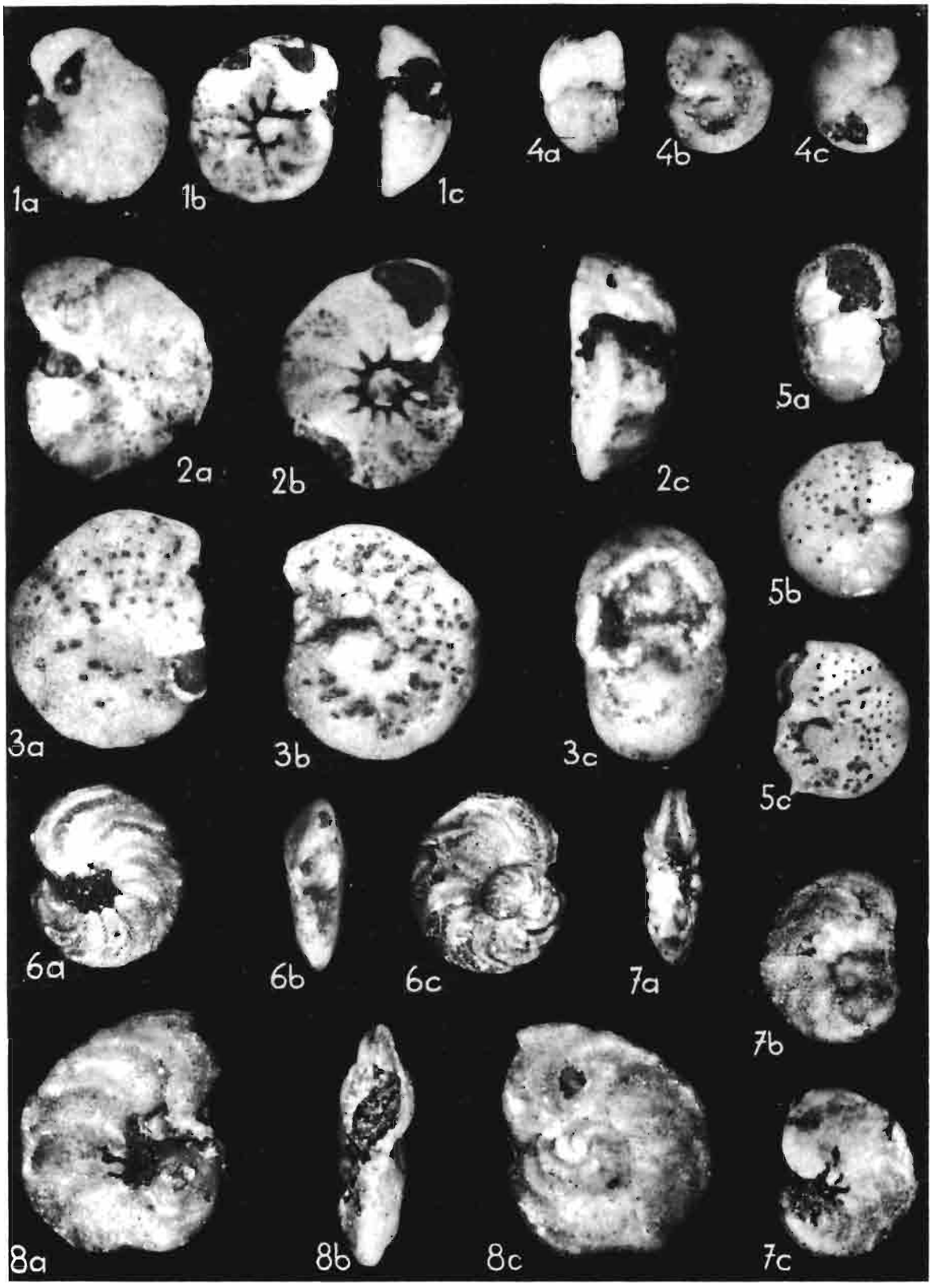
All specimens from Babica clays, Babica loc.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Figs 1-7. *Stensioeina beccariiformis* (WHITE, 1928) 116
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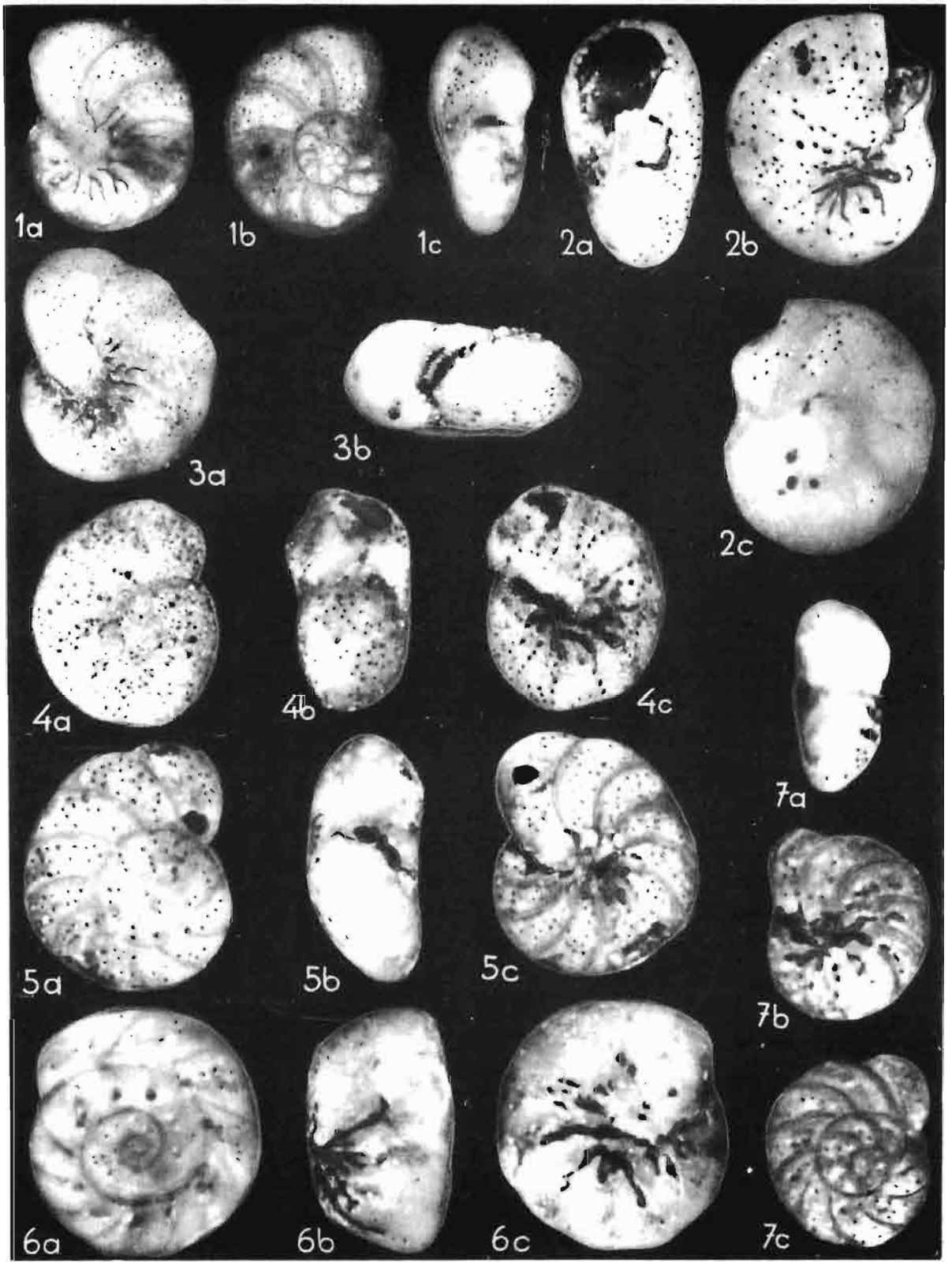
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Figs 7-11. *Cibicides mariae* JONES, 1852 87
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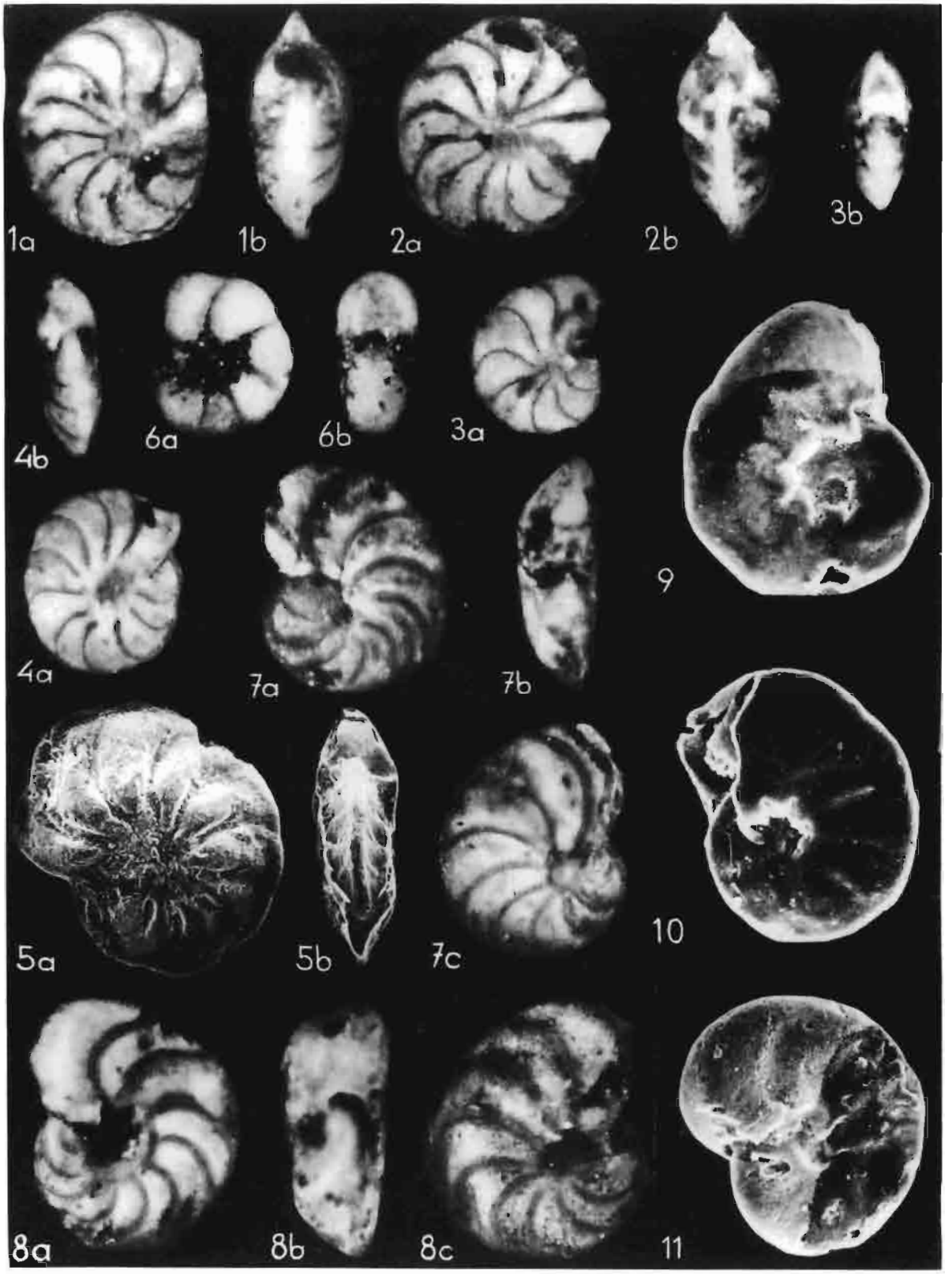
Figs 7, 8, 11 — Babica clays, Babica loc.; Fig. 9 — Paleocene (Thanetian), England; Fig. 10 — Paleocene (Midway Fm.), Texas.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Figs 1-3, 6, 7. *Anomalina acuta* PLUMMER, 1926 103
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Figs 4, 5. *Anomalinoides affinis* (HANTKEN, 1875), ... 109
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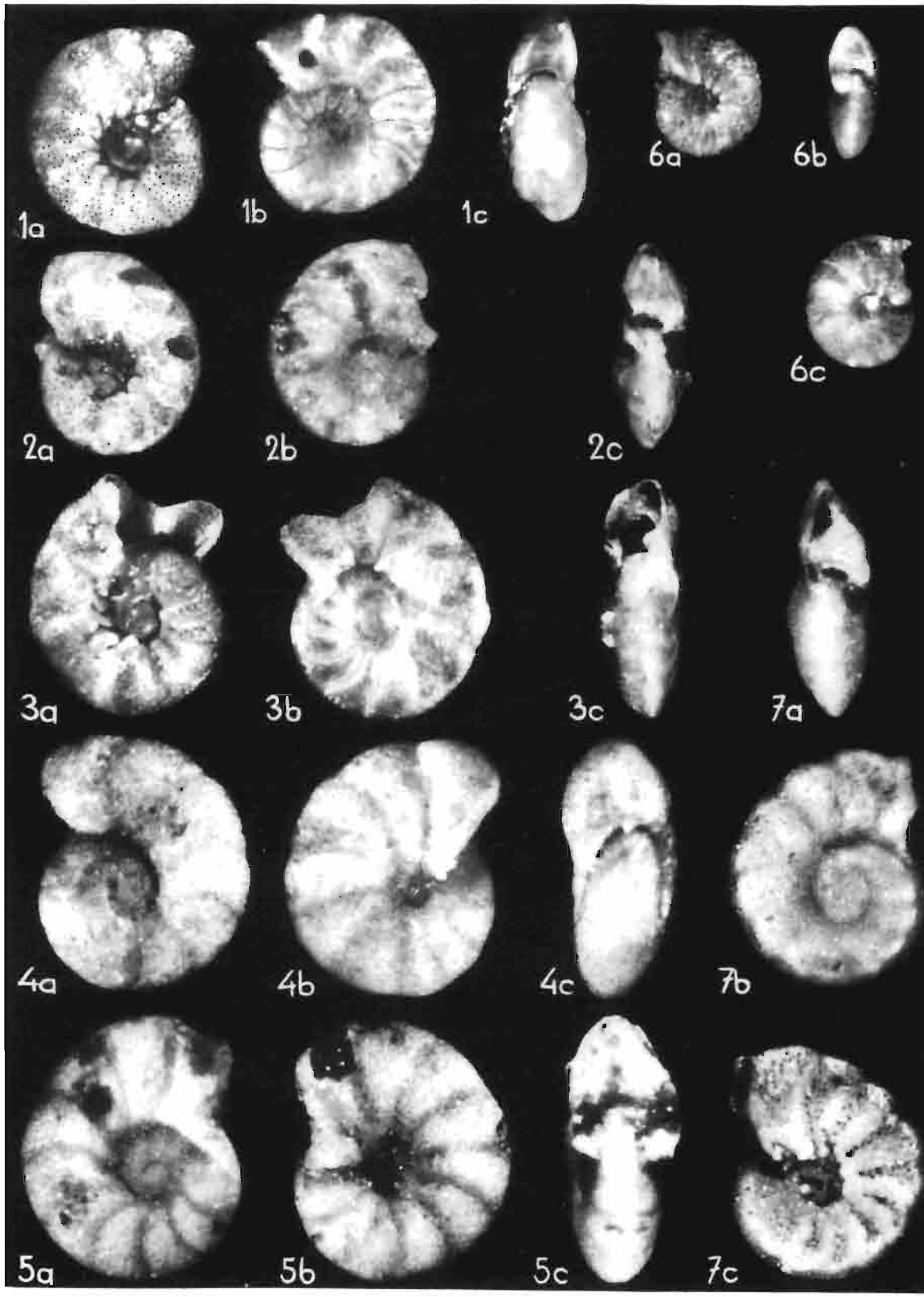

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Figs 1-3. *Anomalina rubiginosa* (CUSHMAN, 1926)
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Figs 4, 5. *Stensioeina beccariiformis* (WHITE, 1928) 116
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Figs 6, 7. *Anomalinoides affinis* (HANTKEN, 1875) 109
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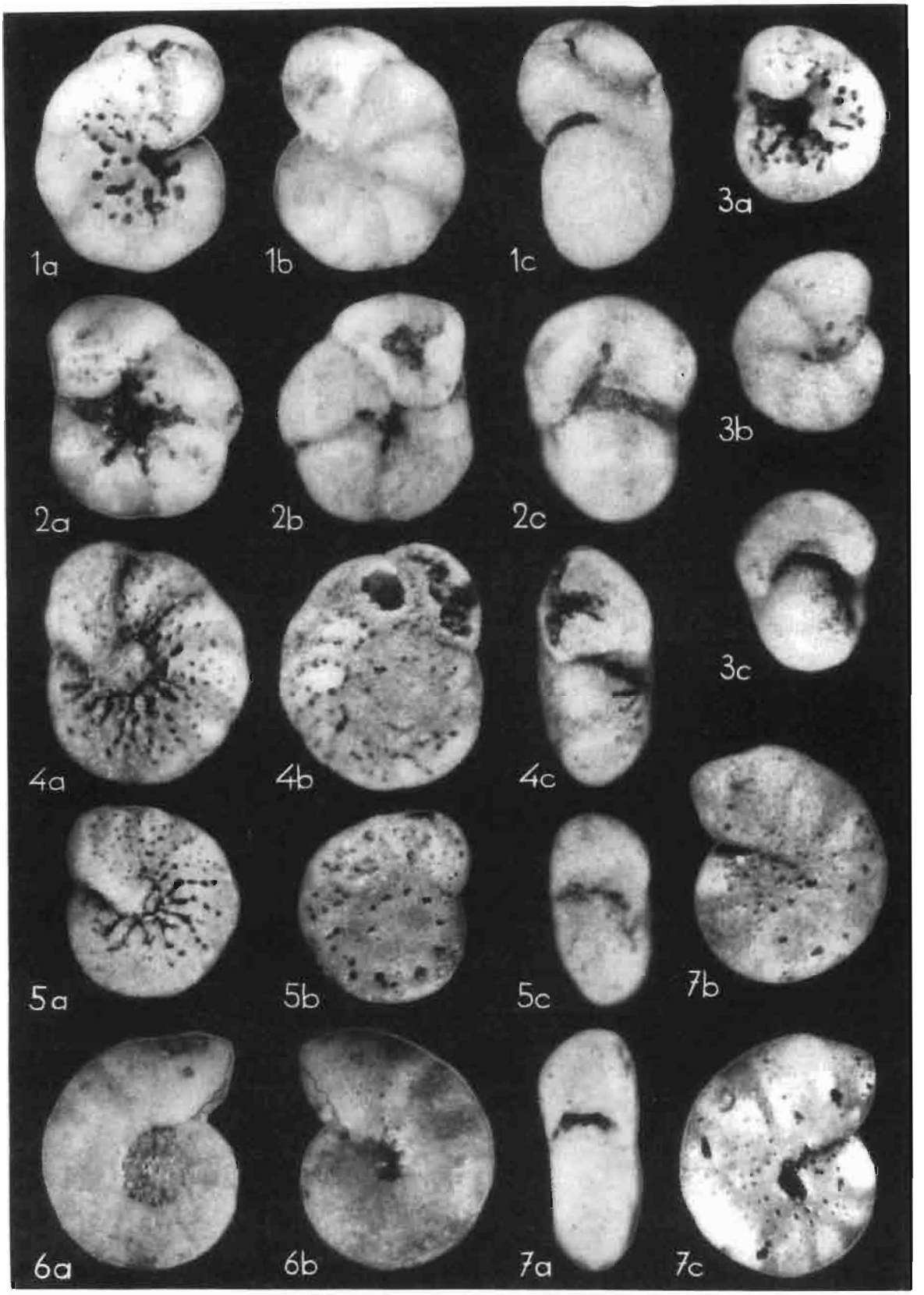

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Fig. 1. *Gavelinella umbilicatula* (MJATLIUK, 1942) 112
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Fig. 2. *Rosalina koeneni* BROTZEN, 1948 61
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Figs 3-5. *Epistomina* cf. *juliae* MJATLIUK, 1949 121
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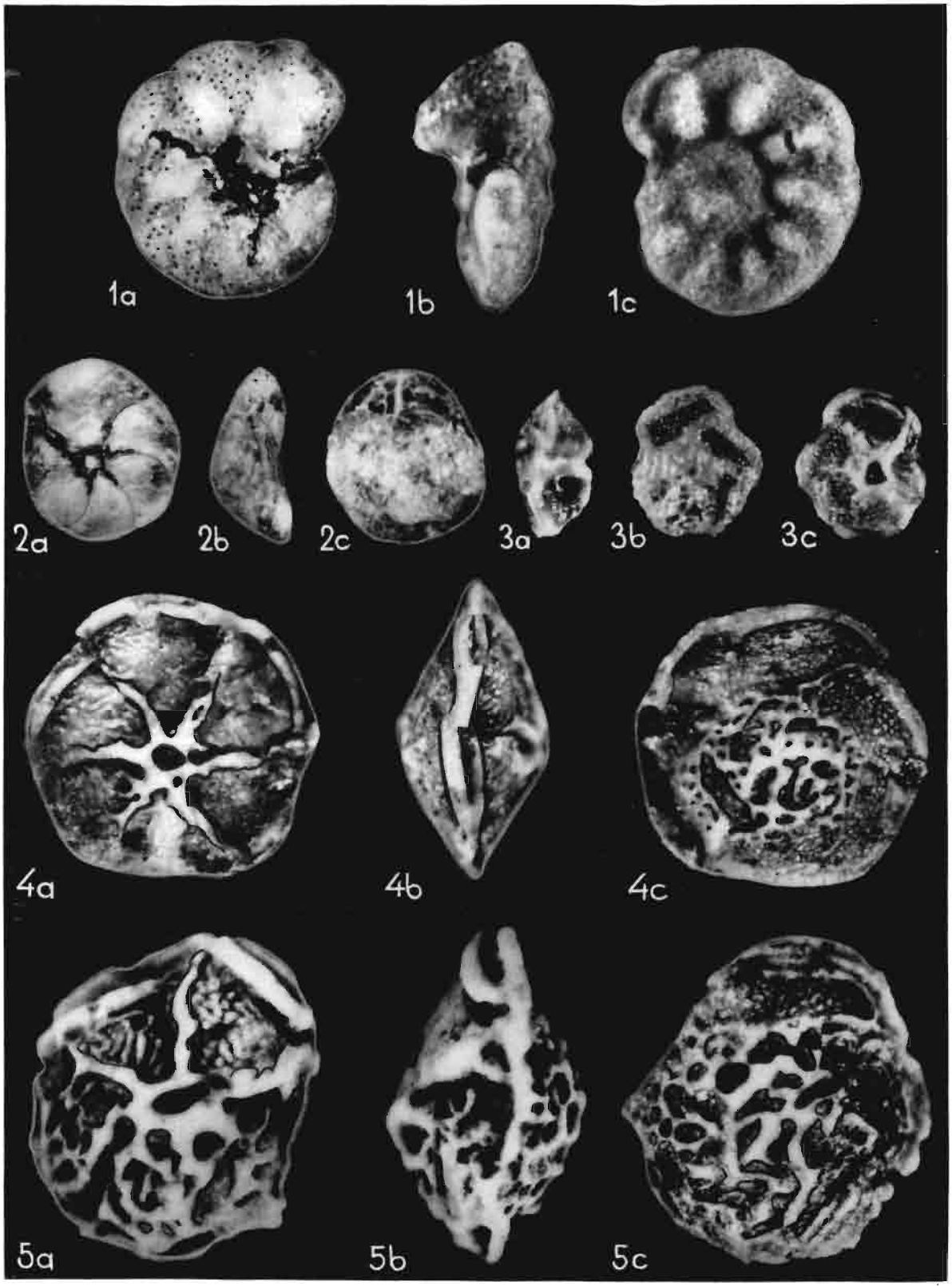
All specimens from Babica clays, Babica loc.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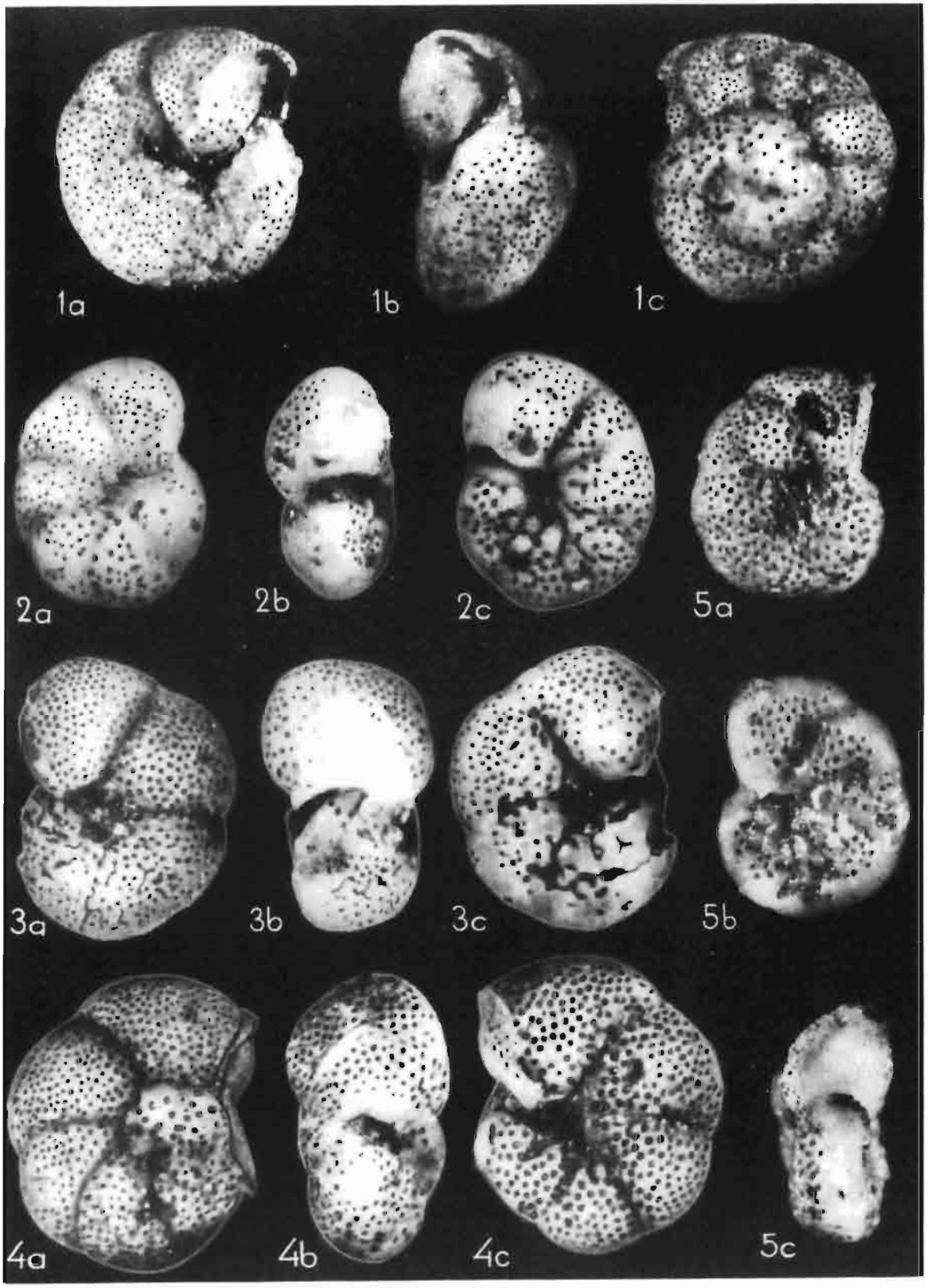
All specimens from Babica clays, Babica loc.



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Figs 1-3. *Globigerina* cf. *yeguaensis* WEINZIERL & APPLIN, 1929 80
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All specimens from Babica clays, Babica loc.

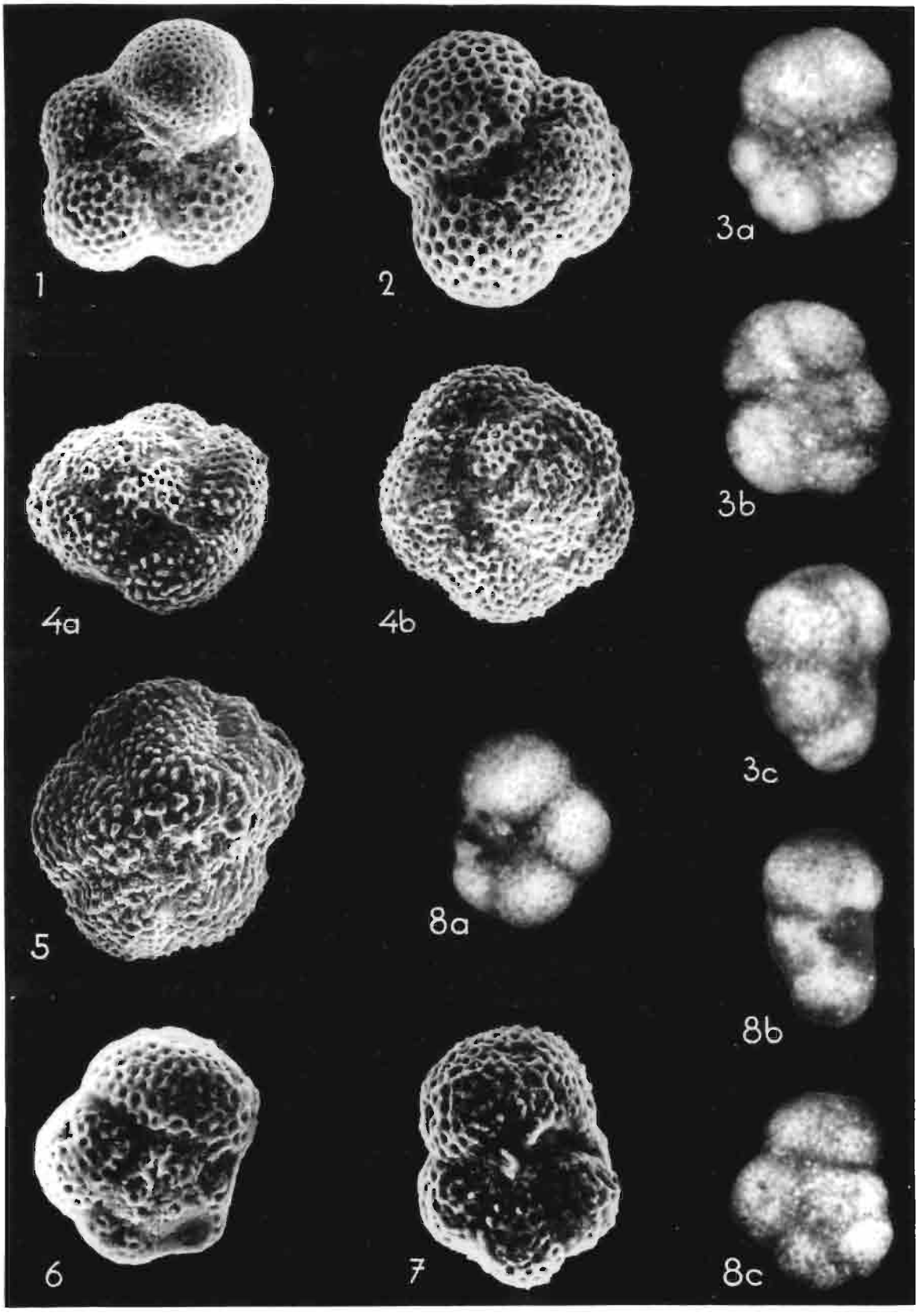
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Fig. 1. *Globorotalia* cf. *laevigata* BOLLI, 1957 76
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Figs 2-4. *Globorotalia perclara* LOEBLICH & TAPPAN, 1957 72
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Fig. 6. Specimen tentatively assigned to *Globorotalia velascoensis* (CUSHMAN, 1925) 73
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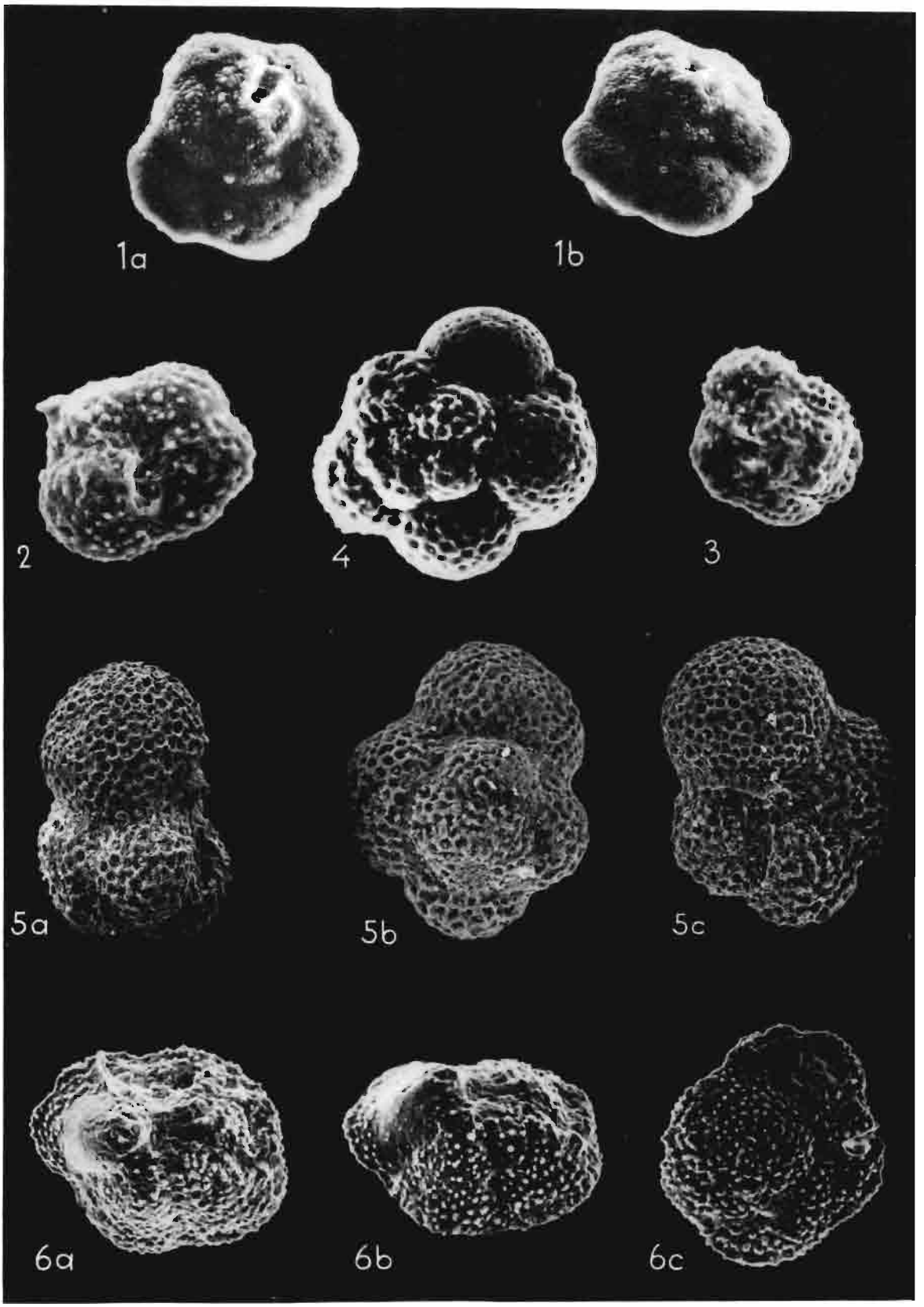
All specimens from Babica clays, Babica loc.



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Figs 1-3. *Globorotalia angulata* (WHITE, 1928) 70
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Figs 4, 5. Intermediate specimens between *G. angulata* (WHITE) and *G. whitei* (WEISS)
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Fig. 6. *Globorotalia whitei* WEISS, 1955 74
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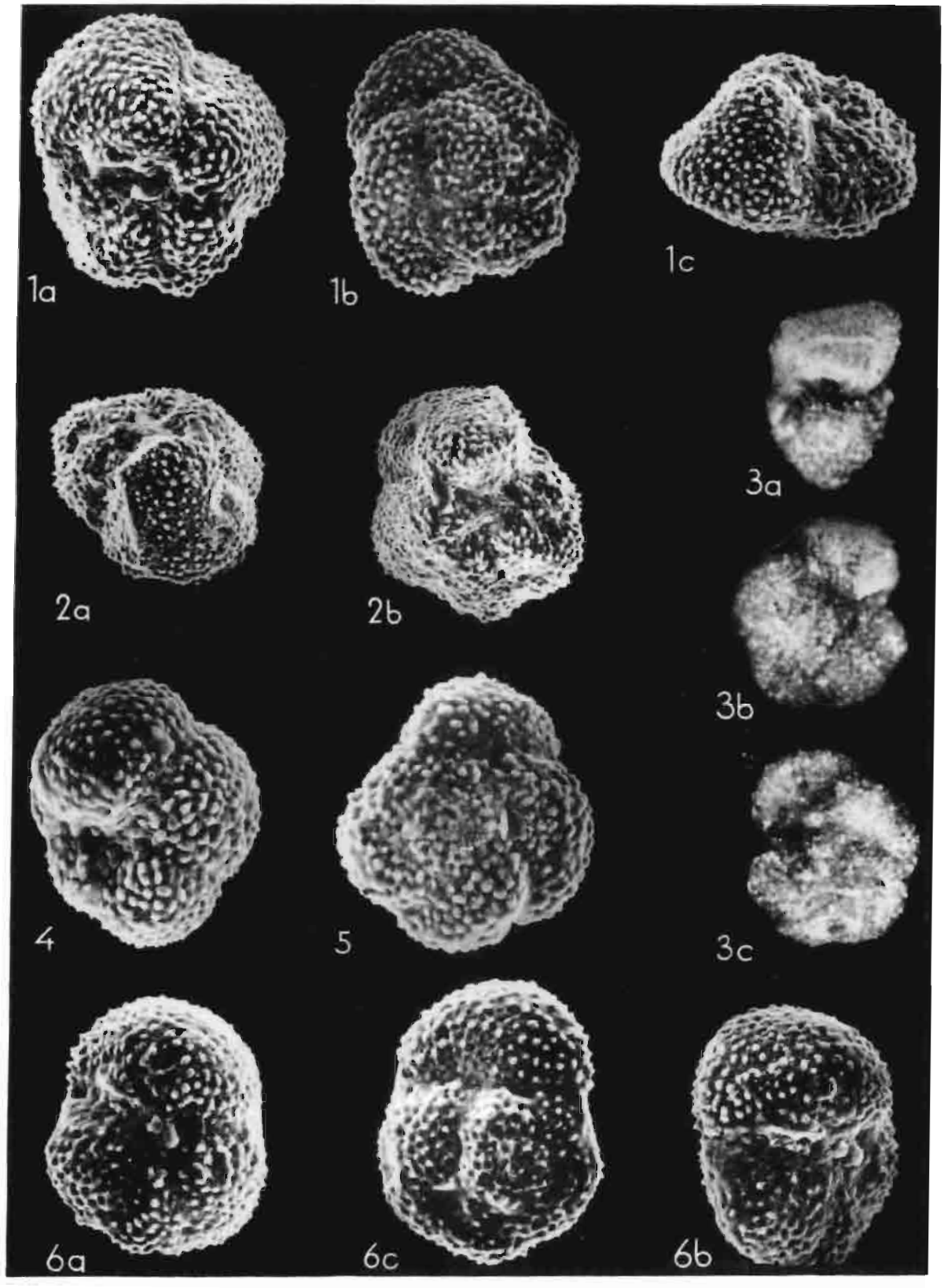
Figs 1, 2, 4, 5, 6 — SEMicrographs.

All specimens from Babica clays, Babica loc.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Figs 1-4, 6. *Globigerina triloculinoides* PLUMMER, 1926 78
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Fig. 5. *Globigerina velascoensis* CUSHMAN, 1925 80
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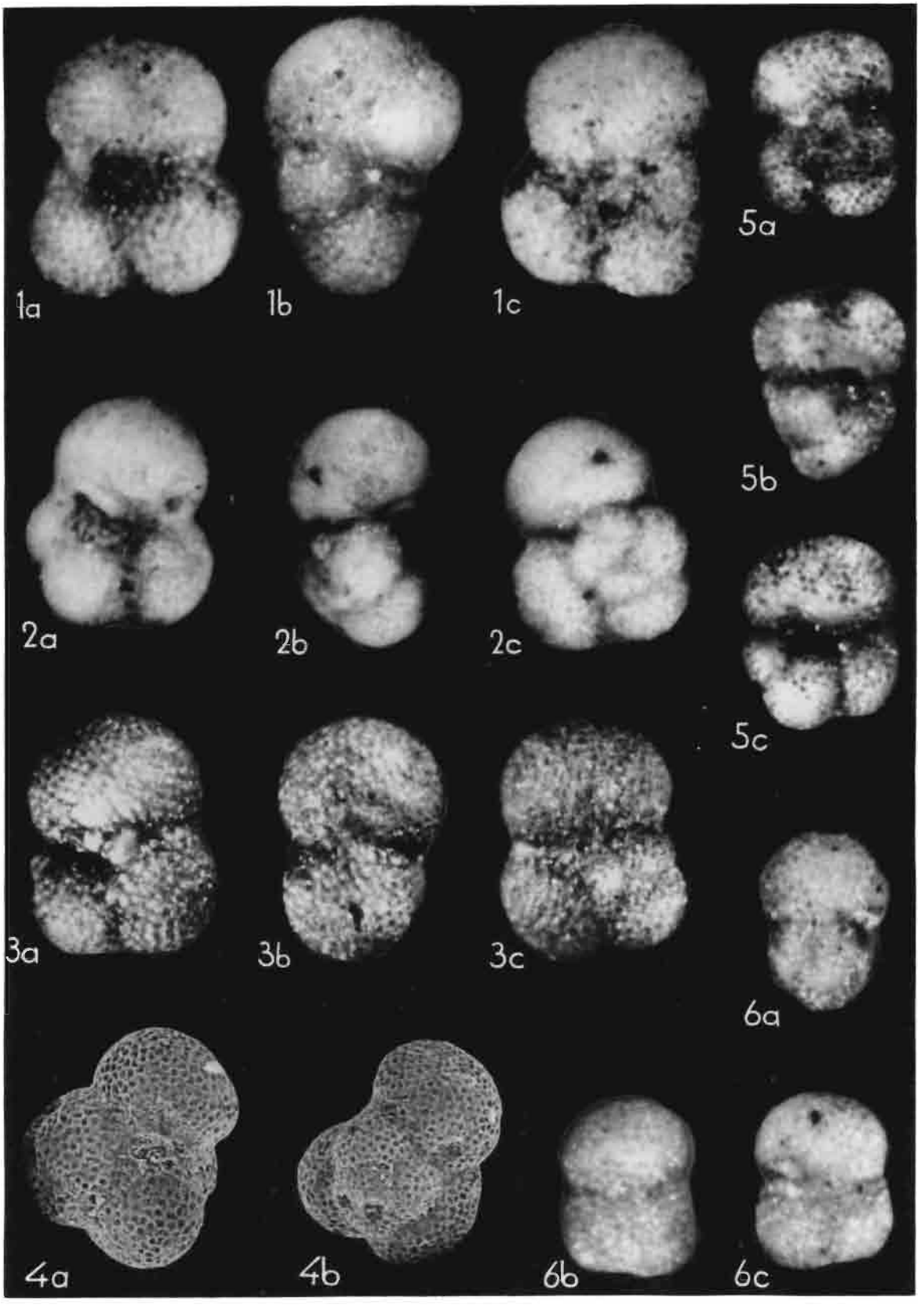
All specimens from Babica clays, Babica loc.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Figs 1-3. *Globorotalia chapmani* PARR, 1938 71
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Fig. 4. *Globigerina pseudobulloides* PLUMMER, 1926 77
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Figs 5-7. *?Globigerina inconstans* SUBBOTINA, 1953 81
(F. XIV/168-170), approx. × 140, × 130, × 100; Figs 5*a*, 6*a* — umbilical sides; Figs 5*b*, 6*b*, 7 — spiral sides; Fig. 5*c* — peripheral view.

Figs 2, 3, 7 — SEMicrographs.

All specimens from Babica clays, Babica loc.

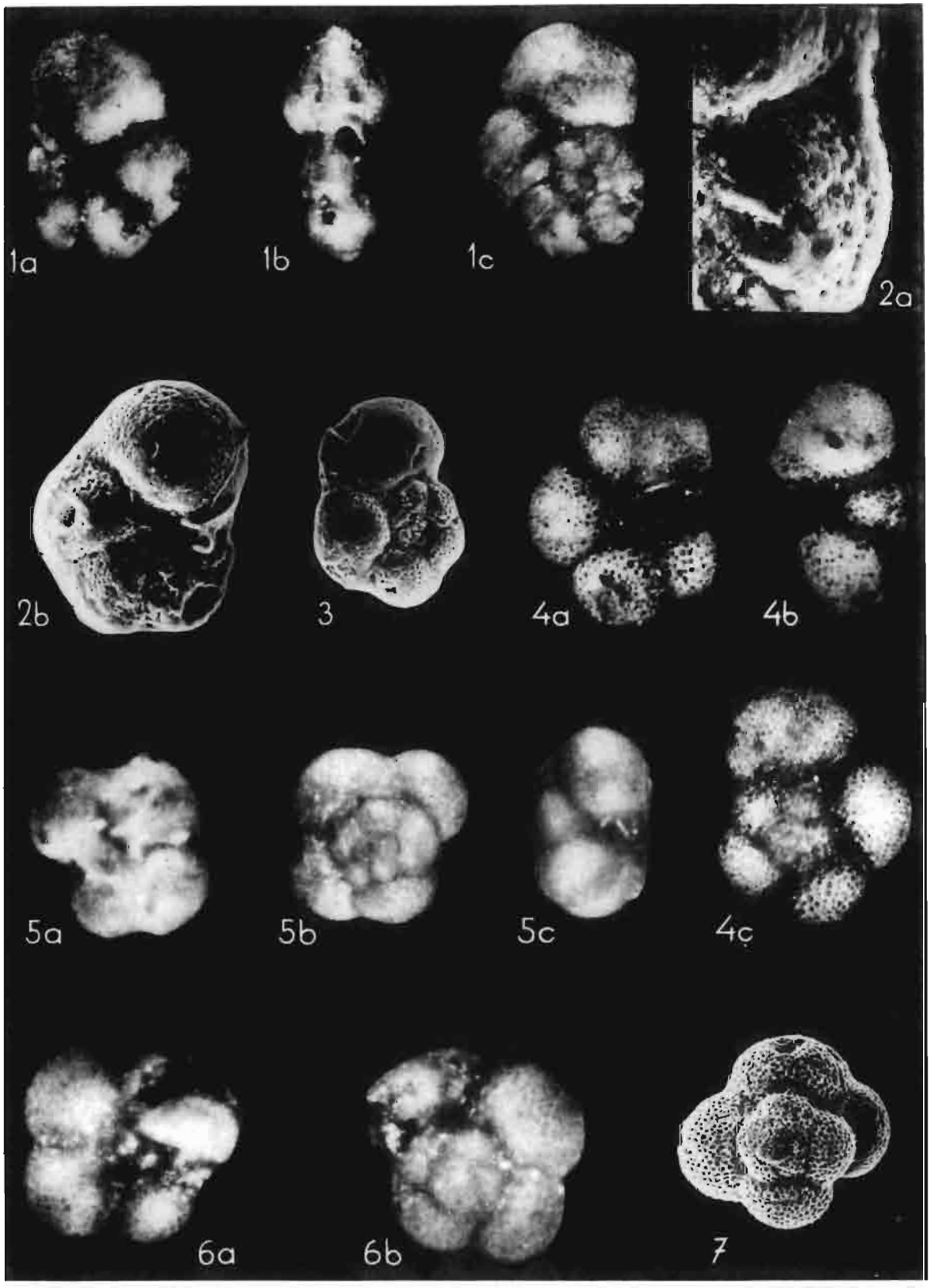
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Fig. 1. *Globigerina triloculinoides* PLUMMER, 1926 78
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Fig. 2. *Globorotalia velascoensis* (CUSHMAN, 1925) 73
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Fig. 3. *Globorotalia* cf. *occlusa* LOEBLICH & TAPPAN, 1957 76
(F. XIV/154); Fig. 3*a* — umbilical side, approx. × 130; Fig. 3*b* — peripheral view, approx. × 150; Fig. 3*c* — enlargement showing type of ornamentation of test on umbilical side, approx. × 800.

Fig. 4. *Globorotalia angulata* (WHITE, 1928) 70
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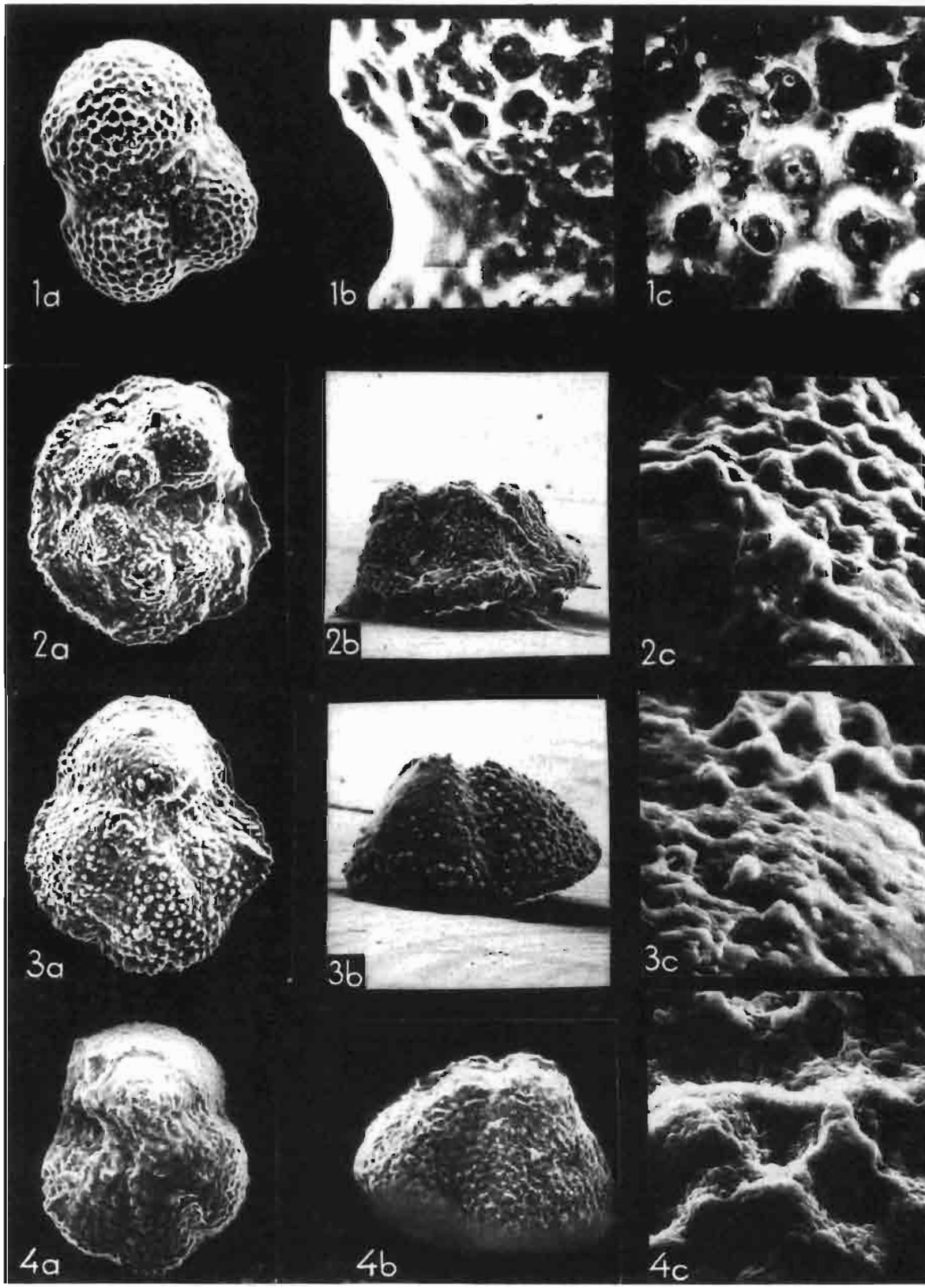
Figs 1-4 — SEMicrographs.

All specimens from Babica clays, Babica loc.



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Figs 1-3. *Asterigerina* cf. *noervangi* BROTZEN, 1948 59
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Fig. 4. *Gyroidina babicensis* n. sp. 98
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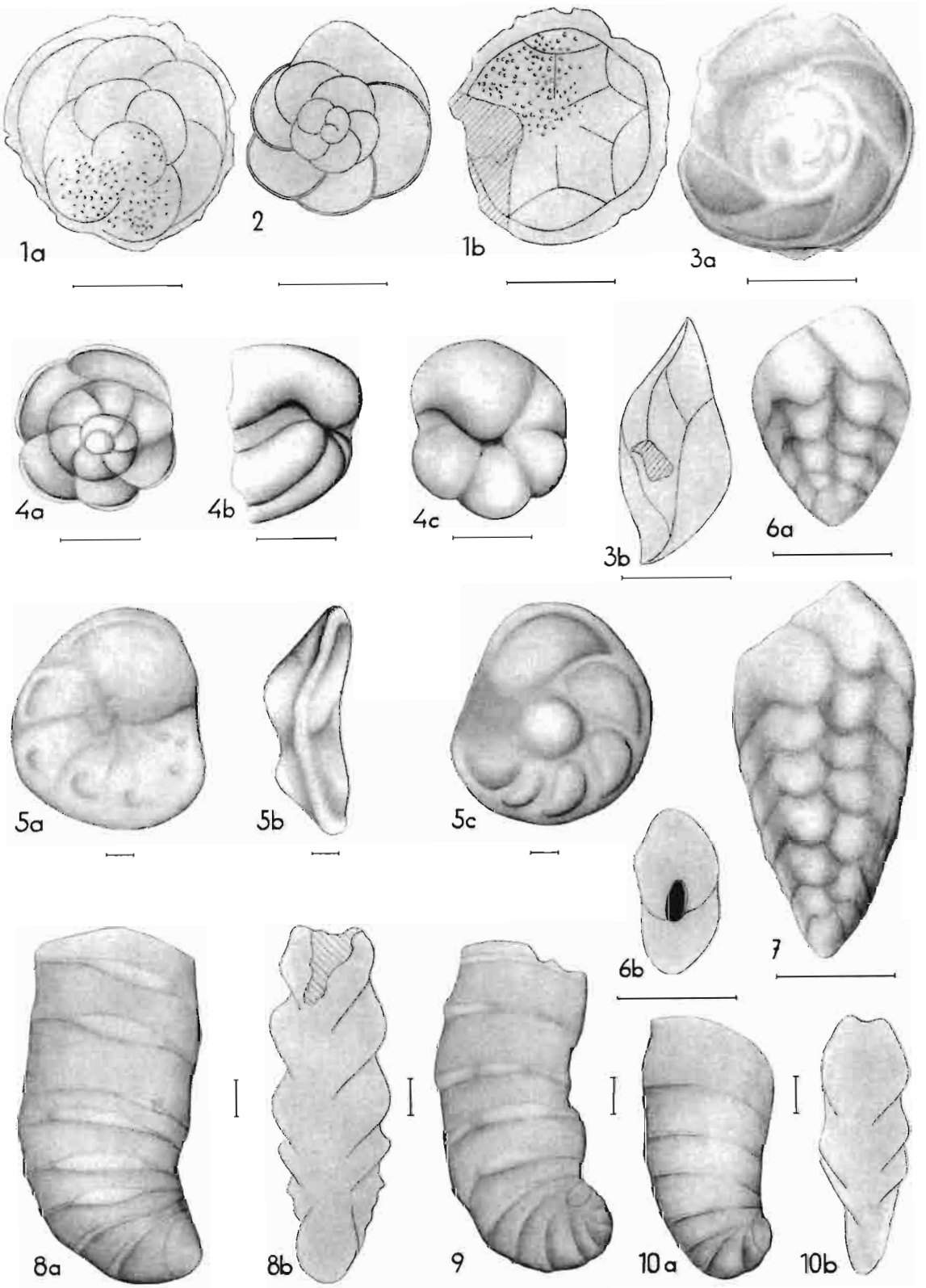
Figs 6, 7. *Bolivina crenulata* CUSHMAN, 1936 48
(F. XIV/70, 71); Figs 6*a*, 7 — side view; Fig. 6*b* — apertural view.

Figs 8-10. *Vaginulina* cf. *plummerae* (CUSHMAN, 1937) 46
(F. XIV/343-345); Figs 8*a*, 9, 10*a* — side views; Figs 8*b*, 10*b* — edge views.

Scales correspond to 0.1 mm.

All specimens from Babica clays, Babica loc.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10a
10b

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Figs 1-3. *Pullenia coryelli* WHITE, 1929 95
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Figs 4, 5. *Eponides lunata* BROTZEN, 1948 82
(F. XIV/175, 174); Figs 4*a*, 5 — spiral sides; Fig. 4*b* — umbilical side; Fig. 4*c* — peripheral view.

Figs 6-9. *Caucasina* cf. *schischkinskayae* (SAMOILOVA) *oligocenica* CHALILOV, 1967 91
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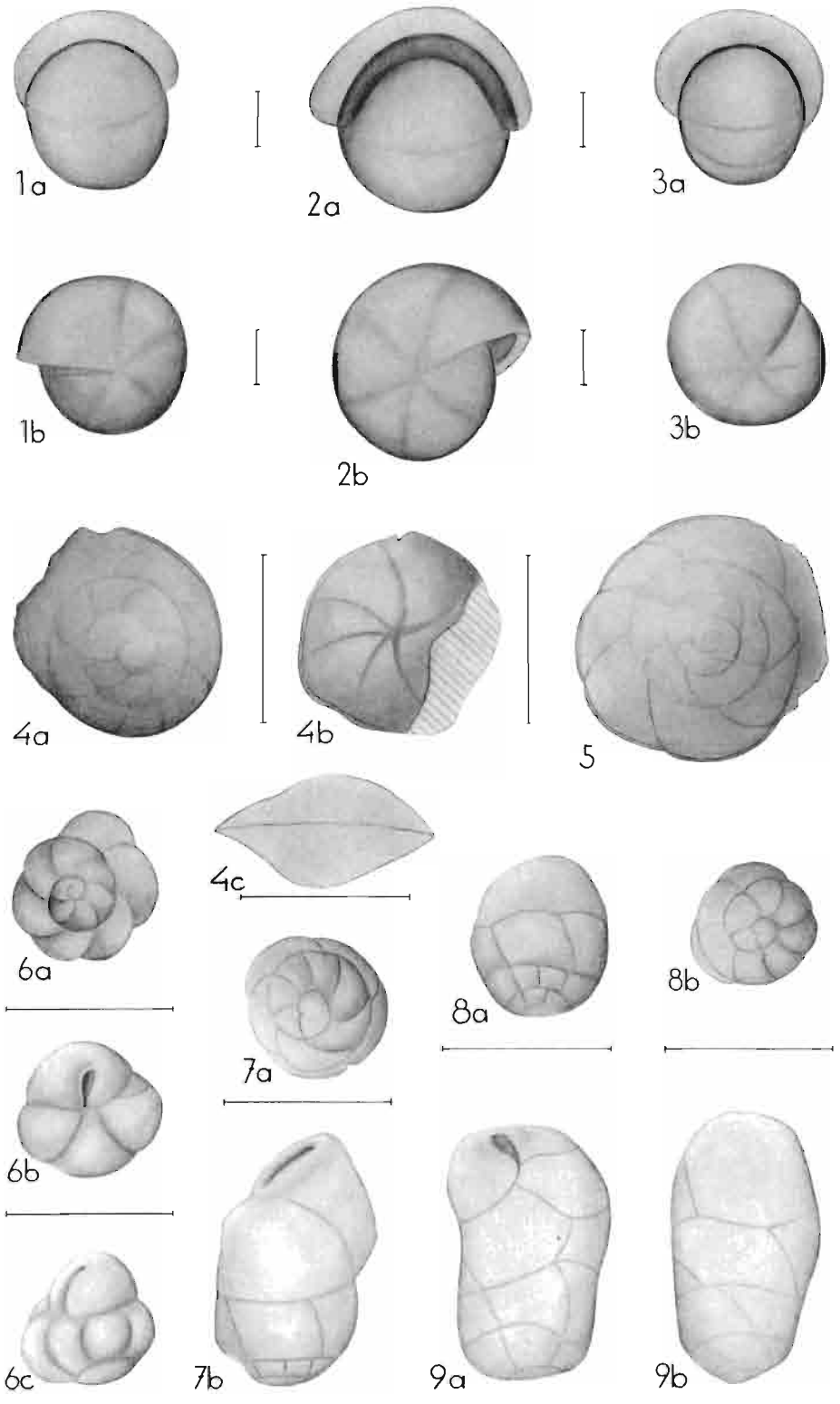
Scales correspond to 0.1 mm.

All specimens from Babica clays, Babica loc.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7a
8a
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6b
6c
7b
9a
9b

PLATE XXXVIII

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Figs 1-3. *Epistominella vitrea* PARKER, 1953 58
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Figs 4-8. *Pseudonodosaria manifesta* (REUSS, 1851) 45
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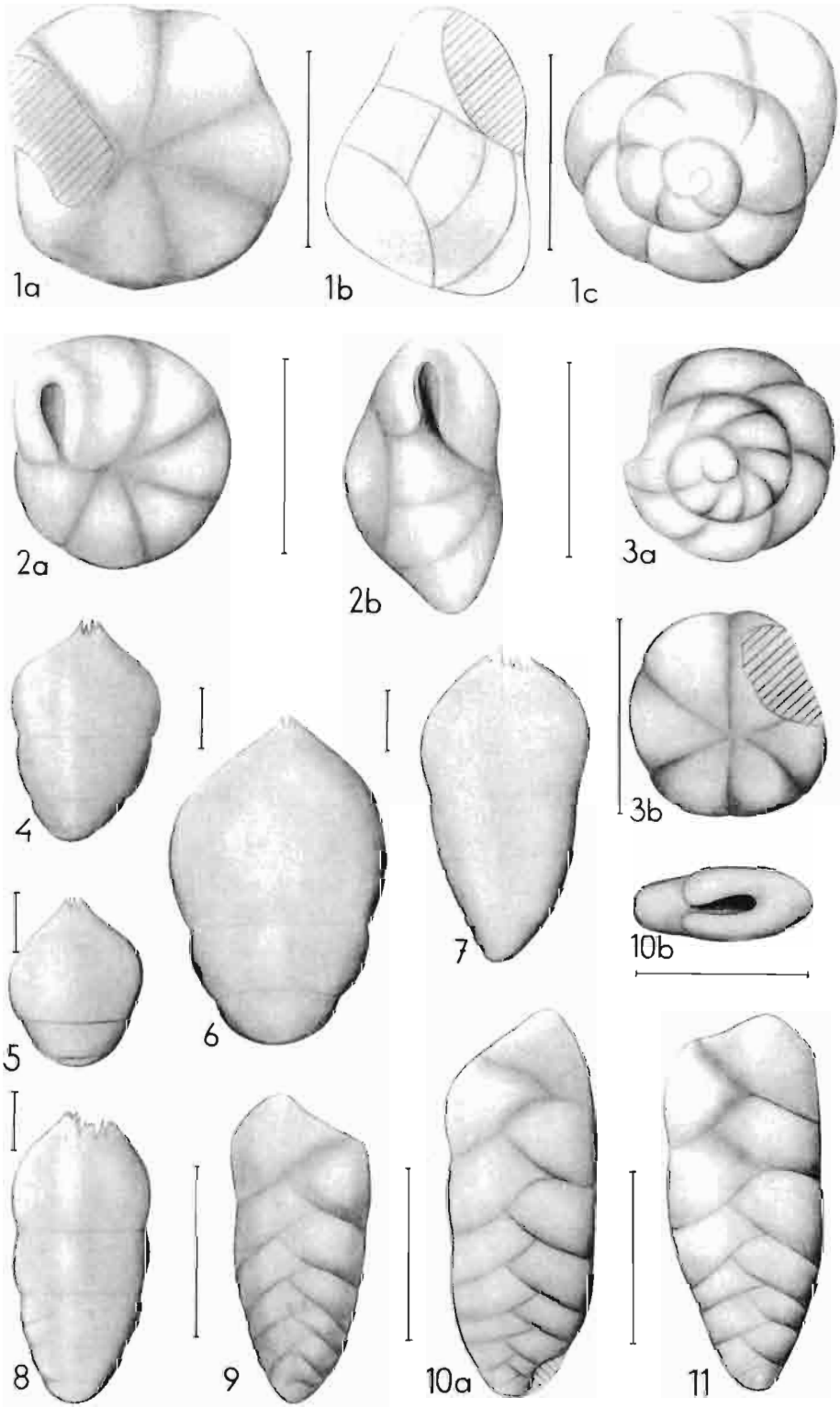
Figs 9-11. *Bolivina* cf. *paula* CUSHMAN & CAHILL, 1932 49
(F. XIV/74, 72, 73); Figs 9, 10*a*, 11 — side views; Fig. 10*b* — apertural view.

Scales correspond to 0.1 mm.

All specimens from Babica clays, Babica loc.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