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FORAMINIFERIDA, ZONATION AND SUBZONATION OF THE PALEOCENE OF TUNISIA

Abstract. — Benthic and planktonic foraminifers of the hypostratotype of the Paleocene (El Haria Fm., El Kef section, northern Tunisia) are discussed and described. The foraminifers identified have made it possible to distinguish 8 planktonic foraminiferal biozones with 5 subzones within the hypostratotype and to correlate them with their stratigraphic equivalents from Tethyan and epicontinental regions. The hypostratotypes of the Danian, Montian and Landenian are proposed and defined. The hypostratotype of the Paleocene *sensu stricto* is proposed as the stratotype of marine Paleocene section of the Tethyan region.

INTRODUCTION

In accordance with the resolution adopted by the VIth African Micropaleontological Colloquium (March 21 — April 3rd, 1974, Tunis), the El Kef (El Haria Fm.) type section is proposed as the hypostratotype for the Paleocene of the Tethyan province and the El Hedil section has been chosen as an auxiliary hypostratotype (El Hedil region, near Sedjenane, NW Tunisia).

Dr J. Salaj of the Tunisian Geological Survey and Prof. Dr. K. Pożaryska and Dr. J. Szczechura of the Polish Academy of Sciences, Warsaw, were charged by the resolution of the Colloquium and the Tunisian Geological Survey with the detailed analysis of the stratotype.

A rich assemblage of mostly benthic foraminifers was analysed in the Palaeozoological Institute, Polish Academy of Sciences, Warsaw. The analysis involved rich comparative materials collected by K. Pożaryska from the stratotype of the Montian (Puits Artésien de Mons and Puits d'Obourg recently drilled by the Geological Survey of Belgium), Montian and Thanetian of the Paris Basin, stratotypes of the Thanetian (Kent, Great Britain) and Landenian (Belgium), Midway Fm. (USA), stratotype of the Danian (Denmark) and Dano-Montian and Thanetian series of the Crimea (USSR) and other well-known localities. The analysis of these materials made it possible to identify reliably the foraminifers from the Tunisian sections as well as to carry out interregional correlations aimed at defining biogeoprovinces and identifying the extent of the Tethyan province in Paleocene times. The Tunisian hypostratotype is here taken to be as the stratotype of the marine Paleocene of the Tethyan province. It should be added that no stratotype of marine Paleocene strata of the Boreal province has been proposed. The distribution in the latter of marine strata is markedly limited; the sections are highly incomplete and several regions of that province were occupied by hyposaline or even fresh-water, usually occupying shallow basins with a restricted marine or non marine microfauna. Planktonic microfauna so important for accurate dating of deposits are rare or absent. All the European stratotypes of the Paleocene (Danian, Montian, Heersian, Landenian, Thanetian and others) are bounded by deposits representing transgressional or regressional phases and the incomplete sections are bounded by hard ground surfaces.

The El Kef section appears to be the most complete and continuous Paleocene section in Tunisia. It displays gradual transition from the uppermost Cretaceous to Eocene strata without any major phases of emergence or shallowing of the basin. Therefore it seems to be very suitable to be selected as a hypostratotype on which biozonation, and especially planktonic biozonation may be based. The biozonation made was verified by the results of analysis of an additional setcion of Hedil, proposed as a parahypostratotype by the present authors. Benthic and planktonic foraminiferal microfauna appeared to be well preserved in the two sections except for the lowermost Paleocene G. taurica/daubjergensis Zone, where foraminifers are relatively infrequent and heavy recrystallized, and the two uppermost Paleocene zones, those of P. pseudomenardii and G. velascoensis, where benthos markedly predominates.

Eight planktonic foraminiferal zones (including 5 subzones) have been distinguished in the El Kef type profile. Moreover, stratigraphic ranges of planktonic and benthic foraminifers occurring there have been determined. Biozonation was made on the basis of planktonic species, taking into account the Paleocene planktonic zones established in other parts of the Tethyan province. Single individuals of index species were sometimes recorded from the strata of older or younger zones and defining of biozones by the time-range of index species proved to be impossible. In addition detailed taxonomic and phylogenetic analyses of the material from the section of the Tunisian hypostratotype have made it possible to propose some new zones.

The studies of the Paleocene hypostratotype from Tunisia also made it possible to compare Paleocene microfaunas of the Tethyan provinces with those of the Boreal province and to establish the links lacking in the latter. In the latter, the plankton, if present, is represented by Globigerina-like forms and only rarely by angulate forms (Szczechura & Pożaryska, 1975) whereas its older Paleocene benthos comprises several species in common with that of the Paleocene of Tunisia but these are primarily pandemic species dominant in both Boreal and Tethyan regions. The Paleocene of Tunisia yields also some benthic elements unknown from the Boreal province, which are characteristic of the Tethyan province or limited to the North-African province (e.g. *Frondicularia phosphatica* Russo, *Palmula sigmoicosta* Ten Dam & Sigal).

Warm thanks are due to Mr. A. Azzouz, Director of the Tunisian Geological Survey, thanks to whose enthusiasm and help this study was undertaken.

Best thanks are due to Dr. H. P. Luterbacher for discussion and to Drs. J. Aubert and W. A. Berggren for sending the manuscript of their unpublished papers. Best thanks are also due to the Laboratory of Electron Microscopy of the Nencki's Institute of Experimental Biology, Warsaw, and to Dr. I. Bang from Geological Survey in Denmark, for their help in preparing photomicrographs. Many thanks are also due to Professor D. Curry for critically reading the general part of the manuscript and for correcting the English language.

The foraminiferal collections are housed at the Geological Survey of Tunisia, Geological Institute of Dionýz Štúr in Bratislava, Czechoslovakia (abbr. here as GIB) and the Palaeozoological Institute of the Polish Academy of Sciences in Warsaw (ZPAL). The numbered samples (text-fig. 4) are housed in the Geological Institute of Dionýz Štúr.

LITHOLOGY, STRATIGRAPHY AND PALAEOECOLOGY

The Paleocene sequences and microfauna of Tunisia were studied by Dalbiez (1956), Dalbiez & Glintzboeckel (*in*: Cuvillier *et al.*, 1955) and others. The foraminifers of that region were also studied by Hofker (1961) and the palaeogeography — by Salaj *et al.* (1973) and Salaj (1974).

The Paleocene section of Tunisia comprises a large part of the El Haria Fm., defined by Burollet (1956). The formation is bounded by the strata of the Abiod Fm. (Campanian-Maastrichtian) below and those of the Metlaoui Fm. (Eocene) above. Its lower part is of Maastrichtian age and its upper parts — of Early or Early and Late Danian age. Text-fig. 1 shows the boundary between the Danian and Maastrichtian. The lithology of the strata of that profile is as follows.

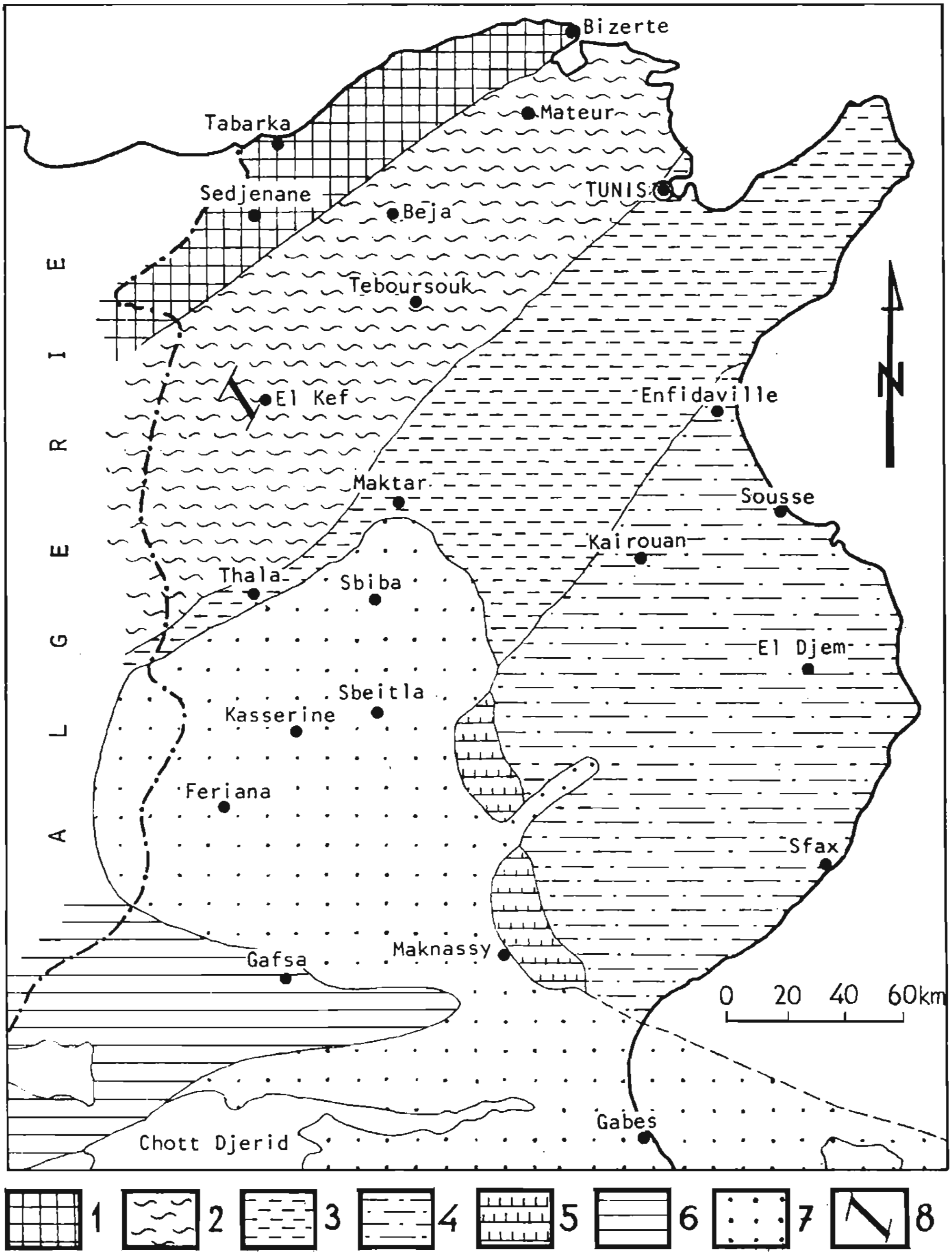


Fig. 1. Sketchmap of the facies distribution during the Paleocene. 1 — El Haria Fm. marls with dolomitic limestone and with two sequences of limestone/marls alternations in zone of subsidence (Fm. also includes Upper Maastrichtian), 2 — El Haria Fm. marls and marly limestone (facies originally described by Burollet), 3 — El Haria Fm. condensed grey marl and greenish limestone facies (with breaks in the succession), 4 — El Haria Fm. commonly condensed (here Upper Maastrichtian and Danian p.p. are missing), 5 — Metlaoui facies of Upper Paleocene, 6 — Metlaoui Fm. lagoonal facies with phosphates, 7 — Emergent zone, 8 — Locality type of El Haria Fm (= hypostratotype of Paleocene).

The whole Paleocene (including Danian) series is primarily represented by gray, relatively soft marls. The Upper Danian, i.e. the Globigerina inconstans Subzone, includes repeated intercalations of harder marly limestones. The whole Middle and Upper Paleocene is represented by dark, grey marls intercalated in the upper part by five marly limestone layers (from the top part of the Globorotalia pusilla pusilla Zone onwards). The layers are very rich in benthic foraminifers, especially *Frondicularia phosphatica* and *Nodosaria mcneilli*, accompanied by numerous fragments of brachiopod and pelecypod shells, forming together a typical coquina. The first limestone layer roughly corresponds to the base of the Planorotalia pseudomenardii Zone. The index species appears 2 m above that layer. Thus it may be assumed that this first limestone represents the uppermost part of the Globorotalia pusilla pusilla Zone.

The whole of the Paleocene displayed both by the El Kef and the Hedil sections is primarily developed in a facies of grey or, sometimes, dark-grey relatively soft marls, which is advantageous for preservation of the microfauna. The Upper Paleocene of the area, from the top of the Globorotalia angulata Zone, upwards, includes gypsum intercalations indicating periods of shallowing of the Paleocene marine basin in Tunisia. This phenomenon is also reflected in the nature of the microfauna present in these strata.

The Paleocene El Kef and Hedil sections display a gradual development in the foraminiferal microfauna. The first of the eight Paleocene zones distinguished is relatively poor especially in benthic forms. They are as well as planktonic forms generally ill-preserved because of recrystallization. The agglutinated forms represented in the assemblage indicate that the climate became cooler than in the late Cretaceous to the end of which the representatives of the genus *Globotruncana* lived in this region. From the Globigerina pseudobulloides Subzone and especially from the Planorotalia compressa Subzone to the Globorotalia angulata Zone there is a marked enrichment of the assemblage of calcareous benthic foraminifers. Several important groups such as the cibicidids and frondicularids appear presumably due to more suitable ecological conditions. Later, in the upper parts of the sections (the Planorotalia pseudomenardii and Globorotalia velascoensis Zones), which may be treated as an equivalent of the Landenian, the number of planktonic forms becomes markedly reduced when the representatives of the species *Eponides elevatus, Cibicides perlucidus* and *Brizalina* sp. appear. This may be explained by some shallowing of the marine basin, also reflected in contemporaneous strata from other parts of Tunisia, e.g. in Upper Paleocene strata from the areas of Hedil and Beja, which also display a predominance of benthic foraminifers (Aubert & Berggren, MS).

The shallowing of the marine basin of Tunisia during the late Paleocene, so well evidenced by the appearance of gypsum and the change in the foraminiferal spectrum, somewhat resembles the phenomena which took place in epicontinental seas of the Boreal province at the same time. However, in the latter province this was recorded by sedimentary gaps and a change to transgressive or regressive deposits. This phase of shallowing may be compared with the submergence preceding the Ilerdian transgression in Spain. It should be added that some small-scale, undoubted gaps in sedimentation, recorded in the Paleocene of eastern Tunisia, indicate the action of synsedimentary movements leading to some short-term shallowings or even local emergence which is confined to the areas where sedimentation was related to a so-called "haut-fond" phenomenon. Thus it follows that the marine basin of northern Tunisia became differentiated as a result of the action of orogenic movements associated with one of the initial Alpine phases during the late Paleocene. These movements led to undulation of sea bottom and creation of some deeper areas as that from El Kef region and shallower ones such as those at Hedil and Beja. The latter presumably correspond to the summits of submarine elevations, the site of sedimentation of a condensed type or even with occasional gaps (Salaj *et al.*, 1973). This theory gives support to the assumption that the intensity of these tectonic movements was greatest in eastern Tunisia and decreased to the west where sedimentation was markedly more continuous in Paleocene times. The differentiation was large enough to influence the character of benthic foraminiferal assemblages present in the two regions.

Summarizing observations obtained on foraminiferal distribution in El Kef section it may be stated the following.

In the Paleocene of the El Kef section (El Haria Fm.) only so-called smaller foraminifers — agglutinated as well as calcareous benthic forms and plankton — were found. The changes in the contribution of these foraminiferal groups to the foraminiferal spectrum and to the taxonomical composition of this foraminiferal assemblage in vertical distribution have made it possible to distinguish three principal foraminiferal assemblages:

(1) The first assemblage, confined to the Globigerina taurica/Globoconusa daubjergensis Zone, consists almost exclusively of minute, usually poorly preserved globigerinids occurring in masses. The species present in this assemblage are characterized by a limited geographic distribution as they are known almost exclusively from deep sea sediments, penetrated by drillings made by the Glomar Challenger in Indian and Pacific oceans and known on land from the Transcaspian area, Italy and southern France. It is not excluded that the deep-water nature of the deposits yielding this foraminiferal assemblage may explain their preservation in times of extensive marine regression at the turn of the Cretaceous and Paleogene. The environment of deep waters, i.e. that of cooler waters, may also be responsible for the dwarfed aspect of the foraminifers of this assemblage.

(2) The second assemblage, confined to the Globigerina trinidadensis till Globorotalia praecursoria uncinata Zones, comprises benthic and planktonic forms. The quantitative ratio between the representatives of the two groups changes markedly through the profile, suggesting some changes in the bathymetry of the environment. However, planktonic foraminifers generally predominate in the assemblage, being represented by genera and species typical of an open warm-water marine basin. The group of benthic forms primarily comprises elements of the Midway type, typical of an epicontinental shelf marine basin, of a rather pandemic type. They are known from the North America and southern and central Europe, and Australia, and were recently recorded by the present authors in samples from southeast Africa (Dunbar region, Zululand). The species represented here indicate deposition in the outer shelf zone. There is, however, also some contribution of important group of foraminifers of the Velasco type (Carpathian microfauna of Szczechura & Pożaryska, 1974), typical of deep sea sediments of the Tethys. Their occurrence indicates the proximity of a deep marine basin. Therefore it may be concluded that this assemblage lived on deeper shelf close to the continental slope. A similar situation was found in the case of the Paleocene microfauna of Babica clays from the Polish Carpathians (Szczechura & Pożaryska, 1974) and elsewhere in Europe.

(3) The third foraminiferal assemblage, continuing from the Globorotalia angulata Zone to the top of the Paleocene beds of this section, is characterized by a decreasing contribution of the elements of the Velasco type, mass occurrence of lenticulinids and gyroidinids (belonging to "cool water" forms, according to Murray, 1973), some intercalations without microfauna, and a decreasing contribution of planktonic forms and especially of the species of the genus *Globorotalia*. This, along with precipitation of gypsum, clearly indicates shallowing of the basin and possibly some isolation from the open sea. It seems that during the late Paleocene the sedimentation in the El Kef area took place under middle or inner shelf conditions at depths not greater than 80 m. The lack of any clearly warm-water elements and the occurrence of cold-water forms suggest some decrease in the temperature of the water.

BIOSTRATIGRAPHY

The section of the Tunisian Paleocene hypostratotype, treated here as the stratotype of marine Paleocene strata of the Tethyan province, may be divided into eight biozones on the basis of the dominant species of foraminiferal plankton present. The El Kef section (El Haria Fm.) is treated

Table 1

Planktonic species distribution in the Paleocene of the El Kef section, NW Tunis

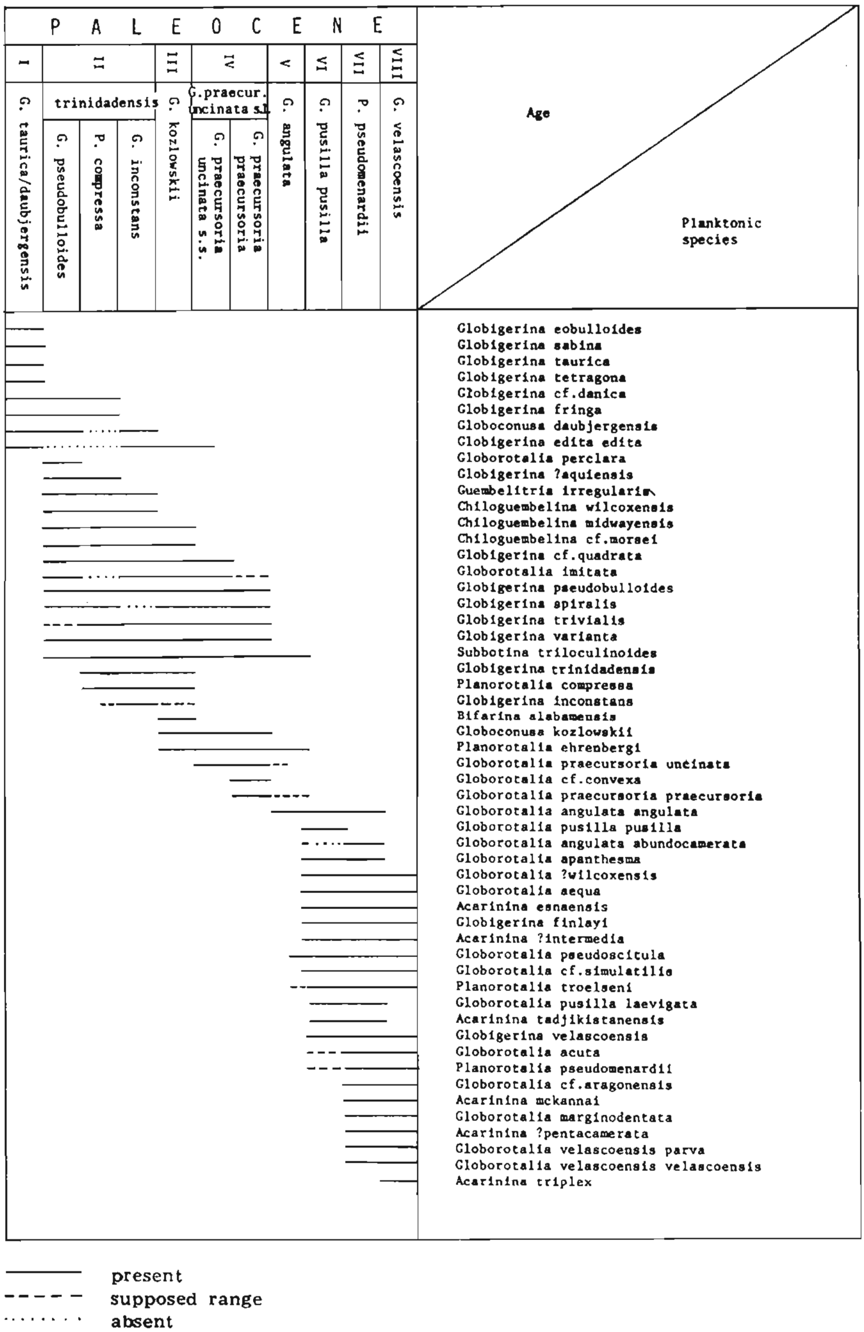
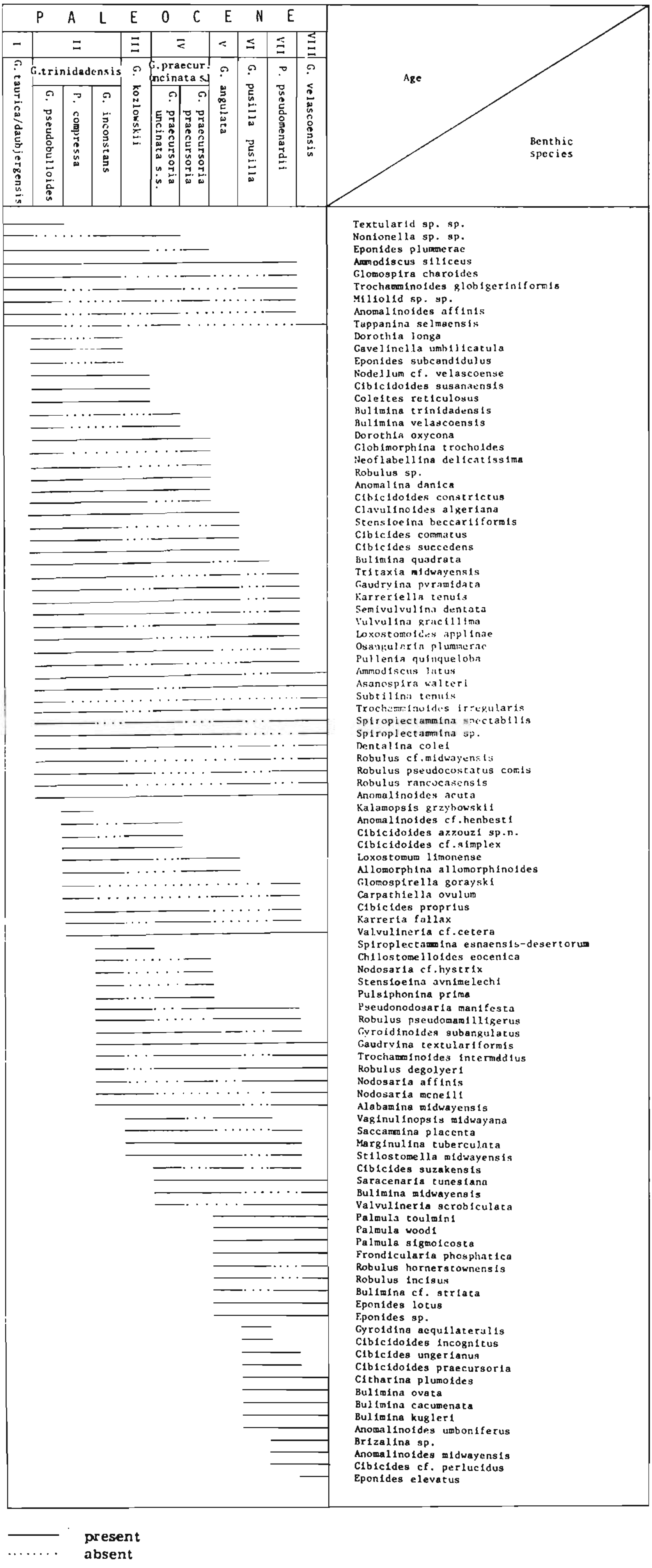


Table 2

Benthic species distribution in the Paleocene of the El Kef section, NW Tunis



here as the hypostratotype proper. Taking into account the results of previous studies as well as those of the present one, it has been possible to distinguish the following zones and subzones from:

<table>
<tr><td>VIII</td><td colspan="2">Globorotalia velascoensis</td></tr>
<tr><td>VII</td><td colspan="2">Planorotalia pseudomenardii</td></tr>
<tr><td>VI</td><td colspan="2">Globorotalia pusilla pusilla</td></tr>
<tr><td>V</td><td colspan="2">Globorotalia angulata</td></tr>
<tr><td rowspan="2">IV</td><td rowspan="2">Globorotalia praecursoria uncinata s.l.</td><td>G. praecursoria praecursoria</td></tr>
<tr><td>G. praecursoria uncinata s.s.</td></tr>
<tr><td>III</td><td colspan="2">Globoconusa kozlowskii</td></tr>
<tr><td rowspan="3">II</td><td rowspan="3">Globigerina trinidadensis</td><td>Globigerina inconstans</td></tr>
<tr><td>Planorotalia compressa</td></tr>
<tr><td>Globigerina pseudobulloides</td></tr>
<tr><td>I</td><td colspan="2">Globigerina taurica/Globoconusa daubjergensis</td></tr>
</table>

The first two zones (I-II) may probably be interpreted as an equivalent of the Danian and this part of the El Kef section is proposed as the hypostratotype of that stage as it is more complete than the European stratotype from the Boreal province (Stevns Klint and Faxe localities, Denmark). The base of the Danian in the Tunisian hypostratotype is defined by the top of the uppermost zone of the Cretaceous — the Abatomphalus mayaroensis Zone — the extinction of globotruncanas and the first occurrence of fine, smooth-walled globigerinas of the species *Globigerina taurica* and *Globoconusa daubjergensis*. The upper boundary of the Danian is defined by the first occurrence of *Globoconusa kozlowskii* (Brotzen & Pożaryska).

Three successive zones (III-V) would correspond to the Montian, the European stratotype of which, situated in the area of the Boreal province, is known to be highly incomplete. The lower part of the profile may be precisely correlated by the presence of *G. kozlowskii* as suggested by Moorkens (MS, in print), and the upper part by the presence of *G. angulata*, found in the Boreal province by Hansen (1968) and Norling (oral inf.). The three uppermost zones (VI-VIII) of the hypostratotype should be correlated with the Landenian, occupying the same position — the top part of the Paleocene — in the European stratigraphic schemes proposed by Moorkens (MS, in print) and Moorkens & Čepek (MS).

It follows that the Tunisian hypostratotypes proposed for the Danian, Montian and Landenian may be compared with European stratotypes from

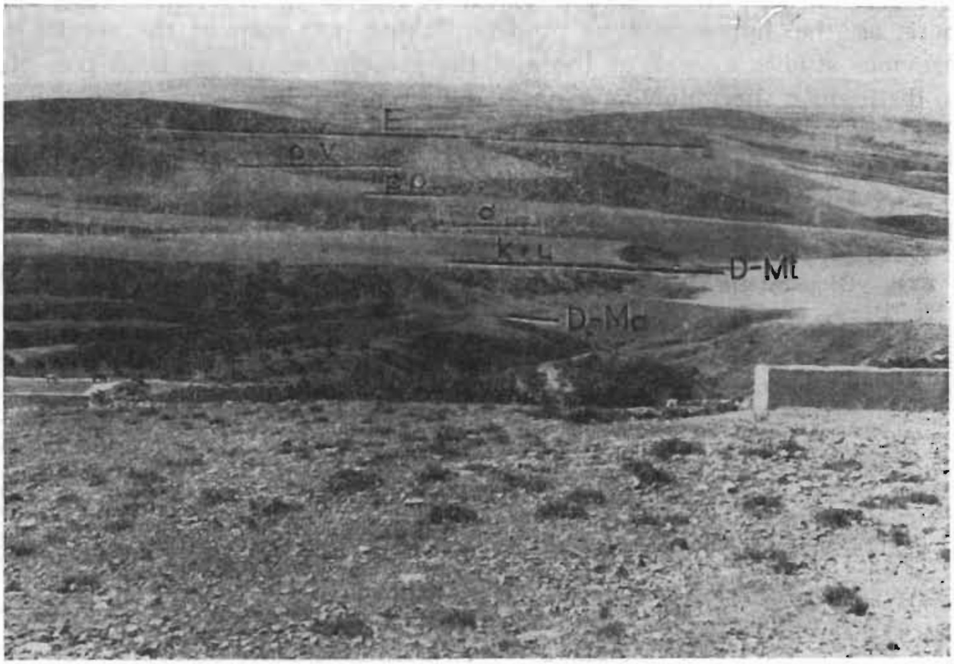


Fig. 2. General view of the type section (El Kef) representing the hypostratotype of the Paleocene marine sediments for Tethyan region. E — Lower Eocene. p+v — zones P. pseudomenardii + G. velascoensis, pp — zone G. pusilla pusilla, a — zone G. angulata, k+u — zones G. kozlowskii + G. praecursoria uncinata, D-Mt — Montian/Danian boundary, D-Ma — Danian/Maastrichtian boundary.
Fig. 3. The Danian/Maastrichtian boundary, fragment (cf. the arrow).

the Boreal province. At the same time they represent stratotypes for the Tethyan province. A detailed biostratigraphy of Paleocene deposits of the Tethyan province is based mainly on planktonic species predominant in particular zones and recorded in continuous sections. It should be of value

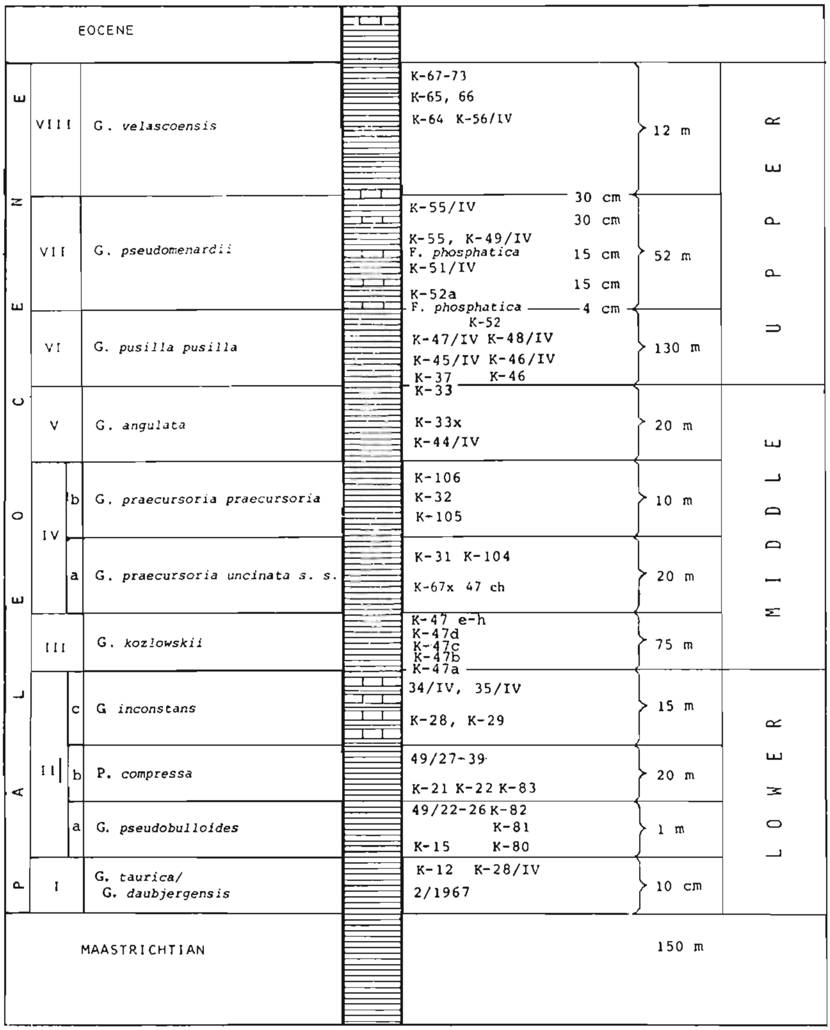


Fig. 4. Location of samples taken from El Kef hypostratotype section of the Paleocene.

in the more accurate determination of the age of the deposits represented in the incomplete sections of northern Europe.

Two subzones, those of G. pseudobulloides and P. compressa, were distinguished in the type locality of the Danian. Up to the present it has not been possible to distinguish the Globigerina taurica/daubjergensis Zone, nor the G. trinidadensis Zone in the European stratotype (Stevns Klint and Faxe localities, Denmark; Pożaryska, 1965). During the VIth

African Micropaleontological Colloquium the proposal was made to accept the hypostratotype of the Danian as the basal stage of the Paleocene after inclusion of the two above mentioned zones. It should be added that, up to the present, the Danian has not been definitely officially included in the Paleocene and thus in the Tertiary. Suggestions concerning that inclusion will be made by the present authors at the International Geological Congress in Australia in 1976.

Taking into account the results of studies by Moorkens (1972, MS) and others, it is now proposed to use the concept of the stratotype of the Paleocene as well as the names Danian, Montian and Landenian. The difficulties in correlating these stages with planktonic zones in the Boreal province are widely known.

The following interpretation of the El Kef hypostratotypes of the Paleocene is suggested:

(1) Hypostratotype of the Danian including zones I and II with 3 subzones.

(2) Hypostratotype of the Montian including zones III, IV (with 2 subzones) and V.

(3) Hypostratotype of the Landenian including zones VI-VIII.

Despite the differences between the Tethyan and Boreal provinces it seems preferable to use the classic, well-known names originally introduced for the areas of the latter, rather than to propose new names and thus to increase the existing controversies.

The proposed Tunisian hypostratotype of the Paleocene is highly complete which makes it possible to correlate the substages of the Paleocene from the Boreal and Tethyan regions, as well as to identify the extent of sedimentary gaps present in the former region. All of the Paleocene substages and zones are excellently displayed in the El Kef and Hedil sections in Tunisia and the transition may be analysed in detail there. Therefore it is proposed to recognize the El Kef section as the hypostratotype and Hedil section as the parahypostratotype (location in: Livret-Guide des excursions du VI Coll. Afr. Microp. 1974) of the whole Paleocene as well as its particular substages (Danian, Montian and Landenian).

I. Globigerina taurica/Globoconusa daubjergensis Zone

This zone was originally proposed by Morozova (1960). *Globigerina* (*recte Globoconusa*) *daubjergensis*, described by Brönnimann (1953) from the stratotype of the Danian, first appears at the base of that stage. Taking into account the principle of priority, the basal zone of that stage is called the Globigerina taurica/Globoconusa daubjergensis Zone. Its base is defined by the first appearance of the guide species and the assemblage of smooth-walled foraminifers, and its upper boundary is defined by the first appearance of primitive forms of *Globigerina pseudobulloides* and

G. trinidadensis. Besides the index species there also occur: *G. tetragona* Morozova, *G. sabina* Luterbacher & Premoli Silva. *G. fringa* Subbotina and *G. eobulloides* Morozova.

Globigerina eugubina, described by Luterbacher and Premoli Silva (1964), is considered as junior synonym of *G. taurica* Morozova. The two *incertae sedis* forms, named as *Bolboforma* by Spiegler and Daniels (1974), were found in that zone.

This zone corresponds to the Globigerina eugubina Zone subsequently proposed by Luterbacher and Premoli Silva (1964). The former is divided by some Soviet authors (Morozova, 1959, 1960; Schutzkaja, 1956, 1960; Subbotina, 1953; *in*: Bolli & Krasheninnikov, MS, in print) into two subzones. the lower, Globigerina eugubina Zone, and the upper, G. taurica Zone. However, this further subdivision appears difficult to make and is not accepted here or in Premoli Silva (MS, in print).

In samples taken at the contact between the Maastrichtian and Danian at El Kef and Hedil localities two planktonic species appear simultaneously: *Globigerina taurica* Morozova and *G. eobulloides* Morozova, which suggests the necessity of uniting the two zones into a single one. Moreover, the first dwarfish representatives of *Globoconusa daubjergensis* (Brönnimann), although very small in size, *Globigerina* cf. *danica* Bang and *G. edita edita* Subbotina (primitive forms) appear here, similarly as the first individuals of the Tertiary genus *Chiloguembelina*. This indicates that all species of small-sized guembelinas, globigerinas and chiloguembelinas appear almost simultaneously already in the lowermost zone of the Paleocene of Tunisia, according to Sigal's observations (1952).

Benthic foraminifers are rather rare in that zone (see Table II). The benthic, arenaceous as well as calcareous foraminifers do not become abundant until the next, G. pseudobulloides Subzone (see Table I).

II. Globigerina trinidadensis Zone

This zone, as defined by Bolli (1957), corresponds to the Danian. The results of detailed studies have shown that it is possible to divide it into three subzones: IIa — Globigerina pseudobulloides, IIb — Planorotalia compressa, IIc — Globigerina inconstans.

Globigerina pseudobulloides Subzone

This subzone was originally distinguished by Glintzboeckel (*in*: Jauzein, 1957) in Tunisia. Its interpretations given by Meijer (1969) and Salaj (1970) are accepted here. The base of this subzone is defined by the first appearance of representatives of the index species *G. pseudobulloides* and its top by the first appearance of *Planorotalia compressa* (Plummer, 1926). *Globigerina pseudobulloides* is very numerous here. Planktonic foraminifers very numerous here similarly as also in the next subzone, being represented by the following species: *G. perclara* Loeblich & Tappan, *Globigerina ?aquiensis* Loeblich &Tappan, *G. fringa* Subbotina, *G. trivialis* Subbotina, *G.* aff. *edita edita* Subbotina (primitive forms), *Subbotina triloculinoides* (Plummer), *Guembelitria irregularis* Morozova, *G. columbiana* Howe, *Chiloguembelina* cf. *morsei* (Kline), *Ch. wilcoxensis* (Cushman & Ponton), *Ch. midwayensis* (Cushman). It should be noted that the genus *Chiloguembelina* is represented already in zone I, but unfortunately only by forms which are unidentifiable due to heavy recrystallization.

Benthic foraminifers occur here abundantly (see Table II and plates I-XVI). Several benthic species known from the Paleocene of the Boreal province (Pożaryska & Szczechura, 1968; Scheibnerova, 1971) have been recorded here, as well as forms typical of the Tethyan province (Szczechura & Pożaryska, 1974).

Planorotalia compressa Subzone

This subzone, originally proposed as the Globigerina compressa-daubjergensis Zone by Loeblich & Tappan (1957) and subsequently redefined as the P. compressa Zone by Samuel (1965), has recently been redefined by Meijer (1969) and Salaj (1974). In the interpretations Loeblich & Tappan (1957) comprised the whole of the Danian, whereas Salaj (1974) defines its lower boundary by the first appearance of the index species *P. compressa* and its upper boundary by the first appearance of the representatives of *Globigerina inconstans.*

Planktonic foraminifers are infrequent here and they are represented mostly by species known from the previous G. pseudobulloides Subzone. Forms transitional between *G. pseudobulloides* and *P. compressa* and displaying traces of two hardly visible "pustulose" bands occur here, as do primitive, five-chambered *Globigerina* aff. *inconstans.* The typical representatives of *G. inconstans* do not appear in this subzone, whereas *G. trinidadensis* (Bolli) occurs. The latter, as interpreted by Bolli (1957), comprises 6- and 7-chambered forms, whereas according to Salaj (1974) it includes only 6-chambered forms, the 7-chambered forms not appearing before the G. inconstans Subzone.

Benthic foraminifers are here infrequent, just as in the lower subzone, being primarily represented by calcareous forms. The contribution of forms known also from the Boreal province is still high (see Table II).

Globigerina inconstans Subzone

This subzone was originally distinguished in the section of the Elburgan Fm. in the Caucasus by Subbotina (1953) but is lacking in the Danish stratotype. Subsequently it was redefined by Salaj (1974) according to whom the lower boundary of that subzone is defined by the first appearance of *Globigerina inconstans* (Subbotina) and the upper boundary by the first appearance of typical representatives of *Globoconusa kozlowskii* (Brotzen & Pożaryska, 1961). This interpretation is accepted here.

Planktonic foraminifers become very numerous in this subzone. The index from, *Globigerina inconstans* Subbotina is very abundant and is accompanied by *G. trinidadensis* (Bolli) and some species passing from the lower subzone — *Globigerina pseudobulloides* Plummer, *Planorotalia compressa* (Plummer), *Globigerina varianta* Subbotina, *G. trivialis* Subbotina, *Subbotina triloculinoides* (Plummer), *G. edita edita* Subbotina, *Globoconusa daubjergensis* Brönnimann. There also occur *Chiloguembelina midwayensis* (Cushman), *Ch. morsei* (Kline), *Ch. wilcoxensis* (Cushman & Ponton), *Guembelitria irregularis* Morozova (see pl. XXVII). Besides the species known from the lower subzones there appear over a dozen species or so known from the Midway Fm. (USA) called the "Midway fauna" by Aubert and Berggren (MS) and known from the Boreal province (Pożaryska & Szczechura, 1968).

III. Globoconusa kozlowskii Zone

This zone is here interpreted according to Salaj (1974). It represents a supplement to the Paleocene, as it is stratigraphically interpreted at present. If a tripartite subdivision of the Paleocene is accepted, i.e. into Lower, Middle and Upper Paleocene, this zone would represent the lowermost level of the Middle Paleocene. This is in accordance with the record of the index form from the European stratotype of the Montian from Puits d'Obourg in Belgium (Moorkens, MS). *Globoconusa kozlowskii* (Brotzen & Pożaryska) is part of the same evolutionary line as *G. daubjergensis* (Brönnimann) which is its ancestral form (see Brotzen & Pożaryska, 1961). Biometric distinction of these species has recently been made by Hansen (1970) and Moorkens (1971).

The base of this zone is defined by the first appearance of well developed *Globoconusa kozlowskii*, not yet recorded from the Danian. This is the boundary between the Danian and Montian when understood as separate stratigraphic substages of the Paleocene.

The texture of the wall surface of the species *Globoconusa daubjergensis* (Brönnimann) and *G. kozlowskii* (Brotzen & Pożaryska) is knobby (pl. XXI, figs 1-3) and not spinose as Loeblich & Tappan were inferred (1964, p. C670), thus the generic name *Globoconusa* proposed by Khalilov (1956) is accepted.

Traditionally the Globorotalia uncinata Zone has been recognized as overlying the G. trinidadensis or P. compressa Zone. The Globoconusa kozlowskii Zone has been neglected and the Globigerina uncinata and G. inconstans Zones have been considered as equivalents. However, studies on Tunisian sections show that the G. praecursoria uncinata Zone does not occur directly above the G. trinidadensis Zone or G. inconstans Subzone. The mass occurrence of *Globoconusa kozlowskii* in the interval between them is accepted as proof of the existence of the zone with this species as the nominative. This is in accordance with the results of Moorkens (1972, MS) quoting the occurrence of *Globorotalia uncinata* and *Globoconusa kozlowskii* (Brotzen & Pożaryska) and the lack of *Globigerina inconstans* in the European stratotype of the Montian. The Tunisian hypostratotype of the Paleocene displays the occurrence of *G. inconstans* species also in the *Globorotalia praecursoria uncinata s.l.* but the mass occurrence of the species is confined to older strata. Therefore, the Globoconusa kozlowskii Zone is recognized as occurring between the Globigerina trinidadensis, Globigerina inconstans Subzone and Globorotalia praecursoria uncinata *s.l.* Zone.

Planktonic foraminifers are very numerous here, including: *Planorotalia ehrenbergi* (Bolli), *P. compressa* (Plummer), *Globigerina inconstans* Subbotina, *G. pseudobulloides* (Plummer), *G. edita edita* Subbotina, *G. trinidadensis* Bolli, *G. varianta* Subbotina, *G. trivialis* Subbotina, *G. spiralis* Bolli, *Subbotina triloculinoides* (Plummer), *Globoconusa kozlowski* (Brotzen & Pożaryska), *Globigerina* cf. *quadrata* White, *Globorotalia imitata* Subbotina, *Chiloguembelina midwayensis* (Cushman), *Ch.* cf. *morsei* (Kline), *Bifarina laevigata* (Loeblich & Tappan), *B. alabamensis* (Cushman).

Benthic foraminifers are listed in Table II.

Contrary to the usage of Aubert and Berggren (MS, 1973), the generic name *Planorotalites* Morozova (1957) is not used here as the type species of that genus (*Globorotalia pseudoscitula*), it appears to be a typical *Globorotalia* (Glaessner, 1937, p. 32). Therefore the use of the generic name *Planorotalia* Morozova (1957) is preferred here as the representatives of that taxon are characterized by a smooth, not spinose test as seen in the whole line from *Planorotalia compressa* (Plummer, 1926) up to *Planorotalia membranacea* (Ehrenberg, 1854) and intermediaries between *P. compressa* and *P. pseudomenardii, P. troelseni* etc.

IV. Globorotalia praecursoria uncinata Zone *s.l.*

This zone is accepted here as originally interpreted by Bolli (1957). It is divided into two subzones: a lower, *Globorotalia praecursoria uncinata s.s.*, and an upper, *Globorotalia praecursoria praecursoria.* The former was precised by Salaj (1974) and its index species is very numerous both in the El Kef section and in other Paleocene sections from Tunisia. The species *Globorotalia praecursoria uncinata*, characterized by a circular aperture (see Bolli, 1957, and pl. XIX, fig. 3, herein), is represented throughout the zone, whereas *G. praecursoria praecursoria* characterized by a slit-like aperture (Mrozova, 1957; Luterbacher, 1964, pl. 2, fig. 3; and here pl. XVIII fig. 4) is confined to the upper part of this zone. Other planktonic species present include: *Globigerina pseudobulloides* Plummer (single individuals), *G. spiralis* Bolli, *G. varianta* Subbotina, *G. trivialis* Subbotina, *G. edita edita* Subbotina, *Planorotalia ehrenbergi* (Bolli), *G. imitata* Subbotina, *Globigerina* cf. *quadrata* White, *Subbotina triloculinoides* (Plummer), *Globorotalia praecursoria uncinata* Bolli, *Globoconusa kozlowskii* (Brotzen & Pożaryska).

Benthic foraminifers present include "Midway fauna" forms as well as some species typical of the North-African region (see Table II).

Globorotalia praecursoria praecursoria Subzone

This subzone is characterized by the first appearance of the nominative index species *Globorotalia praecursoria praecursoria sensu* Morozova (1959). This subzone was originally proposed as a full zone, the Turborotalia (Acarinina) inconstans praecursoria Zone (Samuel & Salaj, 1968) and was subsequently redefined by Salaj (1974).

In this subzone there occur: *Globigerina varianta* Subbotina, *G. trivialis* Subbotina, *G. pseudobulloides* Plummer, *G. spiralis* Bolli, *Globorotalia praecursoria uncinata* Bolli, *G. praecursoria praecursoria* (Morozova), *G. convexa* Subbotina, *Globorotalia imitata* Subbotina, *Planorotalia ehrenbergi* (Bolli), *Globoconusa kozlowskii* (Brotzen & Pożaryska), *Subbotina triloculinoides* (Plummer).

The benthic species are the same as in the lower subzone.

V. Globorotalia angulata Zone

This zone was proposed by Alimarina (1963; see Hillebrandt, 1965; Bolli, 1966; Salaj, 1974; Bolli & Krasheninnikov, MS 1974). The guide species of the zone, *Globorotalia angulata angulata* (White), evolved from both *Globorotalia praecursoria praecursoria* (Morozova) and *G. praecursoria uncinata* Bolli. The co-occurring *Globorotalia angulata abundocamerata* Bolli is considered to be a derivative of *G. praecursoria praecursoria* (Morozova).

The following planktonic forms are present here: *Globigerina pseudobulloides* Plummer, *G. trivialis* Subbotina, *G. varianta* Subbotina, *G. spiralis* Bolli, *Planorotalia troelseni* (Loeblich & Tappan), *P. ehrenbergi* (Bolli), *G. imitata* Subbotina, *G. praecursoria praecursoria* (Morozova), *G. praecursoria uncinata* (Bolli), *Subbotina triloculinoides* (Plummer).

In some profiles of the Paleocene of Tunisia, e.g. the section of the Tunis-Ariana area, the share of *Globorotalia angulata* (White) in the foraminiferal spectrum is 100% and benthic foraminifers are lacking or represented by single individuals. The assemblage of benthic foraminifers is characterized by the appearance of several forms typical of the North-African region. In the uppermost part of this zone some planktonic forms make their first appearance: *Globorotalia apanthesma* Loeblich & Tappan, *G. angulata abundocamerata* Bolli, *G. aequa* Cushman & Renz, *Acarinina esnaensis* (Le Roy), *A. ?intermedia* Subbotina, *Globorotalia ?wilcoxensis* Cushman & Ponton, *Planorotalia* aff. *pseudomenardii* (Bolli). However, it should be mentioned that *Globorotalia pseudoscitula* Glaessner also appears for the first time in the uppermost part of this zone, on the basis of which Salaj (1969) distinguished a separate zone. According to Salaj, *Globorotalia pusilla pusilla* Bolli is a junior synonym of *G. pseudoscitula* Glaessner and thus the G. pusilla Zone could be considered as a synonym of the G. pseudoscitula Zone. The present study has shown that *G. pseudoscitula* is the ancestral form without any keel (see Glaessner, 1937, p. 32, fig. 3 a-c), whereas *G. pusilla pusilla* Bolli, 1957, is characterized by a fairly well developed keel on the ventral side (see the type specimen figured by Bolli, 1957). Therefore the G. pusilla pusilla Zone is recognized as valid. The G. pseudoscitula Zone would then be relatively thin. The species *G. pseudoscitula* Glaessner first appears somewhat earlier than *G. pusilla pusilla* Bolli.

VI. Globorotalia pusilla pusilla Zone

This zone, originally distinguished under this name by Bolli (1957), covers part of the stratigraphic range of *G. angulata* (White). The redefinition given by Bolli and Krasheninnikov (1974) is accepted here.

Planktonic foraminifers are very numerous: *Globigerina finlayi* Brönnimann, *G. velascoensis* Cushman (single individuals), *Planorotalia* aff. *pseudomenardii* (Bolli) — primitive forms, *P. troelseni* (Loeblich & Tappan), *Acarinina ?intermedia* Subbotina, *A. esnaensis* (Le Roy), *A. tadjikistanensis* Bykova, *Globorotalia ?wilcoxensis* Cushman & Ponton, *G. pseudoscitula* Glaessner, *G. angulata angulata* (White), *G. angulata abundocamerata* Bolli, *G. aequa* Cushman & Renz, *G. acuta* Toulmin, *G. apanthesma* Loeblich & Tappan, *G. pusilla pusilla* Bolli, *G. pusilla laevigata* Bolli, *Subbotina triloculinoides* (Plummer). The fauna of benthonic foraminifers includes assemblages of typical buliminids and lagenids (see pls IV—VII), which appear here for the first time.

VII. Planorotalia pseudomenardii Zone

The definition of this zone given by Bolli (1957) and Bolli & Krasheninnikov (1974) is accepted here. Planktonic foraminifers are represented by: *Globigerina velascoensis* Cushman, *G. finlayi* Brönnimann, *Planorotalia* *pseudomenardii* (Bolli), *P. troelseni* (Loeblich & Tappan), *Acarinina mckannai* (White), *A. ?pentacamerata* (Subbotina), *A. ?intermedia* Subbotina, *A. esnaensis* (Le Roy), *A tadjikistanensis* (Bykova), *Globorotalia ?wilcoxensis* Cushman & Ponton, *G. angulata angulata* (White), *G. pseudoscitula* Glaessner, *G. velascoensis velascoensis* (Cushman), *G. aequa* Cushman & Renz, *G. acuta* Toulmin, *G. apanthesma* Loeblich & Tappan, *G. angulata abundocamerata* Bolli, *G. velascoensis parva* Rey, *G. marginodentata* Subbotina.

The base of this zone is delineated by limestone layer characterized by the mass occurrence of *Frondicularia phosphatica* Russo (Klasz & Le Calvez, 1969). The zone is extremely rich in benthic foraminifers, several of which represent forms typical of the North-African region.

VIII. Globorotalia velascoensis Zone

The definition of this zone given by Bolli (1957) is accepted here. The base of the zone is defined by the first appearance of the species *Globorotalia soldadoensis* Brönnimann and the upper boundary — by the first appearance of typical early Eocene forms and the disappearance of *G. velascoensis* (Cushman). However, it is difficult to trace the lower boundary because of the scarcity of planktonic forms. The El Kef section yielded several planktonic forms relatively well characterizing this zone: *Globigerina finlayi* Brönnimann, *G. velascoensis* Cushman, *Acarinina mckannai* (White), *A.?pentacamerata* (Subbotina), *A. triplex* Subbotina, *A.?intermedia* Subbotina, *A. esnaensis* (Le Roy), *Planorotalia troelseni* (Loeblich & Tappan), *Globorotalia ?wilcoxensis* Cushman & Ponton, *G. velascoensis velascoensis* (Cushman), *G. velascoensis parva* Rey, *G. marginodentata* Subbotina, *G. aequa* Cushman & Renz, *G. acuta* Toulmin, *G. pseudoscitula* Glaessner, as well as extremely rich assemblage of benthic foraminifers. By contrast in the Hedil section the strata of zone eight are very rich in planktonic foraminifers and markedly impoverished in benthos. The assemblage typical of the North-African region still predominates here.

GENERAL REMARKS

The hypostratotype of the Paleocene of the El Kef section of northern Tunisia should be understood as the Paleocene *sensu stricto*, with an upper boundary defined by the disappearance of the form *Globorotalia velascoensis* (Cushman). This is in accordance with the classic concept of the Paleocene and that definition of the upper boundary of that unit was recently accepted by Caro, Luterbacher *et al.* (1975, MS). Above the topmost zone of the Paleocene, the G. velascoensis Zone, is distinguished the G. edgari Zone, separating it from the G. subbotinae Zone.

Other authors have assigned the Ilerdien to the Paleocene (Hillebrandt, 1974). This gives expanded unit here referred to the Paleocene *sensu lato*, which should not be confused up with the Paleocene *sensu stricto* (Paleocene not comprising Ilerdien) defined above. If the Paleocene *sensu lato* is accepted, this would also comprise the following upper zones of the El Kef section: the Globorotalia simulatilis Zone (Salaj, 1970), corresponding to the G. edgari Zone of Caro, Luterbacher *et al.* (1975) and the G. formosa Zone of Bolli (1975), (emend. Salaj, 1974). The base of the Eocene would then be defined by the base of the G. aragonensis Zone of Salaj and Samuel, 1968. Alternatively, as suggested by Pomerol (1973) the whole G. velascoensis Zone might be assigned to the Lower Eocene.

BENTHIC FORAMINIFERS

Genus *Nodellum* Rhumbler, 1913

Nodellum cf. *velascoense* (Cushman, 1926)

Specimens recorded from the Paleocene of Tunisia are weakly developed, of rather very small size; this is why they are assigned to this species with a restriction. Present only in lower part of Paleocene El Kef section in Tunisia.

Known in Upper Cretaceous and Paleocene beds in several regions of Tethyan province (America and Europe as well).

Genus *Saccammina* Sars *in* Carpenter, 1869

Saccammina placenta (Grzybowski, 1897)

(Pl. III, fig. 18)

The revision of this species was done by Hanzliková (1972). Species abundant in the Cretaceous-Paleocene sediments in several regions of Tethyan province as well as in some regions of Boreal province.

This species was recorded from Mid-Paleocene of El Kef section of Tunisia.

Genus *Ammodiscus* Reuss, 1862

Ammodiscus latus Grzybowski, 1897

(Pl. II, fig. 5)

Our specimens have rather 3, or even, 3.5 coils and not 2.5 coils as specimens illustrated and described by Grzybowski. Generally rare in Paleocene beds of Tunisia, but present in almost all biozones. Described by Grzybowski from Upper Eocene of Polish Carpathians. Known only from Tethyan province.

Ammodiscus siliceus (Terquem, 1862)

(Pl. II, figs 3, 4)

Our specimens have tests insoluble in HCl, so they belong without doubt to *Ammodiscus siliceus*. Common in the whole section of Paleocene beds in Tunisia, except for its highest zone — G. velascoensis. This species is common in all regions of the Tethyan province, from Jurassic up to Paleocene.

Genus *Glomospira* Rzehak, 1888
Glomospira charoides (Jones & Parker, 1860)
(Pl. II, figs 1, 2)

Present in nearly all zones of Paleocene of Tunisia. Known as common in all regions of Tethyan province, from Upper Cretaceous up to Eocene.

Genus *Kalamopsis* de Folin, 1883
Kalamopsis grzybowskii (Dylążanka, 1901)
(Pl. III, fig. 5)

Our specimens are similar to those described and illustrated by Hanzliková (1972) from the Upper Cretaceous beds in Moravia. Holotype has not been figured. This species is known from Alps and Carpathians. Characteristic for Tethyan province only.

Genus *Carpathiella* Mjatliuk, 1966
Carpathiella ovulum (Grzybowski, 1896)
(Pl. III, fig. 13)

Not common in Paleocene beds of Tunisia. Present in Planorotalia compressa, P. pseudomenardii and Globorotalia angulata Zones. Known as occurring from Cretaceous up to Eocene beds in many regions of Carpathians. Known only from Tethyan province.

Genus *Subtilina* Alekseitchik, 1973
Subtilina tenuis (Cushman, 1927)
(Pl. II, figs 11, 12)

Our specimens are quite flat and even still thinner than the illustrated holotype by Cushman. Rare specimens of this very small and delicate species were found only in Globigerina pseudobulloides, Globorotalia praecursoria praecursoria and G. velascoensis Zones of Paleocene in Tunisia. Described from recent sediments of Pacific Ocean. Recorded also from the Paleocene sediments of the Caucasus. It seems to be restricted to the Tethyan region.

Genus *Glomospirella* Plummer, 1945
Glomospirella gorayskii (Grzybowski, 1897)
(Pl. II, figs 7, 8)

Specimens occurring in the Paleocene beds of Tunisia are very similar to those from the Paleocene of Carpathians. Very seldom found in Paleocene and Eocene of Carpathians. Single specimens found in Tunisia, mainly in compressa and pseudomenardii Zones. This species is known only from Tethyan province.

Genus *Spiroplectammina* Cushman, 1927
Spiroplectammina esnaensis/desertorum Le Roy, 1953

Our specimens are very similar to the illustrated holotypes from Paleocene of Egypt described by Le Roy (1953). Present in all zones, except for the 2 lowermost ones. This species is known only from North Africa.

Spiroplectammina spectabilis (Grzybowski, 1898)
(Pl. III, fig. 3)

Our specimens are very similar to those described from Polish Carpathians. Present in nearly all zones of Paleocene of Tunisia. Known as common in Upper Cretaceous and Paleocene beds in Carpathians, Alps, New Zealand and America. "Velasco" fauna species. It occasionally occurs also in epicontinental facies of Europe.

Spiroplectammina sp.
(Pl. III, figs 11, 12)

This peculiar species of *Spiroplectammina* resembles somewhat *Spiroplectammina desertorum* Le Roy (1953) by having same proportion of chambers; sutures fairly distinct, nearly straight. Common in nearly all zones of Paleocene of Tunisia.

Genus *Vulvulina* d'Orbigny, 1826
Vulvulina gracillima Ten Dam & Sigal, 1951
(Pl. III, figs 1, 2)

Our specimens are quite the same as those described and illustrated by Ten Dam and Sigal (1951). Specimens of *Vulvulina* sp. described by Szczechura and Pożaryska (1974) from Polish Carpathians also can be assigned to *Vulvulina gracillima.* A very similar species, *Vulvulina advena* Cushman (1926—1935), occurs in Upper Eocene beds of Coastal Plain (USA). This species occurs in Paleocene of Tunisia in almost all zones, except for the youngest zone — Globorotalia velascoensis. Its distribution is restricted to the Tethyan province only.

Genus *Semivulvulina* Finlay, 1939
Semivulvulina dentata (Alth, 1850)
(Pl. III, figs 8, 9, 10)

This species is assigned to *Semivulvulina* genus after Hanzliková (1972). It is known from Upper Cretaceous and Paleocene of several regions of Tethyan province. Reported also from epicontinental facies of North Europe. Common in nearly all zones of Paleocene beds in Tunisia.

Textularid sp.
(Pl. I, fig. 3)

Singular specimens belonging possibly to *Pseudobolivina* sp. are occurring in the lowermost zones of El Kef section.

Genus *Trochamminoides* Cushman, 1910
Trochamminoides globigeriniformis (Parker & Jones, 1865)
(Pl. I, figs 6, 7)

Specimens of this species occurring in the Paleocene beds of Tunisia are deformed being much more flattened than the holotype from Trinidad.

Present in nearly all biozones of Paleocene beds of Tunisia beyond the highest — Globorotalia velascoensis Zone. Common in Paleocene of several Tethyan regions, among others in Carpathians.

Trochamminoides intermedius (Grzybowski, 1898)
(Pl. I, fig. 4)

Our specimens are very close to those described by Grzybowski from Polish Carpathians.

Present in nearly all zones of the Paleocene beds of Tunisia. This species is known from Tethyan province only.

Trochamminoides irregularis White, 1928
(Pl. II, figs 9, 10)

Our specimens are much more flattened in comparison with those occurring in the Carpathians.

Present in nearly all zones of Paleocene of Tunisia. Known as common in Paleocene and Eocene of the Carpathians and Caucasus.

Genus *Gaudryina* d'Orbigny, 1839
Gaudryina pyramidata Cushman, 1926
(Pl. III, figs 6, 7)

Our specimens are very similar to those described by Cushman from Lizard Springs marl and in the Velasco shales of Mexico. It seems that *Gaudryina aissana* Ten Dam & Sigal (1951) described from Dano-Montian of Algeria belongs to *Gaudryina pyramidata* Cushman group.

Some species of *Gaudryina carinata* Franke, recorded by Hanzlíková (1972) from Moravian Carpathians, can be assigned with certainty to *Gaudryina carinata pyramidata* Cushman. Known as common in Upper Cretaceous and Paleocene beds in Trinidad as well as in Paleocene beds from Tunisia, where it is common in almost all zones of Paleocene, except for the G. velascoensis Zone. Recorded also from Paleocene of Egypt.

Gaudryina textulariformis Nakkady & Talaat, 1959
(Pl. III, fig. 17)

Our specimens correspond very well with the holotype illustrated by Nakkady (1959) and Talaat from the Danian beds of Egypt, having only the surface of tests not so smooth, more rough. This species occurs in all Paleocene of Tunisia except for the two basal zones. It seems to be restricted to the Paleocene of North African region only.

Genus *Tritaxia* Reuss, 1860
Tritaxia midwayensis (Cushman, 1936)
(Pl. II, fig. 6)

Triserial specimens from Paleocene of Tunisia are assigned to this species, but specimens triserial only in the early portion and uniserial later are assigned to *Clavulinoides*, because they have nothing in common with dimorphism phenomena within *Tritaxia* genus, as established by Cushman (1936). *Tritaxia midwayensis* (Cushman) is common in Paleocene beds of Tunisia in almost all zones. Common in several regions of Tethyan province.

Genus *Dorothia* Plummer, 1931

Dorothia longa (Morozova, 1961)

(Pl. III, figs 14, 15)

This species is rather scarce in Paleocene beds of Tunisia, as well as in Paleocene beds of the Carpathians and Turkmenia, from where it was described for the first time. It was recorded only from Globigerina pseudobulloides and G. inconstans Zones in Tunisia. Known as rare in some regions of Tethyan province.

Dorothia oxycona (Reuss, 1860)

(Pl. I, fig. 5)

Our specimens do not differ from the illustrated holotype. Very common, cosmopolitan species in Cretaceous and Paleocene beds, distributed in Tethyan regions all over the world from Trinidad up to New Zealand and in epicontinental facies as well.

Genus *Clavulinoides* Cushman, 1936

Clavulinoides algeriana Ten Dam & Sigal, 1950

(Pl. III, fig. 4)

Our specimens are very similar to the illustrated holotype and those described by Ten Dam and Sigal (1950). They are also somewhat similar to *Clavulinoides aspera whitei* (Cushman & Jarvis, 1932) on one hand, and on another to *Clavulinoides disjuncta* (Cushman, 1932). The discussion about the difference among all of these species was given by Ten Dam and Sigal (1950).

This species is common in the Paleocene beds of Tunisia, except for the G. velascoensis Zone. Known from North African region mainly. But uniserially arranged specimens assigned by Berggren, Aubert and Tjalsma (MS) to *Tritaxia midwayensis* (Cushman, 1936), ought to be separated from triserial forms of this species and assigned to *Clavulinoides algeriana* Ten Dam. Thus the distribution of the latter species appears to comprise the whole Tethyan province.

Genus *Karreriella* Cushman, 1933

Karreriella tenuis (Grzybowski, 1898)

(Pl. I, fig. 2)

This small, peculiar species of *Karreriella* is quite common in Paleocene and Eocene of Polish Carpathians. It occurs in almost all Paleocene beds in Tunisia. Its distribution is restricted to the Tethyan province.

Genus *Asanospira* Takayanagi, 1960

Asanospira walteri (Grzybowski, 1898)

(Pl. I, figs 1, 8, 9)

Our specimens have slightly higher central part of test than those described and illustrated by Mjatliuk (1970) from Carpathians and Aleksejtschik-Mitzkevitsch (1973) from Turkmenia (USSR). *Asanospira walteri* (Grzybowski) is conspecific with *Haplophragmoides excavatus* Cushman & Jarvis from the Navarro Fm. (USA). A typical Tethyan species. Present in almost all Paleocene of El Kef section of Tunisia. Paleocene — Eocene.

Miliolid spp.

Singular specimens belonging probably to different species occur throughout Paleocene El Kef section.

Genus *Globimorphina* Voloshina, 1969
Globimorphina trochoides (Reuss, 1845)

Singular specimens were found in El Kef section. The detailed discussion of this highly controversial species was given by Szczechura and Pożaryska (1974).

Rare, restricted to Tethyan province only, wherefrom it was recorded from several regions. Upper Cretaceous-Lower Eocene.

Genus *Nodosaria* Lamarck, 1812
Nodosaria affinis d'Orbigny, 1846
(Pl. V, fig. 3)

Our specimens correspond very well with those illustrated by Plummer (1926) as well as with the illustrated holotype by d'Orbigny (1846) from Tertiary of Austria. It has nothing in common with *Nodosaria* (*Dentalina*) *affinis* described by Reuss (1845) from the Cretaceous of Czechoslovakia. Not common. Present in almost all El Kef Paleocene section, except for 3 lowermost zones. Paleocene — Eocene.

Nodosaria mcneili Cushman, 1944
(Pl. V, fig. 12)

Our specimens well correspond to the specimens illustrated from Djebel North Cherahil section in Tunisia by Berggren *et al.* (MS) differing in smaller number of ribs from the holotype figured by Cushman (1944) from Upper Paleocene of USA. Not common. Recorded from nearly all El Kef Paleocene section. Known from Tethyan regions only. Paleocene.

Genus *Citharina* d'Orbigny, 1839
Citharina plumoides (Plummer, 1926)
(Pl. IV, fig. 9)

Our specimens do not differ from the holotype illustrated by Plummer (1926), having the same type of fine striae varying in degree of development. Not common. Present only in the uppermost zones of Paleocene El Kef section in Tunisia. Known from Tethyan regions and epicontinental facies. Upper Cretaceous — Paleocene.

Genus *Dentalina* d'Orbigny, 1826
Dentalina colei Cushman & Dusenbury, 1934
(Pl. IV, fig. 2)

Our specimens are similar to *Dentalina colei* as well as to *D. eocena* corresponding better, however with *Dentalina colei* illustrated holotype by Cushman and Dusenbury, than with *Dentalina eocena* (Cushman, 1944) recorded by Berggren *et al.* (MS), from Djebel North Cherahil section in Tunisia. Our specimens have chambers not so elongated as in *Dentalina eocena*. Not numerous but recorded in nearly all zones in Paleocene El Kef section. Paleocene — Eocene.

Genus *Frondicularia* Defrance, 1826

Frondicularia phosphatica (Russo, 1934)

(Pl. V, figs 1, 4)

This big species of *Frondicularia* is very variable in general shape and development of the central rib as well, which can be single, divided or accompagnied by few smaller, parallel ribs. Variation significant, described in details by de Klasz & Le Calvez, 1969. Very common in 4 highest zones of El Kef section, forming a true "lumachelle", especially well developed at the base of Planorotalia pseudomenardi Zone limestones. A typical North African species. Uppermost Cretaceous — Paleocene.

Genus *Robulus* de Montfort, 1808

Robulus degolyeri (Plummer, 1926)

(Pl. VI, figs 2, 5, 7)

Our specimens correspond very well with those described by Plummer (1926). This species was recorded in almost all zones, except for 3 lowermost of El Kef Paleocene section. Common in many Tethyan regions and in epicontinental facies as well. A "Midway fauna" cosmopolitan species. Paleocene.

Robulus hornerstownensis Olsson, 1960

(Pl. IV, figs 7, 8)

Our specimens correspond to those described by Olsson (1960). This species was recorded only in higher zones of El Kef section. It occurs in the Paleocene of the Tethyan regions as well as in epicontinental facies. A typical "Midway fauna" species. Paleocene.

Robulus incisus Lys, 1951

(Pl. IV, figs 3, 4)

Our specimens fall within the limits of variation of this African species described by Lys (1951) from North Africa (Morocco, Algeria). It was also recorded by the present authors from Libya and recently from upper part of the Paleocene El Kef section of Tunisia. A typical North African species. Paleocene.

Robulus cf. *midwayensis* (Plummer, 1926)

(Pl. IV, figs 1, 10)

Our specimens differ from those described and illustrated by Plummer (1926) by having less numerous chambers in the last whorl, 7—8 instead of 10—12. This is why there are included into this species with a restriction. *Robulus* cf. *midwayensis* (Plummer) was recorded from several zones of the El Kef section of Tunisia. Common in the Paleocene of Midway Fm. in America.

Robulus pseudocostatus comis Cushman, 1951

(Pl. VI, fig. 6)

Our specimens correspond well with the holotype illustrated by Cushman (1951). Not common in Paleocene of Tunisia, but present in almost all zones, except for Globigerina taurica/Globoconusa daubjergensis Zone. A typical "Midway fauna" species. Paleocene.

Robulus pseudomamilligerus (Plummer, 1926)
(Pl. VI, fig. 1)

Our specimens correspond well with topotypes from Midway Fm. (Plummer, 1926). This species is not common but it was recorded in almost all Paleocene of Tunisia. It is known also from epicontinental Paleocene facies. It represents a typical "Midway fauna" species. Paleocene.

Robulus sp.
(Pl. VI, figs 3, 4)

This species is somewhat similar to *Robulus orbicularis* Plummer from Midway Fm. (not *Robulus orbicularis* d'Orbigny from the Tertiary beds of Italy). It is small, rather thick, smooth and with sutures flush with surface. Relatively common in the Lower and Middle Paleocene of El Kef section.

Genus *Marginulina* d'Orbigny, 1826
Marginulina tuberculata (Plummer, 1926)
(Pl. V, figs 6, 7)

Our specimens correspond well with those described and illustrated by Plummer (1926). This species occurs in almost all Paleocene in Tunisia. In Texas it occurs in Upper part of Midway Fm. This species seems to be more common in Tethyan regions. Paleocene — Lower Eocene.

Genus *Neoflabellina* Bartenstein, 1948
Neoflabellina delicatissima (Plummer, 1926)
(Pl. V, fig. 5)

This peculiar species of *Neoflabellina* was recorded for the first time by Plummer (1926) in the Midway Fm. It is rather common in the Paleocene of Tunisia, but only in the lower part of the El Kef section. A typical "Midway fauna" species. Paleocene.

Genus *Palmula* Lea, 1833
Palmula sigmoicosta Ten Dam & Sigal, 1951
(Pl. V, fig. 14)

Specimens recorded from Tunisia are not differing from those described by Ten Dam and Sigal (1951) from Dano-Montian of Algeria. Common in four highest zones of El Kef section. This species occurs always together with *Frondicularia phosphatica* (Russo). A typical North African species. Paleocene.

Palmula toulmini Ten Dam & Sigal, 1950
(Pl. IV, figs 5, 6)

Our specimens correspond well with illustrated holotype by Ten Dam and Sigal (1950) from the Paleocene of Algeria. In Tunisia it is not common and limited only to the upper part of the El Kef section. This species is restricted to the North African region only. Paleocene.

Palmula woodi Nakkady, 1950
(Pl. V, figs 10, 11)

The big specimens of *Palmula* are more similar to those described by Berggren *et al.* (MS) from Djebel North Cherahil section in Tunisia, than to the illustrated holotype by Nakkady (1950) from Gebel Duwi in Egypt. It appears that the Egyptian forms represent the microsphaeric forms whereas those Tunisian ones — megalosphaeric forms. *Palmula woodi* is not common. It occurs only in the last four zones of the El Kef section in Tunisia. This species is restricted to North African region only. Paleocene.

Genus *Pseudonodosaria* Boomgaart, 1949
Pseudonodosaria manifesta (Reuss, 1851)
(Pl. V, fig. 13)

Our specimens correspond well with the illustrated holotype by Reuss. Common in all Upper Cretaceous and Paleocene sediments in "Midway fauna" as well as in others epicontinental facies. A cosmopolitan species occurring from America to New Zealand. Upper Cretaceous — Paleocene.

Genus *Saracenaria* Defrance, 1827
Saracenaria tunesiana Ten Dam & Sigal, 1950
(Pl. VI, fig. 8)

Our specimens correspond well with illustrated holotype and description by Ten Dam and Sigal (1950). This species is characterized by its peculiar costation. Common in Paleocene of Tunisia in upper part of the El Kef section being restricted to the North African region only. Paleocene.

Genus *Vaginulinopsis* Silvestri, 1904
Vaginulinopsis midwayana (Fox & Ross, 1942)
(Pl. V, figs 8, 9)

Our specimens are very similar to those described from Djebel North Cherahil section in Tunisia by Berggren *et al.* (MS). Common in middle part of El Kef section. Known from Midway Fm. as well as from Mid-Paleocene sediments of North African region. Paleocene.

Genus *Brizalina* Costa, 1856
Brizalina sp.
(Pl. VII, figs 1, 2)

Our specimens have all features of *Brizalina* except for ornamentation. This is why they are not assigned to any species of that genus. Very numerous in the two highest zones of Paleocene El Kef section in Tunisia. Paleocene.

Genus *Loxostomum* Ehrenberg, 1854, emend. Howe, 1930
Loxostomum limonense (Cushman, 1926)
(Pl. VII, fig. 5)

Our specimens are very similar to those described by Cushman (1946) from Mendez shale of Upper Cretaceous from Mexico, as well as from Lizard Springs Fm. (Early Paleocene) of Trinidad. Not common in Tunisia. Rather in lower zones up to G. praecursoria uncinata Zone in El Kef section. This species seems to be restricted to the Tethyan region. Upper Cretaceous-Paleocene.

Genus *Loxostomoides* Reiss, 1957
Loxostomoides applinae (Plummer, 1926)
(Pl. VII, fig. 6)

Our specimens display all the features of that species as described by Plummer (1926). Very common in almost all Paleocene of Tunisia. A typical "Midway fauna" species, occurring in Tethyan regions and in epicontinental facies. Pandemic guide form for the Paleocene.

Genus *Tappanina* Montanaro-Gallitelli, 1955
Tappanina selmensis (Cushman, 1933)

This species occurs in small numbers in the almost all Paleocene in Tunisia. A cosmpolitan species known from Tethyan regions and epicontinental facies. Upper Cretaceous — Paleocene.

Genus *Stilostomella* Guppy, 1894
Stilostomella midwayensis (Cushman & Todd, 1946)
(Pl. V, fig. 2)

Our specimens are very similar to those illustrated by Berggren *et al.* (MS) from the Paleocene sediments of Djebel North Cherahil section in Tunisia, differing only by more rounded not bell-like shape of chambers. Not common. Present in almost all El Kef section in Tunisia. Occurring in Tethyan regions and epicontinental facies. Paleocene.

Genus *Bulimina* d'Orbigny, 1826
Bulimina cacumenata Cushman & Parker, 1936
(Pl. VII, fig. 13)

Our specimens are very similar to the holotype illustrated by Cushman and Parker, differing only in having more differentiated ribs, which are of 2 categories: main ribs, thicker and secondary ones — thinner, forming a reticular pattern on the middle and lower part of test. Very common in three highest zones of the Paleocene beds of Tunisia. A "Midway fauna" species. Paleocene.

Bulimina kugleri Cushman & Renz, 1942

Our specimens correspond well with the holotype refigured by Cushman (1951). This species only slightly differs from *Bulimina ovata* d'Orbigny being more fusiform and thickest at the mid-height. Common. In Paleocene sediments in Tunisia it occurs in three highest zones only. A typical for Tethyan region species. Paleocene.

Bulimina midwayensis Cushman, 1936
(Pl. VII, figs 7, 8, 9)

Our specimens do not differ from those described and illustrated by Cushman (1951). Not common, but present in almost all zones from G. praecursoria uncinata

Zone onwards. A typical "Midway fauna" species, reported from the Paleocene sediments of North Africa as well as from epicontinental facies. Found also as far as in Timor. Upper Cretaceous — Eocene.

Bulimina ovata d'Orbigny, 1846

Our specimens do not differ from the holotype described by d'Orbigny (1846). This species is common in Upper Cretaceous and Paleocene sediments all over the world, known mainly from epicontinental facies.

Bulimina quadrata Plummer, 1926
(Pl. VII, figs 3, 4)

Our specimens correspond well with macrosphaeric form of *Bulimina quadrata* holotype illustrated by Plummer (1926). Common in the almost all Paleocene sediments in Tunisia. It is considered as typical "Midway fauna" species.

Bulimina cf. *striata* d'Orbigny, 1843
(Pl. VII, figs 10, 11, 12)

It is difficult to make a proper comparison between our specimens and the illustrated holotype, because of inadequacy of d'Orbigny's drawings. On the other hand, d'Orbigny's species was derived from recent Adriatic seacoast sediments. This is why, this species is assigned to *B. striata* with a restriction. *Bulimina* cf. *striata* was recorded in Paleocene beds of Tunisia in the upper part of the El Kef section, from the G. angulata Zone onwards.

Bulimina trinitatensis Cushman & Jarvis, 1928
(Pl. VII, fig. 15)

Our specimens better match the description than illustration the holotype by Cushman and Jarvis (1928). They have the same proportion of test and same reticulation of irregular network-type. Singular specimens recorded only from lower zones in Lower Paleocene beds of El Kef section (Tunisia). A typical for Tethyan region species. Upper Cretaceous-Paleocene.

Bulimina velascoensis White, 1929
(Pl. VII, fig. 14)

Our specimens are fairly similar to the topotypes found in Paleocene beds of Mexico (Velasco Fm.). They differ from those illustrated and described by Cushman (1946) in being much more distinctly pitted in a net-like pattern especially on the earlier portion of test. Relatively common in the lower part of the El Kef section. A typical for Tethyan region species. Upper Cretaceous — Paleocene.

Genus *Valvulineria* Cushman, 1926
Valvulineria scrobiculata (Schwager, 1883)
(Pl. VIII, figs 1, 2)

Our specimens are generally similar to the drawing of the holotype given by Schwager (1883). The number of chambers is the same. They differ from those presented by Nakkady (1959) from Esna shales section in slightly acute and not rounded margin. This species is relatively common in upper part of the El Kef section in Tunisia. Paleocene — Eocene.

Valvulineria cf. *cetera* (Bykova, 1953)
(Pl. X, figs 3, 4)

Our specimens are similar to the holotype illustrated by Bykova (1953) from the Paleocene of Tadjik depression, differing however in less numerous chambers and much more acute margin of test. Hence they are assigned to this species with a restriction. Rather common in the whole El Kef section, except for three lowermost biozones.

Genus *Eponides* de Montfort, 1808
Eponides elevatus (Plummer, 1926)
(Pl. XIV, fig. 2)

Our specimens differ from the holotype illustrated from Midway Fm. by Plummer (1926) only in being lower on spiral side. This species is relatively common in the highest part of El Kef Paleocene section. The specimen identified as *Eponides elevatus* (Plummer) by Cushman (1951, pl. 14, fig. 18, non 19) may represent another species as its sutures are not raised at all and it has no lips bordering umbilicus. A "Midway fauna" species, unknown from Europe. Paleocene.

Eponides lotus (Schwager, 1883)
(Pl. X, fig. 2)

Our specimens well agree with the holotype illustrated by Schwager (1883), differing from Egyptian specimens assigned to that species by Nakkady (1959) in having, similarly as the holotype, 6 chambers instead of 9. Singular specimens recorded in four highest zones of the Paleocene of El Kef section. This species seems to be restricted to the Tethyan regions only. Paleocene.

Eponides plummerae Cushman, 1948
(Pl. X, fig. 1)

Our specimens correspond well with those described by Cushman (1948) from the Paleocene strata of Texas. This species is very common especially in lower part of El Kef section. Known from Paleocene only. A "Midway fauna" species.

Eponides subcandidulus (Grzybowski, 1896)
(Pl. VIII, fig. 3)

The specimens are very similar to the holotype illustrated by Grzybowski (1896) differing only in less numerous chambers (7 instead of 8—10) in the last whorl. Recorded only in lower part of the El Kef section. This species occurs in several regions of Tethyan province. Upper Cretaceous — Oligocene.

Eponides sp.
(Pl. XIII, figs 1, 2)

This peculiar, 5—6 chambered, high, biconvex species of *Eponides* is not similar to any known species of this genus. Present in four highest zones of El Kef section Mid-Upper Paleocene.

Genus *Cibicides* de Montfort, 1808

Cibicides commatus Morozova, 1954

(Pl. XI, figs 1, 2)

Our specimens are very similar to the holotype illustrated by Morozova (*in* Vassilenko, 1954). This species is very common in the lower and middle part of the Paleocene El Kef section. Common in Upper Maastrichtian and Paleocene strata in epicontinental facies of Europe mainly. Upper Cretaceous — Paleocene.

Cibicides proprius (Brotzen, 1948)

(Pl. XVI, fig. 1)

Our specimens are very similar to the holotype illustrated by Brotzen (1948). Very similar forms were described from Paleocene of Tunisia by Berggren *et al.* (MS) as *C. alleni* (Plummer, 1926). According to the present authors, the specimens occurring from the Paleocene of Tunisia are closer to *C. proprius* than to the holotype of *C. alleni* (Plummer). It seems that the forms of Berggren *et al.* (MS) also belong to the former species.

Rather common in Paleocene of El Kef section. Species well known from epicontinental facies. Paleocene.

Cibicides ungerianus (d'Orbigny, 1846)

(Pl. XVI, figs 3, 4)

Our specimens are similar to those described and illustrated by d'Orbigny (1846), differing in less numerous chambers in the last whorl (8—9 instead of 11). Other features are the same, i.e. coarsely perforated wall, granulation covering central part of dorsal side and strongly curved sutures on ventral side. Present only in the higher part of El Kef section. Known from the Tertiary of Austria (Vienna Basin) and from the Eocene of Belgium, Holland and USSR from where it was recorded from G. velascoensis Zone. Uppermost Paleocene up to the Oligocene. The species is known mainly from the epicontinental facies, but also from geosynclinal facies of the North Caucasus.

Cibicides succedens Brotzen, 1948

(Pl. XV, fig. 3)

Our specimens fall within the limits of variation of this species as precised by Brotzen (1948). Not common in Paleocene of Tunisia, occurring mainly in the lower and middle part of El Kef section. Primarily known from the regions of epicontinental facies. Paleocene.

Cibicides suzakensis Bykova, 1953

(Pl. XVI, figs 7, 8)

Our specimens are not so high as the holotype illustrated by Bykova (1953). It seems also that the central plug from dorsal side of Tunisian specimens is much better developed, being larger and more coarsely pitted. Variability of this species is well described by Bykova, so we can easy prove that our specimens fall within its limits. Not common in El Kef section, being present in its higher part. Described from the Lower Paleogene of Tadjik Depression (Thanetian beds). Paleocene.

Genus *Cibicidoides* Thalmann, 1939

Cibicidoides azzouzi sp.n.

(Pl. XII, figs 4, 5)

Holotype: Specimen presented on Pl. XII, fig. 4.
Paratype: Specimen presented on Pl. XII, fig. 5.
Type level: Lower part of Middle Paleocene.
Type locality: El Kef section, Tunisia.
Derivation of the name: in honour to dr. A. Azzouzi, the Director of Tunisian Geological Survey, Tunisia.

Material. — Some hundred specimens well preserved.

Dimensions (in mm):	Holotype F XIX/108	Paratype F XIX/109
Longest diameter	0.39	0.38
Shortest diameter	0.46	0.48
Height of test	0.18	0.18

Description. — Test convex on spiral side, almost flat on ventral, nearly always involute on both sides; weakly acute, slightly keeled; chambers 11—12 in number in the last whorl, sutures curved on both sides, limbate and raised, especially on spiral side; central plug small, distinctly tuberculate is bordered by well developed tena. Umbilical plug obscure, weakly distinguished, flush with surface on ventral side. Wall coarsely perforate on both sides, aperture in the form of an arched opening on the periphery, somewhat extending on dorsal side.

Remarks. — Similar to *Cibicides susanaensis* (Browning, 1959) differing in being not biconvex and having more chambers in the last whorl. Both species are almost involute. Differing in having ventral plug almost flush with test surface in contrast with *C. susanaensis* where it is distinctly deepened in relation with last chambers. Moreover the umbilicus of spiral side is filled at *C. azzouzi*, while is fairly opened at *C. susanaensis*.

Occurrence. — Very common in the lower part of the El Kef Paleocene section, Tunisia. This species is known from Upper Cretaceous and lowermost Tertiary of Libya and Irak.

Cibicidoides constrictus (Hagenow, 1842)

(Pl. XVI, fig. 2)

Hagenow (1842) did not illustrated the holotype of his Late Cretaceous species, *Rotalia constricta* (*recte Cibicidoides constrictus*). Subsequently this species was described from the Upper Cretaceous of Texas and Arkansas by Cushman (1946) and from the Paleocene of Tunisia by Berggren *et al.* (MS). Our determination of this species is based on the illustration presented by Berggren *et al.* (MS). This species is very rare in Paleocene of Tunisia, being present in the lower part of El Kef section. Possibly it occurs also in Polish Carpathians (Babica Clays). Species rather limited to the epicontinental facies. Upper Cretaceous — Paleocene.

Cibicidoides incognitus (Vassilenko, 1950)

(Pl. XV, figs 4, 5)

Our specimens correspond well to those illustrated by Vassilenko (1954). Very rare in Tunisia. Found only in G. pseudoscitula Zone. *Cibicidoides incognitus* (Vassilenko) is known mainly from Paleocene sediments of epicontinental facies. Paleocene.

Cibicidoides cf. *simplex* Brotzen, 1948
(Pl. XII, fig. 3)

Our specimens differ from the holotype illustrated (Brotzen, 1948) in depressed and not thickened last sutures on the umbilical side and not so well developed central plug. Generally they correspond well, differing much in size, this is why they are assigned with restriction. Singular specimens. Present only in lower part of Paleocene El Kef section. *C. simplex* Brotzen is known from Upper Cretaceous up to Paleocene in epicontinental facies mainly.

Cibicidoides susanaensis (Browning, 1959 *in* Mallory, 1959)
(Pl. XII, figs 1, 2)

Our specimens are assigned to *C. susanaensis* (Browning) on the base of comparison with the illustrations and description of this species given by Berggren *et al.* (MS). According to Berggren the Tunisian specimens correspond well with Browning's Californian species. Differences in respect to *C. azzouzi* sp.n. as given above.

Very common in the lower part of the El Kef Paleocene section. Upper Cretaceous — Lower Eocene.

Genus *Allomorphina* Reuss, 1850
Allomorphina allomorphinoides (Reuss, 1860)
(Pl. XIV, fig. 1)

Our specimens are much more similar to those described from Midway Fm. by Plummer (1926) than to the holotype from Cretaceous of Germany schematically figured by Reuss (1860), but it seems that they all represent the same species. Not common. Present in the Middle Paleocene mainly. Upper Cretaceous — Paleocene. A "Midway fauna" species.

Genus *Chilostomelloides* Cushman, 1926
Chilostomelloides eocaenica Cushman, 1926
(Pl. III, fig. 16)

Singular specimens, very similar to those described and illustrated by Berggren *et al.* (MS) from Djebel North Cherahil section of Tunisia (Cushman's drawings of the holotype is insufficient for identification). A "Midway fauna" species. Paleocene — Lower Eocene.

Genus *Nonionella* Cushman, 1926
Nonionella sp.

Some specimens difficult to allocate in any known Paleocene species, possibly most similar to *Nonionella ovata* Brotzen (1948). Present in the lower part of the Paleocene of El Kef section only.

Genus *Pullenia* Parker & Jones, 1862
Pullenia quinqueloba (Reuss, 1851)
(Pl. XI, fig. 3)

Our specimens are less laterally compressed than the holotype from the Eocene of Germany which is distinctly acute, while our specimens always have rounded margin. Very scarce, but occurring almost throughout the whole Paleocene section of El Kef. This cosmopolitan species is known from epicontinental facies mainly. Cretaceous — Oligocene.

Genus *Alabamina* Toulmin, 1941
Alabamina midwayensis Brotzen, 1948
(Pl. XV, figs 1, 2)

Our specimens fall within the limits of variation of this species as precised by Pożaryska and Szczechura (1968). Common in Paleocene of Tunisia, especially in the higher part of El Kef section. Common mainly in the Paleocene developed in epicontinental facies. Upper Cretaceous — Paleocene.

Genus *Gyroidina* d'Orbigny, 1826
Gyroidina aequilateralis (Plummer, 1926)
(Pl. XIII, fig. 3)

Our specimens correspond well with those described and illustrated by Plummer (1926) from Midway Fm. Sutures on dorsal side are not so curved, but all other features and especially lips bordering umbilicus are the same. Very common, but only in higher part of the El Kef section. A "Midway fauna" species, unknown from Europe. Paleocene.

Genus *Gyroidinoides* Brotzen, 1942
Gyroidinoides subangulatus (Plummer, 1926)
(Pl. VIII, fig. 5)

Our specimens do not differ from the holotype illustrated by Plummer (1926). This species is very common in the El Kef section, except for the 3 lowermost biozones. A typical "Midway fauna" species, known from Tethyan regions and epicontinental facies. Upper Maastrichtian — Paleocene.

Genus *Osangularia* Brotzen, 1940
Osangularia plummerae Brotzen, 1940
(Pl. VIII, fig. 4)

Our specimens are very similar to those described by Brotzen (1940) as well as those occuring in Polish Carpathians (Babica clays) (Szczechura & Pożaryska, 1974). Very common in the whole section El Kef in Tunisia (except for the lowermost zone), especially in the higher part. A typical "Midway fauna" species, present mostly in epicontinental facies. Paleocene.

Genus *Anomalinoides* Brotzen, 1942
Anomalinoides acuta (Plummer, 1926)
(Pl. IX, figs 3, 6)

Our specimens are the same as those described by Plummer and correspond well to the illustrated holotype. This cosmopolitan species occurs especially in epicontinental facies. A typical "Midway fauna" species. Upper Cretaceous — Eocene.

Anomalinoides affinis (Hantken, 1875)
(Pl. IX, figs 1, 2)

Our specimens are almost the same as those described and illustrated by Hantken (1875), being only not so flattened and having not so acute margins. The discussion and comparison — as given by Szczechura and Pożaryska (1974). Conspecific specimens were recorded by Berggren *et al.* (MS) from Paleocene of Tunisia and identified as *A. welleri* (Plummer). This species shows a very large variation. Some specimens have distinctly developed apertural flaps, while others have no flaps at all. Such morphological details were the basis for Berggren *et al.* (MS) for differentiation of several similar species like *A. pseudowelleri* (Olsson, 1960), *A. praespissiformis* (Cushman & Bermudez) and others, which according to the present authors are highly variable and may be conspecific and put in the synonymy of *Anomalinoides affinis* (Hantken), according to the law of priority. This very cosmopolitan species is known from Upper Cretaceous up to Oligocene. Recorded in the whole El Kef section.

Anomalinoides cf. *henbesti* (Plummer, 1935)
(Pl. XI, figs 4, 5)

Our specimens are similar to those described and illustrated by Plummer (1935) from Upper Cretaceous of Texas. The variability of *Anomalina henbesti*, as presented by Plummer, is rather high; some specimens can have thickened sutures, while others have depressed ones, the development of boss varies greatly on both sides, so our specimens from Tunisia fall within the limits of variability of this species. Not common. Present only in the lower part of El Kef Paleocene section. Upper Cretaceous — Paleocene.

Anomalinoides midwayensis (Plummer, 1926)
(Pl. XIII, figs 4, 5)

Our specimens have sutures generally not so strongly raised but more curved or even slightly sickled, and the lips bordering the umbilicus not so well developed as in the holotype illustrated by Plummer (1926). Brotzen's (1948) specimens assigned to *A. midwayensis* (Plummer) differ from *A. midwayensis* recorded from the Midway Fm. Common. Present in two highest biozones in El Kef section. A "Midway fauna" species presumably not known from Europe. Paleocene.

Genus *Anomalina* d'Orbigny, 1826
Anomalina danica (Brotzen, 1940)
(Pl. IX, figs 4, 5

Our specimens are undoubtedly conspecific with those described by Brotzen (1940). Common in the lower and middle part of El Kef section in Tunisia. Upper Cretaceous up to Paleocene mainly from the epicontinental facies of Europe and Israel. Also recorded from some Tethys regions (e.g. the Carpathians).

Genus *Coleites* Plummer, 1934
Coleites reticulosus (Plummer, 1926)
(Pl. XIV, fig. 3)

Our specimens fall within the limits of variation of this species. *Coleites reticulosus* (Plummer) is not common in the Paleocene of Tunisia, being present mainly in lower part of El Kef section. This cosmopolitan species is known from epicontinental facies mainly. Upper Cretaceous — Lower Eocene.

Genus *Gavelinella* Brotzen, 1942

Gavelinella umbilicatula (Mjatliuk, 1942)

(Pl. XVI, figs 5, 6)

Our specimens well correspond with the specimen illustrated by Mjatliuk (1970) from the Maastrichtian of Carpathians, having only not so well bordered umbilical depression. Some additional remarks were given by Szczechura and Pożaryska (1974), Similar form from Paleocene of Tunisia was described by Berggren *et al.* (MS) as *Gavelinella lellingensis* Brotzen, 1948. Rather rare, present in the lower part of El Kef section. Upper Cretaceous — Paleocene of many regions of epicontinental facies and from the Carpathians.

Genus *Karreria* Rzehak, 1891

Karreria fallax Rzehak, 1891

(Pl. III, fig. 19)

Several specimens with typical specific features were found in the lower part of the El Kef section. This species is very common in the Lower Paleocene of epicontinental facies. Upper Cretaceous — Lower Eocene.

Genus *Pulsiphonina* Brotzen, 1948

Pulsiphonina prima (Plummer, 1926)

Singular specimens with all the features typical of *Pulsiphonina prima* (Plummer) were found in three zones only. This species is very common in epicontinental facies of Boreal province. A typical "Midway fauna" species. Upper Cretaceous — Paleocene.

Genus *Stensioeina* Brotzen, 1936

Stensioeina avnimelechi (Reiss, 1952)

(Pl. XIV, figs 4, 5)

A comparison with topotypes and specimens described as *Stensioeina whitei* by Morozova (*in* Vassilenko, 1961) was given by Szczechura and Pożaryska (1974). Our specimens are similar to the holotype illustrated by Reiss (1952). This characteristic species is known from several Tethyan regions, being restricted to this province. Rarely occurring in lower part of El Kef section. Paleocene.

Stensioeina beccariiformis (White, 1928)

(Pl. XIII, figs 6, 7)

This species was discussed in details by Szczechura and Pożaryska (1974). Specimens from El Kef section undoubtedly belong to this species. Very common in the lower part of Paleocene in Tunisia. This species was recorded from several Tethyan regions, as well as rarely from epicontinental facies from marginal western regions of Europe. Upper Cretaceous — Paleocene.

PLANKTONIC FORAMINIFERS

Genus *Guembelitria* Montanaro Gallitelli, 1957
Guembelitria irregularis Morozova, 1961
(Pl. XXVII, fig. 2)

1961 *Guembelitria irregularis* Morozova: 17, pl. 1, fig. 9.
1973 *Guembelitria irregularis* Morozova; Krasheninnikov & Hoskins: 115, pl. 31, figs 1, 2.

Specimens representing *Guembelitria irregularis* Morozova are rather rare in El Kef section; they have less regularly arranged chambers when compared to specimens figured by Morozova (1961) but seem to fall within variation attributed to that species by its author.

Species known from the lowermost Paleocene, restricted to the Tethyan region.

Genus *Bifarina* Parker & Jones, 1872
Bifarina alabamensis (Cushman, 1940)
(Pl. XXVII, fig. 4)

1957 *Tubitextularia alabamensis* (Cushman); Loeblich & Tappan: 180, pl. 41, fig. 7.

Species rare in El Kef section, represented by specimens that well agree with that figured and described by Cushman, 1940, as *Rectoguembelina* (*recte Bifarina*) *alabamensis*.

Recorded from the Middle Paleocene. Exact regional distribution unclear.

Genus *Chiloguembelina* Loeblich & Tappan, 1956
Chiloguembelina cf. *morsei* (Kline, 1943)
(Pl. XXI, fig. 4)

Determination of this species is based on description and illustration of *Chiloguembelina morsei* (Kline) as given by Loeblich & Tappan (1957). When compared with specimens described and figured by these authors, tests from El Kef, assigned to *Chiloguembelina* cf. *morsei*, seem to have more globular chambers, which at the same time are more horizontal, rather centrally situated aperture and the whole test surface more hispid; there is a distinct variation concerning the arrangement of chambers, which is more or less regular. Species well represented in El Kef section.

Chiloguembelina morsei is known from the Lower and Middle Paleocene, in epicontinental as well as deep-sea facies.

Chiloguembelina midwayensis (Cushman, 1940)
(Pl. XXVII, fig. 3)

1957 *Chiloguembelina midwayensis* (Cushman); Loeblich & Tappan: 179, pl. 41, fig. 3, pl. 43, fig. 7, pl. 45, fig. 9.

Species not common in the studied samples, represented by specimens appearing to be conspecific with *Guembelina* (*recte Chiloguembelina*) *midwayensis* Cushman, 1940.

It is known mainly from the Lower and Middle Paleocene, and seems to be cosmopolitan.

Chiloguembelina wilcoxensis (Cushman & Ponton, 1932)
(Pl. XXVII, fig. 1)

1973 *Chiloguembelina wilcoxensis* (Cushman & Ponton); Krasheninnikov & Hoskins: 121, pl. 5, figs 2, 3.

Specimens assigned to this species seem to be common in the lower part of the studied section however, they may be confused with *Chiloguembelina* cf. *Guembelina morsei* Kline, 1943, with which it is associated; the latter has chambers less rapidly growing in size when compared to *Ch. wilcoxensis* (Cushman & Ponton).

Species recorded mostly from the Upper Paleocene and Lower Eocene, of wide geographical distribution.

Genus *Globorotalia* Cushman, 1927

Globorotalia acuta Toulmin, 1941
(Pl. XXVI, figs 3, 4)

1970 *Globorotalia acuta* Toulmin; Samanta: 615, pl. 97, figs 1, 2.
1973 *Globorotalia acuta* Toulmin; Krasheninnikov & Hoskins: 115, pl. 17, figs 7—9.

Usually specimens representing *Globorotalia acuta* Toulmin, 1941, have more chambers (i.e. 4—6) than those founded in the Paleocene of the El Kef section and open, deep umbilicus, however other features of the latter allow us to attribute them to that species. Similar forms, like those from the Paleocene of Tunisia are also assigned to *G. acuta* by Luterbacher (1964, fig. 102).

Species known from the Upper Paleocene of the Tethyan region.

Globorotalia aequa Cushman & Renz, 1942
(Pl. XX, fig. 5, pl. XXV, figs 3—6)

1970 *Globorotalia aequa* Cushman & Renz; Samanta, 617, pl. 96, figs 5, 11—14.
1971 *Globorotalia aequa* Cushman & Renz; Postuma, 168 (illustrations included).
1973 *Globorotalia aequa* Cushman & Renz, Krasheninnikov & Hoskins, 117, pl. 17, figs 10—12.

Most of the specimens assigned to that species agree well, according to their morphological features with its holotype. There are some, however, which differ in the test ornamentation as well as arrangement and shape of chambers, which are only tentatively treated as conspecific with the former; even large variation attributed to *Globorotalia aequa* (cf. Luterbacher, 1964) allow to see them belonging to different taxons.

Species known mostly from Upper Paleocene, rather restricted to the Tethyan region.

Globorotalia angulata abundocamerata Bolli, 1957
(Pl. XVIII, fig. 1)

1964 *Globorotalia angulata abundocamerata* Bolli; Luterbacher: figs 41, 42.
1971 *Globorotalia abundocamerata* Bolli; Postuma, 166 (illustration included).

Some specimens rather typical for that subspecies, never having more than $6^1/_2$ chambers in the last coil.

Age and distribution similar as for the nominative subspecies, however, *Globorotalia angulata abundocamerata* is somewhat younger in age than *G. angulata angulata*.

Globorotalia angulata angulata (White, 1928)
(Pl. XX, fig. 4)

1974 *Globorotalia angulata* (White); Szczechura & Pożaryska: 70, pl. 32, figs 1—3, pl. 35, fig. 4.
1974 *Globorotalia (Morozovella) angulata* (White); Sigal: pl. 4, fig. 1.

A few dozen of specimens including the forms typical for the species as well as more compressed and rather biconvex ones, closer to *Globorotalia simulatilis* (Schwager, 1883); this latter determined after Luterbacher (1964). Specimens with four chambers in the final whorl (pl. XXIII, figs 5, 6) almost identical to those referred by Loeblich & Tappan (1957, pl. 45, fig. 7, pl. 55, fig. 7) to *Globorotalia angulata*, are here also assigned, although questionably, to that species.

Globorotalia apanthesma Loeblich & Tappan, 1957
(Pl. XXV, figs 7—9)

1970. *Globorotalia apanthesma* Loeblich & Tappan; Samanta: 620, pl. 96, figs 15, 16.
1973 *Globorotalia apanthesma* Loeblich & Tappan; Krasheninnikov & Hoskins: 119, pl. 18, figs 1—3.

A few specimens well comparable to the holotype of the species.

Species appearing in the Middle Paleocene and passing to the Eocene, known mostly from the Tethyan region.

Globorotalia cf. *aragonensis* Nuttall, 1930
(Pl. XXIII, figs 1, 2)

Few specimens resembling much the typical specific forms especially because of their tight arrangement of chambers, almost even peripheral margin and a thick test wall; heavy ornamentation occurs along the sutures on flat, spiral side, along the peripheral margin and on the umbilical shoulders. The difference concerns mostly the number of chambers. There are no more than $5^1/_2$ (instead 6—8) in the last whorl, in the Tunisian forms.

Species known up to now from Lower and Middle Eocene being restricted to the Tethyan region.

Globorotalia cf. *convexa* Subbotina, 1953
(Pl. XVIII, fig. 6)

Test low trochospiral; equatorial periphery weakly lobulate, axial periphery narrowly rounded. Wall distinctly perforate, surface rough. Chambers inflated, especially the last ones, arranged in about $2^1/_2$ whorls; about 7 chambers, increasing gradually in size, occur in the last whorl. Aperture interiomarginal, extraumbilical-umbilical. Specimens assigned to that species (a few in number), from El Kef, have more chambers and more rounded periphery than the specimens described by Subbotina (1953) as *Globorotalia convexa*, and that is why they are not treated here as conspecific.

Globorotalia convexa is recorded from almost all levels of the Paleocene and seems to have large geographical distribution.

Globorotalia imitata Subbotina, 1953
(Pl. XIX, figs 1, 2)

1957 *Globorotalia imitata* Subbotina; Loeblich & Tappan: 190, pl. 54, fig. 8, pl. 45, fig. 6, ?pl. 63, fig. 3.
1970 *Globorotalia imitata Subbotina*; Samanta: 625, pl. 98, figs 1, 2.

A dozen or so specimens, well agree with the holotype of *Globorotalia imitata* Subbotina.

Species recorded mostly from Lower Paleocene, but present also in younger strata of the Paleocene; rather ubiquitous taxon.

Globorotalia marginodentata Subbotina, 1953
(Pl. XXIII, figs 7, 8)

1970 *Globorotalia marginodentata* Subbotina; Samanta: 626, pl. 96, figs 3, 4.
1973 *Globorotalia marginodentata* Subbotina; Krasheninnikov & Hoskins: 117, pl. 24, figs 5—7.

Some specimens, found in the studied section, seem to be undoubtedly conspecific with those, described by Subbotina (1953) as *Globorotalia marginodentata*, as well as with those referred to this species by the authors mentioned in the synonymy.

Species characteristic in the top of Paleocene and Lower Eocene, recorded from the Tethyan region.

Globorotalia perclara Loeblich & Tappan, 1957
(Pl. XXII, figs 1, 2)

1970 *Globorotalia perclara* Loeblich & Tappan; Samanta: 630, pl. 95, figs 1, 2.

The only specimen found in the Paleocene of El Kef section corresponds undoubtedly to those ones assigned to *Globorotalia perclara* by Loeblich & Tappan (1957).

Species recorded from all Paleocene levels, rather cosmopolitan according to its geographical extent.

Globorotalia praecursoria praecursoria (Morozova, 1957)
(Pl. XVIII, fig. 4, pl. XIX, fig. 3)

1964 *Globorotalia praecursoria* (Morozova); Luterbacher: 652, fig. 25.

Species not so common in the Paleocene of El Kef section. Most of the specimens attributed to *Globorotalia praecursoria praecursoria* are without doubt conspecific with those from the comparative material from the Paleocene of the USSR; they have, however, generally less chambers in the last whorl i.e. no more than 6. Some of them, especially these more tightly coiled ones and having small number of chambers in the last whorl, seem to be closer to *G. uncinata* Bolli (see. pl. XVIII, fig. 5). Additional remarks see below.

Species characteristic for Lower Paleocene, restricted to the Tethyan region.

Globorotalia praecursoria uncinata Bolli, 1957 *
(Pl. XVIII, fig. 2)

1964 *Globorotalia uncinata* Bolli; Luterbacher: 655; figs 30, 31.
1971 *Globorotalia uncinata* Bolli; Postuma: 216 (illustrations included).

Species relatively common in El Kef section. Specimen attributed to *Globorotalia praecursoria uncinata* Bolli are rather easily recognized, although sometimes they seem to be closer to *G. praecursoria praecursoria* (Morozova); additional remarks see above.

Species typical for lower part of the Middle Paleocene, recorded from the Tethyan region.

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* According to the first author, *Globigerina inconstans*, *G. trinidadensis*, and *Globorotalia praecursoria uncinata* should be assigned to *Acarinina*.

Globorotalia pseudoscitula Glaessner, 1937
(Pl. XX, figs 10, 11)

1973 *Globorotalia pseudoscitula* Glaessner; Krasheninnikov & Hoskins: 119, pl. 27, figs 7—9.

Representatives of that species are seldom found in the Paleocene of the studied section. They appear not to differ from those described by Glaessner (1937), as *Globorotalia pseudoscitula* neither from those referred to that species by Subbotina (1953) and Krasheninnikov & Hoskins (1973) although specimen figured by Subbotina, have, more chambers (up to 7 in the last whorl) than those from Tunisia. Postuma's Manual of planktonic Foraminifera (1971) shows figured specimen (from Dyr el Kef, Tunisia), assigned by this author to *G. pusilla pusilla* Bolli; specimens included here in *G. pseudoscitula* show close resemblance to the latter. Supposedly there exists close relationship between these two species.

Globorotalia pseudoscitula is recorded from the Lower Eocene of the Tethyan region only.

Globorotalia pusilla laevigata Bolli, 1957
(Pl. XX, figs 8, 9)

1970 *Globorotalia pusilla laevigata* Bolli; Samanta: 634, pl. 98, figs 7, 8.
1971 *Globorotalia laevigata* Bolli; Postuma: 196 (illustrations included).

Species rare in El Kef section. Specimens described and figured by Krasheninnikov & Hoskins (1973) as *Globorotalia pseudoscitula* Glaessner confirm earlier suggestions, of different authors, concerning the possible relationships (if any ?) of both species.

Globorotalia pusilla laevigata Bolli is recorded from the Middle and Upper Paleocene, mostly of the Tethyan region.

Globorotalia cf. *simulatilis* (Schwager, 1883)
(Pl. XXIII, fig. 9, pl. XXV, figs 1, 2)

Several specimens, found in the studied samples from El Kef section seem to fall within the variation attributed to *Globorotalia simulatilis* (Schwager) by Luterbacher (1964); determination of that species is based on its revised description, given by the latter author.

Species recorded from Middle and Upper Paleocene, of the Tethyan region.

Globorotalia velascoensis parva Rey, 1955
(Pl. XXVI, figs 1, 2)

1966 *Globorotalia velascoensis parva* Rey; El-Naggar: 244, pl. 20, fig. 4.
1970 *Globorotalia parva* Rey; Samanta: 628, pl. 97, figs 3, 4.

Few specimens from the El Kef section, assigned to *Globorotalia velascoensis parva* Rey do not seem to differ from those, referred to this species by other authors, especially mentioned in the synonymy, as well as from those described by its author.

Species recorded in Upper Paleocene, mostly of the Tethyan region.

Globorotalia velascoensis velascoensis (Cushman, 1923)
(Pl. XXIII, figs 3, 4)

1974 *Globorotalia velascoensis* (Cushman); Szczechura & Pożaryska: 73, pl. 35, fig. 2.
1974 *Globorotalia (Morozovella) velascoensis* (Cushman); Sigal: pl. 4, fig. 4.

Specimens assigned to *Globorotalia velascoensis* (Cushman) are rather common in the Paleocene layer of El Kef section, being typical for the species.

It is an index form in the Upper Paleocene of the Tethyan region.

Globorotalia ?wilcoxensis Cushman & Ponton, 1932
(Pl. XX, figs 1—3)

A dozen or so specimens, referred to that species, characterised mainly by their very compact tests, distinctly angular chambers, especially so the last one, and moderate number of chambers ($3^1/_2$—4) in the final coil.

These features make them most similar to *Globorotalia wilcoxensis* Cushman & Ponton, 1932 from which they differ however, by more tightly coiled tests. Similar forms as those occurring in the Paleocene of Tunisia, have been determined by Loeblich & Tappan (1957) (pl. 19, figs 7—9) as *Globorotalia wilcoxensis.*

Taking under consideration rather large variation of specimens included to that species from El Kef it is not excluded that they are related to *G. wilcoxensis. G. whitei* which seems to be very close to *G. wilcoxensis*, is more rounded in edge view than specimens here discussed and that is why their affinity seems to be less probable; the latter, however, is more compact then *G. wilcoxensis* i.e. very similar to the most of the Tunisian forms.

G. wilcoxensis is known to occur in the Paleocene as well as Eocene beds, being rather ubiquite species when considering its regional distribution.

Genus *Planorotalia* Morozova, 1957

Planorotalia compressa (Plummer, 1927)
(Pl. XXII, figs 10, 11)

1971 *Globorotalia compressa* (Plummer); Postuma: 186 (illustration included).

Specimens included into that species well agree with the holotype. Index species for Lower Paleocene, rather cosmpolitan according to its geographical distribution.

Planorotalia ehrenbergi (Bolli, 1957)
(Pl. XXII, figs 8, 9)

1971 *Globorotalia ehrenbergi* Bolli; Postuma: 188 (illustration included).
1974 *Globorotalia (Turborotalia) ehrenbergi* Bolli; Sigal: pl. 4, fig. 5.

Specimens from El Kef Paleocene section are typical for the species, being, at the same time rather common there.

Species characteristic for the Middle and sometimes Upper Paleocene deposits, restricted to the Tethyan region.

Planorotalia pseudomenardii (Bolli, 1957)
(Pl. XXII, figs 3, 4)

1971 *Globorotalia pseudomenardii* Bolli; Postuma: 204 (ilustrations included).

Specimens assigned to *Planorotalia pseudomenardii* (Bolli) hardly differ from its holotype; rather rare in the Paleocene of El Kef section.

Species known in the Upper Paleocene, restricted to the Tethyan region.

Planorotalia troelseni (Loeblich & Tappan, 1957)
(Pl. XXVI, figs 6, 7)

1973 *Globorotalia troelseni* Loeblich & Tappan; Krasheninnikov & Hoskins: 119, pl. 29, figs 4—6.

Specimens assigned to *Planorotalia troelseni* (Loeblich & Tappan) seem to be typical for species; they are very rare in the studied samples. Its relation with *Planorotalia elongata* (Glaessner, 1937), *P. chapmani* (Parr, 1938) and *P. ehrenbergi* (Bolli, 1957) appear to be necessary to explain.

Species recorded from Upper Paleocene and Lower Eocene of the Tethyan region.

Genus *Acarinina* Subbotina, 1953

Acarinina esnaensis (Le Roy, 1953)

(Pl. XXVI, fig. 8)

1970 *Globorotalia esnaensis* (Le Roy); Samanta: 624, pl. 95, figs 7, 8.

1973 *Acarinina esnaensis* (Le Roy); Krasheninnikov & Hoskins: 120, pl. 1, figs 10—12.

Several specimens found in the Paleocene of El Kef section well correspond to those figured and described as *Globigerina* (*recte Acarinina*) *esnaensis* by Le Roy (1953). More tightly coiled specimens with shallower and narrower umbilicus may be easily identified with those assigned here questionably to *Acarinina intermedia* Subbotina (1953) (see pl. 24, figs 1—7).

Species recorded in the Middle Paleocene up to the Lower Eocene, mostly of the Tethyan region.

Acarinina ?intermedia Subbotina, 1953

(Pl. XXIV, figs 1—7)

1953 *Acarinina intermedia* Subbotina: 227, pl. 20, figs 1—4, 14—16.

1970 *Acarinina intermedia* Subbotina; Schutzkaja: pl. 24, fig. 3, pl. 27, fig. 1.

Rather common species in the studied samples from El Kef section. Its representatives appear to be related to those figured and described by Subbotina (1953) as *Acarinina intermedia*, especially if one takes under consideration large variation attributed to that species by its author. Similar forms are determined as *A. intermedia* also by Schutzkaja (1970). In comparison with the specimen figured by Krasheninnikov & Hoskins (1973), determined as *A. intermedia* the Tunisian ones are more lobulate in outline, having at the same time more inflated chambers on spiral side; variation concerning these features within the Tunisian forms is, however, rather large.

Acarinina intermedia is known to occur in the Upper Paleocene and Lower Eocene of the Tethyan region.

Acarinina mckannai (White, 1928)

(Pl. XXIV, figs 10, 11)

1971 *Globorotalia mckannai* (White); Postuma: 500 (illustration included).

1973 *Acarinina mckannai* (White); Krasheninnikov & Hoskins: 116, pl. 2, figs 6—8.

1974 *Globorotalia* (*Acarinina*) *mckannai* (White); Sigal: pl. 5, fig. 1.

Some specimens rather well preserved, fairly falling within variation of *Acarinina mckannai* (White); specimens from El Kef section never have more than 5 chambers in the last whorl.

Species known from the Upper Paleocene and earliest Eocene, mostly from the Tethyan region.

Acarinina ?pentacamerata (Subbotina, 1947)

(Pl. XXIV, figs 8, 9)

1953 *Globorotalia pentacamerata* Subbotina; Subbotina: 233, pl. 23, fig. 8; pl. 24, figs 1—9.

Single specimens belonging to that species occur in the Paleocene of El Kef section. They seem to fall within the varation, large enough, of *Globorotalia* (*recte Acarinina*) *pentacamerata*, as attributed to this species by its author (Subbotina, 1953). In comparison with specimen assigned to *A. pentacamerata pentacamerata* by Krasheninnikov & Hoskins (1973) this former have more rounded periphery, shallower umbilicus and more elevated inner spire on dorsal side. Tunisian forms seem to be close to *Globigerina gravelli* Bronnimann, 1952 from which they differ mostly in shallower umbilicus and interiomarginal, extraumbilical-umbilical aperture.

Acarinina pentacamerata is known from Upper Paleocene and Lower Eocene of the Tethyan region mainly.

Acarinina tadjikistanensis (Bykova, 1953)
(Pl. XX, figs 6, 7)

1953 *Globorotalia tadjikistanensis* Bykova: 86, pl. 3, fig. 5.
1964 *Globorotalia tadjikistanensis* Bykova; Luterbacher: 663, fig. 52.

Species rare in El Kef section, determined after Bykova's (1953) and Luterbacher's (1964) descriptions of *Globorotalia tadjikistanensis*, as well as on the basis of the comparative material from the USSR.

Species known from upper part of the Middle and Upper Paleocene, probably restricted to the Tethyan region.

Acarinina triplex Subbotina, 1953
(Pl. XXVI, fig. 5)

1970 *Acarinina triplex* Subbotina; Schutzkaja: pl. 12, fig. 12.
1973 *Acarinina triplex* Subbotina; Krasheninnikov & Hoskins: 121, pl. 4, figs 1—3.

The single specimens included in *Acarinina triplex* Subbotina from El Kef, fairly fall within variation of that species, attributed to it by its author (Subbotina, 1953). Identification of *Acarinina triplex* and *Globigerina velascoensis*, taking into account differences in ornamentation of their tests, (cf. El-Naggar, 1966, p. 184), seems to be unjustified.

Acarinina triplex is known from Upper Paleocene and Lower Eocene of the Tethyan region mainly.

Genus *Globigerina* d'Orbigny, 1826

Globigerina ?aquiensis Loeblich & Tappan, 1957
(Pl. XXVII, fig. 8)

1957 *Globigerina aquiensis* Loeblich & Tappan: 180, pl. 51, figs 4, 5; pl. 56, figs 4—6.
1970 *Globigerina aquiensis* Loeblich & Tappan; Schutzkaja: pl. 2, fig. 2; pl. 13, fig. 7; pl. 34, fig. 8.

Species weakly represented in El Kef section. It contains forms which seem to fall within variation range of *Globigerina aquiensis* as ascribed to that species by its authors (Loeblich & Tappan, 1957); they are, however, more coarsely perforated and less hispid than those from America, India (Samanta, 1970) and USSR (Schutzkaja, 1970).

Species recorded mostly from Upper Paleocene and Lower Eocene beds; seem to be cosmopolitan.

Globigerina cf. *danica* Bang, 1967
(Pl. XIX, fig. 4)

Test very low trochospiral, equatorial periphery strongly lobulate, axial periphery broadly rounded. Wall distinctly perforate, test surface rough. Chambers inflated, arranged in about 2 whorls; $4^1/_2$ chambers, rapidly growing in size as added, occur in the last coil; inner coil somewhat depressed. Aperture interiomarginal, badly seen. Singular specimens, rather badly preserved, do not allow to make more exact determination. They seem to be related with specimens referred here to *Globigerina eobulloides* Morozova (1959) (see pl. XXII, fig. 5, ?6, ?7) from which somewhat differ, however, in general shape and surface ornamentation.

G. danica Bang is an index form for the lowermost Danian, described from Denmark.

Globigerina edita edita Subbotina, 1953
(Pl. XXI, figs 5—7, pl. XXVII, fig. 11)

1953 *Globigerina edita* Subbotina: 54, pl. 2, fig. 1.

Some highly-trochospiral, minute forms, rather poorly preserved, associated with another very small globigerinids, seem to be closest to *Globigerina edita* Subbotina, 1953. It is especially so when the variation attributed to this species by its author is taken under consideration. Specimens occurring above Planorotalia compressa Zone are larger (see pl. XXI, figs 6, 7) than those from the oldest zone with the minute globigerinids, where they seem to be primitive individuals (pl. XXI, fig. 5, pl. XXVII, fig. 11).

Species known to occur in the Lower Paleocene, in the Tethyan region mostly.

Globigerina eobulloides Morozova, 1959
(Pl. XXII, figs 5, ?6, ?7)

1970 *Globigerina eobulloides* Morozova; Schutzkaja: pl. 17, fig. 9.

Representatives of that species may be recognised within the rich but unfortunatelly rather badly preserved association of minute planktonic foraminifera at the base of the studied section. Most of specimens assigned to *Globigerina eobulloides* Morozova well agree with those from the comparative material from the Soviet Union, as well as with that described by Morozova (1959). Specimens from El Kef section are low-spired while Premoli Silva & Luterbacher (MS) assigned to *G. eobulloides* highly-trochospiral forms. The similarity of *Globigerina eobulloides* Morozova to *G. danica* Bang is discussed above.

Species known from the Lower Paleocene, restricted to the Tethyan region.

Globigerina finlayi Brönnimann, 1952
(Pl. XXI, fig. 9)

1970 *Globigerina finlayi* Brönnimann; Samanta: 611, pl. 94, fig. 6.

Specimens determined as *Globigerina finlayi* Brönnimann (1952) appear to be rather common in El Kef section. However they may be confused with *G. triloculinoides* Plummer, to which they are evidently related.

Species occurring in the Upper Paleocene, of the Tethyan region.

Globigerina fringa Subbotina, 1950
(Pl. XXVII, fig. 5)

1953 *Globigerina fringa* Subbotina: 62, pl. 3, figs 3, 4.

Species poorly represented in El Kef section. Most specimens undoubtedly correspond to forms described as *Globigerina (Eoglobigerina) fringa* by Subbotina (1953)

Species characteristic in the lowermost Paleocene, known from the Tethyan region.

Globigerina inconstans Subbotina, 1953
(Pl. XIX, figs 9-11)

1964 *Globorotalia inconstans* (Subbotina); Luterbacher: 650, figs 19—23.

Hundreds of specimens, considerably varying in general shape i.e. size, number and arrangement of chambers seem to fall partly at least, within the variation of *Globigerina inconstans* Subbotina (1953), see also foot-note on p. 167.

Species characteristic mostly for the Lower Paleocene of the Tethyan region.

Globigerina pseudobulloides Plummer, 1926
(Pl. XVII, fig. 3)

1974 *Globigerina pseudobulloides* Plummer; Szczechura & Pożaryska: 77, pl. 24, fig. 4.
1974 *Globorotalia (Turborotalia) pseudobulloides* (Plummer); Sigal: pl. 3, fig. 5.

Species common in the Paleocene of El Kef section, recorded mainly from the Lower and Middle Paleocene, cosmopolitan according to its regional distribution.

Globigerina cf. *quadrata* White, 1928
(Pl. XVII, fig. 4)

Test low trochospiral, spiral side and umbilical side flat; equatorial periphery slightly lobulate, axial periphery rounded. Wall perforate, surface smooth. Chambers compressed, subglobular, arranged in more than 2 coils rather rapidly growing in size as added; the last coil contains 4—5 chambers. Sutures on both sides depressed, almost radial. Umbilicus shallow, small. Aperture as a slit, rather interiomarginal, extraumbilical-umbilical. Species rather rare in the Paleocene layers of the studied section. Similar forms are referred to *Globigerina quadrata* White by El-Naggar (1966), Bolli (1957) and others, however, it is difficult to prove if they are conspecific with those referred to *G. quadrata* by White; White's (1928) figure as well as description of *Globigerina quadrata* is insufficient to exclude confusion.

Species recorded from almost entire Paleocene, probably cosmopolitan.

Globigerina sabina Luterbacher & Premoli Silva, 1964
(Pl. XXVII, figs 10, 13)

1964 *Globigerina sabina* Luterbacher & Premoli Silva; Luterbacher & Premoli Silva: 108, pl. 2, figs 1, 6, 7.
1973 *Globigerina sabina* Luterbacher & Premoli Silva: Krasheninnikov & Hoskins: 114, pl. 11, figs 1—3.

Specimens assigned to *Globigerina sabina* Luterbacher & Premoli Silva, 1964, are rather frequent in the lower part of the studied section and appear to be sufficiently characteristic. Unfortunately their test surface is generally obscured. Individuals with higher spire seem to be related with *G. pentagona* Morozova, 1961.

Species known from lowermost Paleocene, restricted to the Tethyan region.

Globigerina spiralis Bolli, 1957
(Pl. XVIII, fig. 3; pl. XIX, figs 5, 6)

1966 *Globigerina spiralis* Bolli; El-Naggar: 175, pl. 16, fig. 2.

Specimens, not abundant in El Kef section, seem to be well comparable with those, assigned to *Globigerina spiralis* by its author (Bolli, 1957), as well as by

Loeblich and Tappan (1957) and the author mentioned in the synonymy; the specimen presented in pl. XVIII, fig. 3 appears to be especially typical for this species. Specimens attributed to *G. spiralis* are, however, rather roughly spinose what, according to El-Naggar (1966) make them closer to *G. aquiensis* Loeblich & Tappan.

Similar forms, like those here referred to *G. spiralis* but smaller, with low spire and more number of chambers in the last coil are associated with minute planktonic foraminifera in the lowermost Paleocene of El Kef section, from where they are described as *Globigerina* cf. *edita* Subbotina; relation between these three forms needs additional study.

Species recorded mostly from the Middle Paleocene beds of the Tethyan region.

Globigerina taurica Morozova, 1959

(Pl. XXI, fig 8; pl. XXVII, figs 6, 7)

1970 *Globigerina taurica* Morozova; Schutzkaja: pl. 19, fig. 2.

1973 "*Globigerina*" *eugubina* Luterbacher & Premoli Silva; Krasheninnikov & Hoskins: 114, pl. 7, figs 6—8.

Specimens attributed to *Globigerina taurica* Morozova, 1959, seem to be rather common within the minute planktonic foraminiferal assemblage, of the studied section, however, they are not so well preserved. Specimens figured in the present paper appear to be conspecific with those described and figured by Morozova (1959) as *G. taurica* and, at the same time, they are very close to those described by Luterbacher & Premoli Silva (1964) as *G. eugubina*. To prove identity of the two discussed species further research is needed.

Globigerina taurica, as well as *G. eugubina*, have been recorded in lowermost Paleocene, of the Tethyan region only.

Globigerina tetragona Morozova, 1961

(Pl. XXVII, figs 9, 12)

1961 *Globigerina* (*Eoglobigerina*) *tetragona* Morozova; 13, pl. 1, fig. 2.

Specimens included in that species are rather common in the studied section, however, they may be confused, especially individuals with low spire on dorsal side, with those referred here to *Globigerina sabina* Luterbacher & Premoli Silva, 1964.

Species recorded from the lowermost Paleocene, unknown outside the Tethyan region.

Globigerina trinidadensis (Bolli, 1957)

(Pl. XIX, figs 7, 8)

1964 *Globorotalia trinidadensis* Bolli; Luterbacher: 651, figs 26—29.

1971 *Globorotalia trinidadensis* Bolli; Postuma: 214 (illustration included).

Specimens included in *Globigerina trinidadensis* (Bolli, 1957), from El Kef section, fairly fall within variation of that species, however, sometimes they are hardly distinguishable from those attributed to *Globorotalia praecursoria* (Morozova); the latter being more ornamented and angulate along peripheral margin, especially of older chambers (see pl. XVIII, fig. 4; pl. XIX, fig. 3), see also foot-note on p. 167.

Species known from the Lower Paleocene, rather common in the Paleocene of Tunisia, occurring mainly in the Tethyan region.

Globigerina trivialis Subbotina, 1953
(Pl. XVII, fig. 1)

1974 *Globigerina trivialis* Subbotina; Szczechura & Pożaryska: 79, pl. 31, fig. 5.
1974 *Globigerina (Subbotina) trivialis* Subbotina; Sigal: pl. 3, fig. 4.

A dozen or so specimens, in most cases not differing from those described as *Globigerina trivialis* by Subbotina, 1953.

Species recorded from almost all Paleocene horizons, but occurring mainly in older Paleocene, rather cosmopolitan.

Globigerina varianta Subbotina, 1953
(Pl. XVII, fig. 2)

1965 *Globigerina varianta* Subbotina; Pożaryska: 125, pl. 23, fig. 5.
1970 *Globigerina varianta* Subbotina; Schutzkaja: pl. 19, fig. 12, pl. 21, fig. 4.
1970 *Globigerina* ex gr. *varianta* Subbotina; Schutzkaja: pl. 22, fig. 5; pl. 38, fig. 11.

Specimens assigned to *Globigerina varianta* Subbotina (1953) are rather common in the Paleocene of El Kef section, however, sometimes they may be confused with *G. pseudobulloides* Plummer. Small morphological differences between these two species, mostly in number of chambers in the last whorl, cause that *G. varianta* is regarded as a subspecies of *G. pseudobulloides* (see Olsson, 1970) or its younger synonym. Additional study is needed to prove taxonomic interrelations of both discussed species.

Species cosmopolitan, ranging from Lower to Middle Paleocene.

Globigerina velascoensis Cushman, 1925
(Pl. XXI, fig. 10)

1970 *Globigerina velascoensis* Cushman; Samanta: 615, pl. 94, figs 7, 8.
1973 *Globigerina velascoensis* Cushman; Krasheninnikov & Hoskins: 116, pl. 11, figs 10—12.
1974 *Globigerina velascoensis* Cushman; Szczechura & Pożaryska: 80, pl. 33, fig. 5.

A few dozens of specimens, typical for the species. Guide fossil in the Upper Paleocene, rather restricted to the Tethyan region.

Genus *Globoconusa* Khalilov, 1956
Globoconusa daubjergensis (Brönnimann, 1952)
(Pl. XXI, fig. 3)

1966 *Globigerina daubjergensis* Brönnimann; El-Naggar: 161, pl. 15, fig. 3.
1974 *Globoconusa daubjergensis* (Brönnimann); Sigal: pl. 3, fig. 1.

Species rather rare in the Paleocene of El Kef section. Specimens attributed to it are badly preserved, generally with a low spire and considerably varying in arrangement of chambers. Larger forms, from the upper part of Lower Paleocene, are hardly distinguishable from *Globoconusa kozlowskii* (Brotzen & Pożaryska, 1961); Additional remarks see p. 176.

Species cosmopolitan, more common in epicontinental Paleocene beds, recorded from Lower Paleocene.

Globoconusa kozlowskii (Brotzen & Pożaryska, 1961)
(Pl. XXI, figs 1, 2)

1966 *Globigerina kozlowskii* Brotzen & Pożaryska; El-Naggar: 168, pl. 15, figs 1, 2.

Species common in the Paleocene of El Kef section. Specimens, especially those from Middle Paleocene strata, correspond to those, occurring in the Polish Paleocene, described as *Globigerina kozlowskii* Brotzen & Pożaryska (1961), although there are also small specimens closer to *Globoconusa daubjergensis* (Brönnimann); according to some authors e.g. Moorkens (MS), Hansen, 1970 the difference between these two species lies in various size of their representatives.

Species recorded in Upper Danian (Lower Paleocene) and Middle Paleocene, rather cosmopolitan.

Genus *Subbotina* Brotzen & Pożaryska, 1961
Subbotina triloculinoides (Plummer, 1926)
(Pl. XXI, figs 11, 12)

1974 *Globigerina (Subbotina) triloculinoides* Plummer; Szczechura & Pożaryska: 78, pl. 33, figs 1—4; pl. 35, fig. 1.

1974 *Globigerina* (*Subbotina*) *triloculinoides* Plummer; Sigal: pl. 3, fig. 3.

Specimens attributed to that species vary rather much in size and general shape i.e. mostly in arrangement of chambers and perhaps represent more than one species; most of the specimens, however, are undoubtedly conspecific with those from Midway Fm. described as *Globigerina triloculinoides* Plummer, 1926.

Species occurring in almost all Paleocene horizons, cosmopolitan.

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ALEKSEITSCHIK-MITZKEVITSCH, L. S. see АЛЕКСЕЙЧИК-МИЦКЕВИЧ, Л. С.

ALIMARINA, V. P. see АЛИМАРИНА, В. П.

AUBERT, I. & BERGGREN, W. A. 1973. Paleocene benthonic foraminiferal biostratigraphy and paleoecology of Tunisia. — *W.H.O.I. Contr.*, 3417, 1—135, Woods Hole.

BANG, I. 1969. Planktonic Foraminifera and biostratigraphy of the type Danian. — *Proc. 1th Int. Conf. Plankt. Microf.*, 1967, 58—65, Geneva.

— (MS). Planktonic Foraminifera from the North Sea Danian. — Abstr. *Third Plankt. Conf. Kiel 1974.*

BERGGREN, W. A. 1972. A Cenozoic time scale. — Some implications for regional geology and paleobiogeography. — *Lethaia*, 5, 195—215.

— , AUBERT, I. & TJALSMA, R. C. 1974. Paleocene benthonic foraminiferal biostratigraphy, paleobiogeography and paleoecology of Atlantic-Tethyan regions. 1—186, Woods Hole.

BOLLI, H. M. 1957. The Globigerina and Globorotalia in the Paleocene — Lower Eocene Lizard Springs Formation of Trinidad. — *B.W.I.U.S. Nat. Mus. Bull.*, **215**, 61—68.

— 1966. Zonation of Cretaceous to Pliocene marine sediments based on planktonic Foraminifera. — *Bol. Inf. Assoc. Venezuelana Geol. Min. Petrol.*, **9**, 3—22.

— & KRASHENINNIKOV, V. A. (MS). Problems in Neogene and Paleogene correlations based on planktonic Foraminifera. — *Abstr. Third Plankt. Conf., Kiel 1974.*

BRÖNNIMANN, P. 1953. Note on planktonic Foraminifera from Danian localities of Jutland, Denmark. — *Eclogae geol. Helv.*, **55**, 2, 339—341.

BROTZEN, F., 1948. The Swedish Paleocene and its foraminiferal fauna. — *Sveriges Geol. Unders.*, **493**, 42, 2, 1—140.

— POŻARYSKA, K. 1961. Foraminifères du Paléocène et de l'Éocène en Pologne septentrionale. Remarques paléogéographiques — *Rev. Micropal.*, **4**, 3, 155—166.

BUROLLET, P. F. 1956. Contribution à l'étude stratigraphique de la Tunisie centrale. — *Ann. Mines Géol.*, **18**, 1—352, Tunis.

BYKOVA, N. K. see БЫКОВА, Н. К.

CARO, Y., LUTERBACHER, H., PERCH-NIELSEN, K. *et al.* (MS) Zonations du Paléocène supérieur et de l'Eocène inférieur à l'aide de microfossiles pélagiques. Beglès.

CRAMPAN, N. & SIGAL, J. 1967. Stratigraphie du Crétacé terminal et de l'Éocène en bordure des Megods (Tunisie septentrionale). — *Bull. Soc. Géol. France*, sér. 7, **11**, 129—140.

CUSHMAN, J. A., 1951. Paleocene Foraminifera of the Gulf Coastal Region of the United States and Adjacent Areas. — U.S. Geol. surv. *Prof. Pap.* **232**, 1—75.

— & JARVIS, P. W. 1941. Cretaceous Foraminifera from Trinidad. — *Contr. Cush. Lab. For. Res.*, **4**, 4, 85—103.

— RENZ, H. H. 1946. The foraminiferal fauna of the Lizard Springs Formation of Trinidad, British West Indies. — *Ibidem, spec. publ.*, **18**, 1—48.

CUVILLIER, I., DALBIEZ, E., GLINTZBOECKEL, G. *et al.* 1955. Études micropaléontologique de la limite Crétacé-Tertiaire dans les mers mésogéennes. — *Proc. 4th World Petrol. Congr.*, Sect. 1/D, **6**, 517—544, Rome.

DALBIEZ F. 1956. Étude sommaire des microfaunes de la région du Kef. *In*: Burollet, P. F., Sainfeld, P. 1956. Carte géol. de la Tunisie au 1/50 000. Feuille 44, Le Kef. Notice explic. 35—37. — Serv. Géol. Tunisie, Tunis.

DAM, A. TEN & SIGAL, J., 1950, Some new species of foraminifera from the Dano-Montian of Algeria. — *Cush. Found. For. Res. Contr.* **1**, 1—2, 31—40.

EHRENBERG, C. G. 1854. Mikrogeologie. 1—374. L. Voss, Leipzig.

GLAESSNER, M. F. 1937. Planktonforaminiferen aus der Kreide und dem Eozän und ihre stratigraphische Bedeutung. — *Stud. Micropal.*, **1**, 1, 17—52, Moskva.

GRZYBOWSKI, J. 1897. Otwornice pokładów naftonośnych okolicy Krosna. — *Rozpr. Akad. Um.*, **33**, 7—49.

— 1898. Mikroskopowe badania namułów wiertniczych z kopalń naftowych. — *Kosmos*, **22** (1897).

HANSEN, H. J. 1968. On the biostratigraphical age of the Lower Selandian of Denmark. — *Medd. Dansk. Geol. For.*, **18**, 3/4, 276—284.

— 1970. Biometric studies on the stratigraphic evolution of Globoconusa daubjergensis (Brönnimann) from the Danian of Denmark. — *Bull. Geol. Soc. Denmark*, **19**, 341—360.

HANZLIKOVÁ, E. 1972. Carpathian Upper Cretaceous Foraminiferida of Moravia. — *Rozpr. Ustr. Ust. Geol.*, **39**, 1—60.

HILLEBRANDT, A. V. Paleogene biostratigraphy in Southeastern Spain (Murcia and Alicante province). — Actes VI Colloque Afric. Micropaléont., Tunis (in print).

HOFKER, J. 1961. Globigerina pseudobulloides Plummer dans le Paléocène inférieur de Tunisie. — *Rev. Micropal.*, **1**, 59—71.

JAUZEIN, A. 1957. Carte géologique de la Tunisie au 1/50000, feuille 28, de Bir M'Cherga, notice explic. — *Publ. Serv. Géol. Tunisie*, 1—40.

KHALILOV, D. M. 1956. La faune pélagique de Foraminifères des dépots paléogène de l'Azerbaidjan. — *Trudy Ak. Nauk ASSR, Inst. Geol.*, **17**, 234—361.

KLASZ, I. de & CALVEZ, Y. Le. 1969. Sur le groupe de Frondicularia phosphatica Russo (Foraminifères). — *Proc. III Afric. Micropal. Coll., Cairo 1968*, Nidoc, 289—297.

KRASHENINNIKOV, V. A. & HOSKINS, R. H. 1973. 10. Late Cretaceous, Paleogene and Neogene Planktonic Foraminifera. — *Init. Rep. Deep Sea Drilling Proj.*, **20**, 105—203, Washington.

KRASHENINNIKOV, V. A. & MUZYLIOV, N. G. see КРАШЕННИКОВ, В. А. & МУЗЫЛЕВ, Н. Г.

LOEBLICH, A. R. Jr. & TAPPAN, H. 1957. Planktonic Foraminifera of Paleocene and early Eocene age from the Gulf and Atlantic Coastal Plains. — *Bull. U.S. Nat. Mus.*, **215**, 173—198.

— & — 1964. Treatise on Invertebrate Paleontology. Pt. C, Protista. Univ. Kansas Press, 1—900.

LUTERBACHER, H. P. 1964. Studies in some Globorotalia from the Paleocene and Lower Eocene of the Central Apennines. — *Eclogae geol. Helv.*, **57**, 2, 631—730.

— & PREMOLI SILVA, I. 1964. Biostratigrafia del limite Cretaceo-Tertiaro nell'Appennini Centrale. — *Riv. Ital. Paleont.*, **70**, 1, 67—128.

LYS, M., 1951. Robulus incisus n.sp. phylum caractéristique en Afrique à la limite Crétacé-Eocène. — *Rev. Inst. Fr. Pétr.*, **6**, 91—100.

MEJER, M. 1969. Les Foraminifères planctiques de Tuffeau de Ciply (stratotype), leur signification bio- et chronostratigraphique. — *Proc. 1th Int. Conf. Planct. Microfoss. Geneva* 1967, **2**, 414—419, Leiden.

MIATLJUK, E. W. see МЯТЛЮК, Е. В.

MOORKENS, TH. L. 1971. Some Late Cretaceous and Early Tertiary Planktonic Foraminifera from the Maastrichtian type area. — *Proc. IInd Plankt. Conf.*, 847—877, Rome.

— 1972. Foraminifera of the Montian stratotype and of subjacent strata in the Obourg well, with a review of Belgian Paleocene stratigraphy. 1—20.

— & ČEPEK, P. (MS). Zonation of Belgian Lower Tertiary with Planktonic Foraminifera and Nannoplankton. — *Abstr. Third Plankt. Conf. Kiel 1974.*

MOROZOVA, V. G. see МОРОЗОВА, В. Г.

MURRAY, J. W. 1973. Distribution and ecology of living benthic foraminiferids, 1—274, Heinemann, London.

NAGGAR, EL, Z. R. 1966. Stratigraphy and planktonic Foraminifera of the Upper Cretaceous — Lower Tertiary succession in the Esna-Idfu Region, Nile Valley, Egypt, U.A.R. — *Bull. Brit. Mus. (Nat. Hist.), Geol. Suppl.*, **2**, 3—279.

NAKKADY, S. E. 1959. Biostratigraphy of the Um Elghanayem section, Egypt. — Micropaleontology, **5**, 4, 453—465.

OLSSON, R. K. 1960. Foraminifera of latest Cretaceous and earliest Tertiary age in the New Jersey Coastal Plain. — *J. Paleont.*, **34**, 1, 1—59.

— 1970. Paleocene planktonic foraminiferal biostratigraphy and paleozoogeography of New Jersey. — *Ibidem*, **44**, 4, 589—597.

PESSAGNO, E. A. Jr. 1967. Upper Cretaceous planktonic Foraminifera from the western Gulf Coastal Plain. — *Paleont. Amer.*, **5**, 37, 243—444.

PLUMMER, H. J. 1926. Foraminifera of the Midway formation in Texas. — *Univ. Texas Bull.*, **2644**, 1—206.

POMEROL, CH. 1973. Ere Cénozoïque, Doin éd., 1—269, Paris.

POSTUMA, J. A. 1971. Manual of Planktonic Foraminifera. — Elsevier Publ. Comp. Amsterdam.

POŻARYSKA, K. 1965. Foraminifera and biostratigraphy of the Danian and Montian in Poland. — *Paleont. Pol.*, **14**, 1—156.

— & SZCZECHURA, J. 1968. Foraminifera from the Paleocene of Poland, their ecological and biostratigraphical meaning. — *Ibidem*, **20**, 1—107.

— & — (MS). Biogeography of small Paleogene foraminifers. — *Actes VI Coll. Afric. Micropal. 1974, Tunisia.*

PREMOLI SILVA, I. (MS). The earliest Globigerina eugubina zone: palaeontological significance and geographical distribution. — *Abstr. Third Plankt. Conf. Kiel, 1974.*

REISS, Z. 1952. On the Upper Cretaceous and Lower Tertiary microfaunas of Israel — *Bull. Res. Counc. Israel*, **2**, 1, 37—50.

ROY, L. W. Le. 1953. Biostratigraphy of the Maqfi section, Egypt. — *Mem. Geol. Soc. Amer.*, **54**, 1—73.

SALAJ, J. 1962. Mikrobiostratigraphische Studien der Kreide in der Krizna- und Manin-Einheit. — *Geol. Praće, Správy* **62**, 245—259, Bratislava.

— 1969. Zones planctiques du Crétacé et du Paléogène de Tunisie. — *Proc. 1st Int. Conf. Plankt. Microfossils, Geneva 1967*, 588—593, Leiden.

— 1970. Quelques remarques sur les problèmes de microbiostratigraphie du Crétacé supérieur et du Paléogène. — *IVe Colloque Afric. Micropaléont., Abidjane*, 357—374, Nice.

— 1974. Microbiostratigraphie du Sénonien supérieur, du Danien et du Paléocène, de la région du Kef. — *Livret-Guide VIe Coll. Afr. Micropal., Serv. Géol. Tunisie*, 51—57.

— Contribution à la microbiostratigraphie des hypostratotypes tunisiens du Crétacé supérieur, du Danien et du Paléocène, et la discussion. — *Actes VI Colloque Afric. Micropaléont.*, Tunis (in print).

— 1975. Geology of the Pelagian Block; The Eastern Tunisian platform. *In*: A. Nairn *et al.* (ed.): The Ocean basins and Margins, vol. IV. Répartition of facies within Paleocene in Tunisia (in print).

— , BAJANIK, S., MENCIK, E. *et al.* 1973. Quelques problèmes relatifs au Paléocène du Sillon tunisien et de l'Atlas oriental. Livre Jub. M. Solignac. — *Ann. Mines Géol.*, **26**, 223—231, Tunis.

SAMANTA, B. K. 1970. Planktonic Foraminifera from the early Tertiary Pondicherry Formation of Madras, South India. — *J. Paleont.*, **44**, 4, 605—641.

SAMUEL, O. 1965. Die Zonen-Gliederung der Westkarpatischen Paläogen auf Grund der planktonischen Foraminiferen. — *Geol. Práce, Správy*, **37**, 183—198, Bratislava.

— & SALAJ, J. 1968. Microbiostratigraphy and Foraminifera of the Slovak Carpathian Paleogene. 1—232. Geol. Ústav D. Stura, Bratislava.

SCHEIBNEROVÁ, V. 1971. Palaeoecology and palaeogeography of Cretaceous deposits of the Great Artesian Basin (Australia). — *Records Geol. Surv. New South Wales*, **13**, 1, 5—48.

SCHUTZKAJA, E. K. 1956. Stratigraphy of the Lower Paleogene horizons of the Central Precaucasus by means of Foraminifera (in Russian). — *Trudy Geol. Inst. Ak. Nauk SSSR*, **164**, 3—119.

— 1960. Stratigraphy of the Lower Paleogene of the Northern Precaucasus and Crimea (in Russian). *In*: Menner W. W. (ed.) 207—229.

SCHUTZKAJA, E. K. 1970. see ШУЦКАЯ, Е. К.

SIGAL, J. 1952. Aperçu stratigraphique sur la micropaléontologie du Crétacé, — 19e Congr. Geol. Int., Monogr. rég. 1 sér.: Algeri 26, 40, Alger.

— 1974. 32. Comments on Leg 25 sites in relation to the Cretaceous and Paleogene stratigraphy in the eastern and southeastern Africa coast and Madagascar regional setting. — Repr. from Simpson, E. S. W., Schlich, R. *et al.* — *Init. Rep. Deep Sea Drilling Proj.*, **25**, 687—723, Washington.

SPIEGLER, D. & DANIELS, CH. 1974. Bolboforma n.gen. (Protozoa?) eine neue stratigraphische wichtige Gattung aus dem Oligocen-Miocene nord-west Deutschland. — *Pal. Zeitschr.*, **48**, 1, 2, 57—76.

SUBBOTINA, N. N. see СУББОТИНА, Н. Н.

SZCZECHURA, J. & POŻARYSKA, K. 1974. Foraminiferida from the Paleocene of Polish Carpathians (Babica clays). — *Palaeont. Pol.*, **31**, 1—142.

— & — 1975. Biogeography of small Paleocene foraminifers of Europe. — *Rev. Esp. Micropal.*, (in print).

VASSILENKO, W. P. see ВАССИЛЕНКО, В. П.

WHITE, M. P. 1928. Some Index Foraminifera of the Tampico Embayment Area of Mexico. — *J. Paleont.*, **2**, 3, 177—215; **2**, 4, 280—317.

АЛЕКСЕЙЧИК-МИЦКЕВИЧ, Л. С. 1973, К классификации фораминифер семейства Haplophragmiidae — *Тр. ВНИГРИ*, **343**, 12—44.

АЛИМАРИНА, В. П. 1963. Некоторые особенности развития планктонных фораминифер в связи с зональным расчленением нижнего палеогена Северного Кавказа. — *Вопросы Микропал.*, **7**, 159—198.

БЫКОВА, Н. К. 1953. Фораминиферы сузакского яруса Таджикской деплессии. — *Тр. ВНИГРИ*, Микрофауна СССР, **6**, 1—103.

КРАШЕНИННИКОВ, В. А. & МУЗЫЛЁВ, Н. Г. 1975. Соотношение зональных шкал по планктонным фораминиферам и нанноплактону в разрезах палеогена Северного Кавказа. — *Вопросы Микропал.*, **18**, 212—224.

МЯТЛЮК, Е. В., 1970. Фораминиферы флишевых отложений восточных Карпат. — *Тр. ВНИГРИ*, **282**, 1—225.

МОРОЗОВА, В. Г. 1957. Надсемейство фораминифер Globigerinidea superfam. nova и некоторые его представители. — *Доклады Ак. Наук СССР*, **114**, 5, 1109—1112.

— 1959. Стратиграфия датско-монтских отложений Крыма по фораминиферам. *Ibidem*, **124**, 5, 1113—1116.

— 1960. Зональная стратиграфия датско-монтских отложений СССР и граница мела с палеогеном. — Int. Geol. Congr. 21, Rep. Soviet geol., 5, 85—100, Kopenhagen.

— 1961. Датско-монтские планктонные фораминиферы юга СССР. — *Палеонт. Жур.* **2**, 8—19.

ШУЦКАЯ, Е. К. 1970. Стратиграфия, фораминиферы и палеогеография нижнего палеогена Крыма, Предкавказа и западной части Средней Азии. — *Тр. ВНИГРИ*, **70**, 5—254.

СУББОТИНА, Н. Н. 1953 Глобигериниды, ханткениниды и глобороталииды. — *Ibidem*, **76**, 5—239.

ВАССИЛЕНКО, В. П. 1954 Аномалиниды. — *Ibidem*, **80**, 1—203.

JOSEPH SALAJ, KRYSTYNA POŻARYSKA & JANINA SZCZECHURA

HYPOSTRATOTYP PALEOCENU W TUNISIE I JEGO PODZIAŁ NA PODSTAWIE OTWORNIC

Streszczenie

W czasie VI Afrykańskiego Kolokwium Mikropaleontologicznego w Tunisie, w roku 1974, dr J. Salaj zaproponował uznanie profilu paleocenu El Haria Fm. w El Kef w NW Tunisie za hypostratotyp paleocenu morskiego dla prowincji tetydzkiej. Projekt ten został zaakceptowany przez Komisję Stratygraficzną kolokwium. Opracowanie paleontologiczne i stratygraficzne hypostratotypu powierzono J. Salajowi, K. Pożaryskiej i J. Szczechurze.

Profil paleocenu morskiego w Tunisie jest jednym z najpełniejszych profilów na świecie. Nie jest on ograniczony żadnymi przerwami sedymentacyjnymi jak to ma miejsce w większości serii paleoceńskich i stanowi serię ciągłą począwszy od kredy do eocenu, bez większych zmian facjalnych. Profil ten jest odkryty na dużych przestrzeniach w Tunisie północnym.

W profilu paleocenu w El Kef autorzy ustanowili następujące biozony, oparte na otwornicach planktonicznych:

VIII — zona Globorotalia velascoensis
VII — zona Planorotalia pseudomenardii
VI — zona Globorotalia pusilla pusilla
V — zona Globorotalia angulata
IV — zona Globorotalia praecursoria uncinata *s.l.* — podzona G. praecursoria praecursoria; podzona G. praecursoria uncinata *s.s.*
III — zona Globoconusa kozlowskii — podzona G. inconstans
II — zona Globigerina trinidadensis — podzona Planorotalia compressa; podzona G. pseudobulloides
I — zona Globigerina taurica/Globoconusa daubjergensis

Zony I i II zostały uznane przez autorów za ekwiwalent danu i są wykształcone bardziej kompletnie niż stratotyp danu w prowincji borealnej (Dania). Dolna granica danu w El Kef jest zdefiniowana pojawieniem się pierwszych drobnych, głównie gładkościennych globigerin z grupy *Globigerina taurica* i *Globoconusa daubjergensis*, przy jednoczesnym wygaśnięciu globotrunkan górnokredowych. Górną granicę danu w El Kef wyznacza pojawienie się *Globoconusa kozlowskii*, gatunku charakterystycznego dla montu *s.s.* (Belgia). Górną granicę montu wyznacza tu zanikanie występowania *Planorotalia ehrenbergi* i szeregu globigerin przetrwałych tu jeszcze z danu i pojawienie się gatunków *Globorotalia pusilla laevigata, Acarinina tadjikistanensis, Globigerina velascoensis*. Trzy najwyższe zony paleocenu w El Kef korelowane są z europejskim landenem (stratotyp w Belgii), mieszczącym w swej dolnej części tanet (stratotyp w Anglii), co udowodnili ostatnio Moorkens i Čepek (1974) na podstawie nannoplanktonu. Górny landen jest w stratotypie europejskim wyrażony przez osady kontynentalne, dlatego najwyższe zony paleocenu Tunisu skorelowano bezpośrednio

z górnymi zonami najwyższego paleocenu prowincji tetydzkiej (Bolli, 1966); zona z Globorotalia velascoensis zakańcza w całej prowincji tetydzkiej, a więc i w Tunisie, serię osadów morskich paleocenu.

Pomimo różnic stwierdzonych między profilem paleocenu prowincji tetydzkiej (Tunis) a profilami z prowincji borealnej (Anglia, Dania) i przejściowej (Belgia), gdzie występują stratotypy poszczególnych wycinków europejskiego paleocenu morskiego, zaproponowano dla prowincji tetydzkiej stosowanie terminów dan, mont i landen i potraktowanie odpowiednich odcinków stratygraficznych w Tunisie jako hypostratotypów.

Szczegółowa stratygrafia warstw hypostratotypu paleocenu morskiego w Tunisie oparta jest głównie na otwornicach planktonicznych. Jednakże zarejestrowane jest tu również występowanie otwornic bentonicznych, stwierdzonych w badanym profilu.

W obrębie otwornic bentonicznych wyróżniono formy występujące w prowincjach tetydzkiej, borealnej i przejściowej, formy charakterystyczne wyłącznie dla prowincji tetydzkiej oraz zespół ograniczony tylko do obszaru północnej Afryki.

ЙОЗЕФ САЛАЙ, КРИСТИНА ПОЖАРЫСКА & ЯНИНА ЩЕХУРА

ПАЛЕОЦЕНОВЫЙ ГИПОСТРАТОТИП В ТУНИСЕ И ЕГО РАСЧЛЕНЕНИЕ НА ОСНОВАНИИ ФОРАМИНИФЕР

Резюме

Во время VI Африканского микропалеонтологического коллоквиума в Тунисе в 1974 г. д-р Й. Салай выступил с предложением, чтобы разрез палеоцена Эль-Хария в Эль-Кеф (северо-западная часть Туниса) принять в качестве гипострототипа морского палеоцена провинции Тетиды. Этот проект был одобрен Стратиграфической комиссией коллоквиума. Осуществление палеонтологической и стратиграфической характеристики гипостратотипа было поручено Й. Салаю, К. Пожарыской и Я. Щехуре.

Профиль палеоцена в Тунисе является едним из наибелее пелных профилей мира. Он не егранчен никакими седиментационными перерывами, какие наблюдаются в большинстве рарезов палеоцена, и охватывает последовательную свиту отложений с мела по эоцен без существенных фациальных изменений. Этот профиль обнажается на обширных пространствах Северного Суниса.

В разрезе палеоцена Эль-Кеф авторами были епределены следующие биозоны (сверху вниз), основанные на планктонных фораминиферах:

VIII — зона Globorotalia velascoensis

VII — зона Planorotalia pseudomenardii

VI — зона Globorotalia pusilla pusilla
V — зона Globorotalia angulata
IV — зона Globorotalia praecursoria uncinata *s. l.* — подзона G. praecursoria praecursoria; подзона G. praecursoria uncinata *s. s.*
III — зона Globoconusa kozlowskii
II — зона Globigerina trinidadensis — подзона G. inconstants; подзона Planorotalia compressa; подзона G. pseudobulloides
I — зона Globigerina taurica/Globoconusa daubjergensis.

Зоны I и II были определены авторами в качестве экивалента датского яруса. Они развиты более полно в сравнении со стратотипом дата в бореальной провинции (Дания). Нижняя граница дата в разрезе Эль-Кеф проводится на основании появления первых мелких, как правило гладкостенных, глобигерин из групп *Globigerina taurica* и *Globoconusa daubjergensis* и одновременного исчезновения верхнемеловых глоботрункан. Верхняя граница дата в этом разрезе определяется появлением *Globoconusa kozlowskii*, характерного вида монтского яруса *s. s.* (Бельгия). Верхняя граница монтского яруса проводится в месте исчезания *Planorotalia ehrenbergi* и ряда глобигерин, сохранившихся с датского яруса, и появления видов *Globorotalia pusilla laevigata, Acarinina tadjikistanensis, Globigerina velascoensis*. Три верхних зоны палеоцена в разрезе Эль-Кеф коррелируются с европейским ланденом (стратотип в Бельгии), включающем в своем нижнем интервале танетский ярус (стратотип в Англии), что было недавно доказано Муркенсом и Чепеком (1974) на основании наннопланктона. Верхний ланден в европейском стратотипе представлен континентальными отложениями и поэтому верхние зоны тунисского палеоцена коррелируются непосредственно с верхними зонами в верхах палеоцена тетической провинции (Болли, 1966). Зона с *Globorotalia velascoensis* во всей тетической провинции, следовательно и в Тунисе, завершает свиту морских отложений палеоцена.

Несмотря на выявленные отличия в палеоценовом профиле тетической провинции (Тунис) в сравнении с профилями бореальной (Англия, Дания) и переходной (Бельгия) провинций, в которых представлены стратотипы отдельных интервалов европейского морского палеоцена, предлагается применять в тетической провинции термины датский, монтский и ланденский ярусы и принять соответствующие стратиграфические интервалы в Тунисе в качестве гипостратотипов.

Детальная стратиграфия морского палеоцена в разрезе гипостратотипа в Тунисе основывается, главным образом, на планктонных фораминиферах. Однако, учитываются также бентонные фораминиферы, представлены в данном разрезе.

Среди бентонных фораминифер наблюдались формы, распространенные в тетической, бореальной и переходной провинциях, формы, характерные лишь исключительно для тетической провинции, и сообщество, распространение которого ограничено лишь территорией Северной Африки.

EXPLANATION OF PLATES

Plate I

Figs 1, 2, 9. *Asanospira walteri* (Grzybowski), G. praecursoria praecursoria sZ., ZPAL FXIX/1—3, × 80.
Fig. 2. *Karreriella tenuis* (Grzybowski), P. pseudomenardii Z., ZPAL FXIX/4, × 80.
Fig. 3. *Textularid* sp., P. pseudomenardii Z., ZPAL FXIX/5, × 90.
Fig. 4. *Trochamminoides intermedius* (Grzybowski), G. praecursoria uncinata sZ., ZPAL FXIX/6, × 60.
Fig. 5. *Dorothia oxycona* (Reuss), G. praecursoria uncinata sZ., ZPAL FXIX/7, × 80.
Figs 6, 7. *Trochamminoides globigeriniformis* (Parker & Jones), G. praecursoria uncinata sZ., ZPAL FXIX/8, 9, × 70.

Plate II

Figs 1, 2. *Glomospira charoides* (Jones & Parker), P. pseudomenardii Z., ZPAL FXIX//10, 11, × 90.
Figs 3, 4. *Ammodiscus siliceus* (Terquem), G. inconstans sZ., ZPAL FXIX/12, 13, × 70.
Fig. 5. *Ammodiscus latus* Grzybowski, G. praecursoria praecursoria sZ., ZPAL FXIX/14, × 70.
Fig. 6. *Tritaxia midwayensis* (Cushman), P. pseudomenardii Z., ZPAL FXIX/15, × 40.
Figs 7, 8. *Glomospirella gorayski* (Grzybowski), P. compressa sZ., ZPAL FXIX/16, 17, × 90.
Figs 9, 10. *Trochamminoides irregularis* White, G. inconstans sZ., ZPAL FXIX/18, 19, × 80.
Figs 11, 12. *Subtilina tenuis* (Cushman), G. pseudobulloides sZ., ZPAL FXIX/20, 21, fig. 11, × 80, fig. 12, × 90.

Plate III

Figs 1, 2. *Vulvulina gracilima* Ten Dam & Sigal, P. pseudomenardii Z, ZPAL FXIX/22, 23, × 60.
Fig. 3. *Spiroplectammina spectabilis* (Grzybowski), G. kozlowskii Z., ZPAL FXIX/24, × 80.
Fig. 4. *Clavulinoides algeriana* Ten Dam & Sigal, G. angulata Z., ZPAL FXIX/25, × 40.
Fig. 5. *Kalamopsis grzybowski* (Dylążanka), P. compressa sZ., ZPAL FXIX/26, × 50.
Figs 6, 7. *Gaudryina pyramidata* Cushman, P. compressa sZ., ZPAL FXIX/27, 28, × 30.
Figs 8, 9, 10. *Semivulvulina dentata* (Alth), G. angulata Z., ZPAL, FXIX/29—31, × 70.
Figs 11, 12. *Spiroplectammina* sp., G. velascoensis Z., ZPAL FXIX/32, 33, × 80.
Fig. 13. *Carpathiella ovulum* (Grzybowski), G. angulata Z., ZPAL FXIX/34, × 90.
Figs 14, 15. *Dorothia longa* (Morozova), G. inconstans sZ., ZPAL FXIX/35, 36, × 80.
Fig. 16. *Chilostomelloides eocenica* Cushman, G. praecursoria praecursoria sZ., ZPAL FXIX/37, × 50.
Fig. 17. *Gaudryina textulariformis* Nakkady & Talaat, G. kozlowskii Z., ZPAL FXIX/38, × 90.
Fig. 18. *Saccammina placenta* (Grzybowski), G. kozlowskii Z., ZPAL FXIX/39, × 80.
Fig. 19. *Karreria fallax* Rzehak, P. pseudomenardii Z., ZPAL FXIX/40, × 70

Plate IV

Figs 1, 10. *Robulus* cf. *midwayensis* (Plummer), G. pusilla pusilla Z., ZPAL FXIX/41, 42, fig. 1, × 30, fig. 10, × 40.
Fig. 2. *Dentalina colei* Cushman & Dusenbury, G. pseudobulloides sZ., ZPAL FXIX/ /43, × 30.
Figs 3, 4. *Robulus incisus* Lys, G. pusilla pusilla Z., ZPAL FXIX/44, 45, × 60.
Figs 5, 6. *Palmula toulmini* Ten Dam & Sigal, G. angulata Z., ZPAL FXIX/46, 47, × 30.
Figs 7, 8. *Robulus hornerstownensis* Olsson, G. angulata Z., ZPAL FXIX/48, 49, × 40.
Fig. 9. *Citharina plumoides* (Plummer), P. pseudomenardii Z., ZPAL FXIX/50, × 30.

Plate V

Figs 1, 4. *Frondicularia phosphatica* (Russo), G. pusilla pusilla Z., × 50.
Fig. 2. *Stilostomella midwayensis* (Cushman & Todd), P. pseudomenardii Z., ZPAL FXIX/51, × 40.
Fig. 3. *Nodosaria affinis* d'Orbigny, G. kozlowskii Z., ZPAL FXIX/53, × 50.
Fig. 5. *Neoflabellina delicatissima* (Plummer), P. compressa, ZPAL FXIX/53, × 50.
Figs 6, 7. *Marginulina tuberculata* (Plummer), G. angulata Z., ZPAL FXIX/54, 55, × 60.
Figs 8, 9. *Vaginulinopsis midwayana* (Fox & Ross), G. praecursoria uncinata sZ., ZPAL FXIX/56, 57, × 40.
Figs 10, 11. *Palmula woodi* Nakkady, G. pusilla pusilla Z., ZPAL FXIX/58, 59, × 40.
Fig. 12. *Nodosaria mcneili* Cushman, G. kozlowskii Z., ZPAL FXIX/60, × 20.
Fig. 13. *Pseudonodosaria manifesta* (Reuss), P. pseudomenardii Z., ZPAL FXIX/61, × 50.
Fig. 14. *Palmula sigmoicosta* Ten Dam & Sigal, G. angulata Z., × 30.

Plate VI

Fig. 1. *Robulus pseudomamilligerus* (Plummer), G. angulata Z., ZPAL FXIX/62, × 30.
Figs 2, 5, 7. *Robulus degolyeri* (Plummer), P. pseudomenardii Z., ZPAL FXIX/63—65, figs 2,5 — × 30, fig. 7 — × 40.
Figs 3, 4. *Robulus* sp., G. pseudobulloides sZ., ZPAL FXIX/66, 67, × 80.
Fig. 6. *Robulus pseudocostatus comis* Cushman, P. pseudomenardii Z., ZPAL FXIX/ /68, × 30.
Fig. 8. *Saracenaria tunesiana* Ten Dam & Sigal, G. praecursoria uncinata sZ., ZPAL FXIX/69, × 40.

Plate VII

Figs 1, 2. *Brizalina* sp., P. pseudomenardii Z., ZPAL FXIX/70, 71, × 70.
Figs 3, 4. *Bulimina quadrata* Plummer, G. praecursoria praecursoria sZ., ZPAL FXIX/ /72, 73, × 60.
Fig. 5. *Loxostomum limonense* (Cushman), G. kozlowskii Z., ZPAL FXIX/74, × 80.
Fig. 6. *Loxostomoides applinae* (Plummer), P. pseudomenardii Z., ZPAL FXIX/75, × 70.
Figs 7—9. *Bulimina midwayensis* Cushman, G. praecursoria uncinata sZ., ZPAL FXIX/76—78, fig. 7, × 110, fig. 8, × 100, fig. 9 — SEM micrograph × 200.
Figs 10—12. *Bulimina* cf. *striata* d'Orbigny, G. angulata Z., ZPAL FXIX/79—81, fig. 10 — SEM micrograph × 130, fig. 11 — SEM micrograph × 150, fig. 12 — × 90.

Fig. 13. *Bulimina cacumenata* Cushman & Parker, P. pseudomenardii Z., ZPAL FXIX/82, SEM micrograph × 130.
Fig. 14. *Bulimina velascoensis* White, G. inconstans sZ., ZPAL FXIX/83, SEM micrograph × 190.
Fig. 15. *Bulimina trinitatensis* Cushman & Jarvis, G. inconstans sZ., ZPAL FXIX/84, SEM micrograph × 190.

Plate VIII

Figs 1, 2. *Valvulineria scrobiculata* (Schwager), G. pusilla pusilla Z., ZPAL FXIX/85, 86, × 90.
Fig. 3. *Eponides subcandidulus* (Grzybowski), G. inconstans sZ., ZPAL FXIX/87, × 80.
Fig. 4. *Osangularia plummerae* Brotzen, P. pseudomenardii Z., ZPAL FXIX/88, × 80.
Fig. 5. *Gyroidinoides subangulatus* (Plummer), G. praecursoria praecursoria sZ., ZPAL FXIX/89, × 100.

Plate IX

Figs 1, 2. *Anomalinoides affinis* (Hantken), G. inconstans sZ., ZPAL FXIX/90, 91, × 90.
Figs 3, 6. *Anomalinoides acuta* (Plummer), G. inconstans sZ., ZPAL FXIX/94, 95, × 80.
Figs 4, 5. *Anomalina danica* (Brotzen). G. praecursoria praecursoria sZ., ZPAL FXIX/ /94, 95, × 80.

Plate X

Fig. 1. *Eponides plummerae* Cushman, G. kozlowskii Z., ZPAL FXIX/96, × 90.
Fig. 2. *Eponides lotus* (Schwager), G. angulata Z., ZPAL FXIX/97, × 90.
Figs 3, 4. *Valvulineria* cf. *cetera* (Bykova), P. pseudomenardii Z., ZPAL FXIX/98, 99, × 110.

Plate XI

Figs 1, 2. *Cibicides commatus* Morozova, G. inconstans sZ., ZPAL FXIX/100, 101, × 60.
Fig. 3. *Pullenia quinqueloba* (Reuss), G. praecursoria uncinata sZ., ZPAL FXIX/102, × 70.
Figs 4, 5. *Anomalinoides* cf. *henbesti* (Plummer), G. kozlowskii Z., ZPAL FXIX/103, 104, × 80.

Plate XII

Figs 1, 2. *Cibicidoides susanaensis* (Browning), G. kozlowskii Z., ZPAL FXIX/105, 106, × 70.
Fig. 3. *Cibicidoides* cf. *simplex* Brotzen, G. praecursoria uncinata sZ., ZPAL FXIX/ /107, × 80.
Figs 4, 5. *Cibicidoides azzouzi* sp.n., G. kozlowskii Z., ZPAL FXIX/108, 109, × 80.

Plate XIII

Figs 1, 2. *Eponides* sp., G. pusilla pusilla Z., ZPAL FXIX/110, 111, × 100.
Fig. 3. *Gyroidina aequilateralis* (Plummer), G. pusilla pusilla Z., ZPAL FXIX/112, × 80.

Figs 4, 5. *Anomalinoides midwayensis* (Plummer), G. pseudomenardii Z., ZPAL FXIX/113, 114, × 80.
Figs 6, 7. *Stensioeina beccariiformis* (White), G. inconstans sZ., ZPAL FXIX/115, 116, × 80.

Plate XIV

Fig. 1. *Allomorphina allomorphinoides* (Reuss), G. praecursoria praecursoria sZ., ZPAL FXIX/117, × 90.
Fig. 2. *Eponides elevatus* (Plummer), G. velascoensis Z., ZPAL FXIX/118, × 90.
Fig. 3. *Coleites reticulosus* (Plummer), G. kozlowskii Z., ZPAL FXIX/119, × 70.
Figs 4, 5. *Stensioeina avnimelechi* (Reiss), G. inconstans sZ., ZPAL FXIX/151, 152, × 100.

Plate XV

Figs 1, 2. *Alabamina midwayensis* Brotzen, G. praecursoria praecursoria sZ., ZPAL FXIX/122, 123, × 90.
Fig. 3. *Cibicides succedens* Brotzen, G. kozlowskii Z., ZPAL FXIX/124, × 50.
Figs 4, 5. *Cibicidoides incognitus* (Vassilenko), G. pusilla pusilla Z., ZPAL FXIX/125, 126, × 90.

Plate XVI

Fig. 1. *Cibicides proprius* (Brotzen), G. praecursoria praecursoria sZ., ZPAL FXIX//127, × 50.
Fig. 2. *Cibicidoides constrictus* (Hagenow), G. kozlowskii Z., ZPAL FXIX/128, × 100.
Figs. 3, 4. *Cibicides ungerianus* (d'Orbigny), P. pseudomenardii Z., ZPAL FXIX/129, 130, fig. 3, × 100, fig. 4, × 90.
Figs 5, 6. *Gavelinella umbilicatula* (Mjatliuk), G. inconstans sZ., ZPAL FXIX/131, 132, × 100.
Figs. 7, 8. *Cibicides suzakensis* Bykova, G. praecursoria uncinata sZ., ZPAL FXIX/133, 134, × 80.

Plate XVII

Fig. 1. *Globigerina trivialis* Subbotina, P. compressa sZ., ZPAL FXIX/135, × 100.
Fig. 2. *Globigerina varianta* Subbotina, G. pseudobulloides sZ., ZPAL FXIX/136, × 100.
Fig. 3. *Globigerina pseudobulloides Plummer*, G. pseudobulloides sZ., ZPAL FXIX//137, × 100.
Fig. 4. *Globigerina* cf. *quadrata* White, P. compressa sZ., ZPAL FXIX/138, × 120.

Plate XVIII

Fig. 1. *Globorotalia angulata abundocamerata* Bolli, P. pseudomenardii Z., ZPAL FXIX/139, × 120.
Fig. 2. *Globorotalia praecursoria uncinata* Bolli, G. praecursoria uncinata sZ., ZPAL FXIX/140, × 120.
Fig. 3. *Globigerina spiralis* Bolli, G. kozlowskii Z., ZPAL FXIX/141, × 120.

Fig. 4. *Globorotalia praecursoria praecursoria* (Morozova), G. praecursoria praecursoria sZ., ZPAL FXIX/144, × 120.
Fig. 5. Transitional form between *G. praecursoria praecursoria* (Morozova) and *G. praecursoria uncinata* Bolli, G. praecursoria uncinata sZ., ZPAL FXIX/146, × 130.
Fig. 6. *Globorotalia* cf. *convexa* Subbotina, G. praecursoria praecursoria sZ, ZPAL FXIX/147, × 120.

Plate XIX

Figs 1, 2. *Globorotalia imitata* Subbotina, G. kozlowskii Z., ZPAL FXIX/148, 149, × 160.
Fig. 3. *Globorotalia praecursoria praecursoria* (Morozova), G. praecursoria praecursoria sZ., ZPAL FXIX/145, × 110.
Fig. 4. *Globigerina* cf. *danica* Bang, Globigierna taurica (Globoconusa daubjergensis Z., ZPAL FXIX/150, × 130.
Figs 5, 6. *Globigerina spiralis* Bolli, P. compressa sZ., ZPAL FXIX/142, 143, × 140.
Figs 7, 8. *Globigerina trinidadensis* (Bolli), P. compressa sZ., ZPAL FXIX/151, 252, fig. 7, × 110, fig. 8, × 100.
Figs 9—11. *Globigerina inconstans* Subbotina, G. inconstans sZ., × 140.

Plate XX

Figs 1—3. *Globorotalia ?wilcoxensis* Cushman & Ponton, G. angulata Z., ZPAL FXIX/153—155, fig. 1, × 130, fig. 2a, × 120, fig. 2b, × 110, fig. 3, × 150.
Fig. 4. *Globorotalia angulata angulata* (White), G. angulata Z., ZPAL FXIX/156, × 130.
Fig. 5. ?*Globorotalia aequa* Cushman & Renz, G. angulata Z., ZPAL FXIX/157, × 110.
Figs 6, 7. *Acarinina tadjikistanensis* (Bykova), P. pseudomenardii Z., ZPAL FXIX/162, 163, × 160.
Figs 8, 9. *Globorotalia pusilla laevigata* Bolli, P. pseudomenardii Z., ZPAL FXIX/164, 165, × 100.
Figs 10, 11. *Globorotalia pseudoscitula* Glaessner, G. angulata Z., ZPAL FXIX/166, 167, × 130.

Plate XXI

Figs 1, 2. *Globoconusa kozlowskii* (Brotzen & Pożaryska), G. kozlowskii Z., ZPAL FXIX/168, × 170, × 800.
Fig. 3. *Globoconusa daubjergensis* (Brönnimann), Globigerina taurica/Globoconusa daubjergensis Z., ZPAL FXIX/169, × 220.
Fig. 4. *Chiloguembelina* cf. *morsei* (Kline), G. kozlowskii Z., ZPAL FXIX/170, × 110.
Figs 5—7. *Globigerina edita edita* Subbotina, Globigerina taurica/Globoconusa daubjergensis Z., ZPAL FXIX/171, × 220.
Fig. 8. *Globigerina taurica* Morozova, Globigerina taurica/Globoconusa daubjergensis Z., ZPAL FXIX/172 × 250.
Fig. 9. *Globigerina finlayi* Brönnimann. P. pseudomenardii Z., ZPAL FXIX/173, × 140.
Fig. 10. *Globigerina velascoensis* Cushman, G. velascoensis Z., ZPAL FXIX/174, × 250.
Figs 11, 12. *Subbotina triloculinoides* (Plummer), G. pseudobulloides sZ., ZPAL FXIX/ /175, 176, × 110.

Plate XXII

Figs 1, 2. *Globorotalia perclara* Loeblich & Tappan, G. pseudobulloides sZ., ZPAL FXIX/177, 178, × 160.

Figs 3, 4. *Planorotalia pseudomenardii* (Bolli), P. pseudomenardii Z., ZPAL FXIX/179, 180, fig. 3, × 150, fig. 4, × 140.

Figs 5, ?6, ?7. *Globigerina eobulloides* Morozova, Globigerina taurica/Globoconusa daubjergensis Z., ZPAL FXIX/181—183, fig. 5, × 300, fig. ?6, ?7, × 160.

Figs 8, 9. *Planorotalia ehrenbergi* (Bolli), G. angulata Z., ZPAL FXIX/186, 187, × 140.

Plate XXIII

Figs 1, 2. *Globorotalia* cf. *aragonensis* Nuttall, P. pseudomenardii Z., ZPAL FXIX/188, 189, fig. 1, × 120, fig. 2, × 110.

Figs 3, 4. *Globorotalia velascoensis velascoensis* (Cushman), P. pseudomenardii Z., ZPAL FXIX/190, 191, fig. 3, × 100, fig. 4, × 80.

Figs 5, 6. *Globorotalia ?angulata angulata* (White), G. praecursoria praecursoria sZ., ZPAL FXIX/192, 193, fig. 5, × 170, fig. 6, × 160.

Figs 7, 8. *Globorotalia marginodentata* Subbotina, P. pseudomenardii Z., ZPAL FXIX//194, 195, fig. 7, × 150, fig. 8, × 100.

Fig. 9. *Globorotalia* cf. *simulatilis* (Schwager), G. angulata Z., ZPAL FXIX/196, × 150.

Plate XXIV

Figs 1—7. *Acarinina ?intermedia* Subbotina, G. angulata Z., ZPAL FXIX/199—205, figs 1, 2, 3, × 125, fig. 4, × 160, fig. 5, × 150, fig. 6, × 170, fig. 7, × 160.

Figs 8, 9. *Acarinina ?pentacamerata* (Subbotina), P. pseudomenardii Z., ZPAL FXIX//206, 207, × 130.

Figs 10, 11. *Acarinina mckannai* (White), G. velascoensis Z., ZPAL FXIX/208, 209, × 110.

Plate XXV

Figs 1, 2. *Globorotalia* cf. *simulatilis* (Schwager), G. angulata Z., ZPAL FXIX/197, 198, × 140.

Figs 3—6. *Globorotalia aequa* Cushman & Renz, G. pusilla pusilla Z., ZPAL FXIX//158—161, figs 3, 4, × 140, figs 5, 6, × 130.

Figs 7—9. *Globorotalia apanthesma* Loeblich & Tappan, P. pseudomenardii Z., ZPAL FXIX/210, 211, figs 7, 8, × 110, fig. 9, × 100.

Plate XXVI

Figs 1, 2. *Globorotalia velascoensis parva* Rey, P. pseudomenardii Z., ZPAL, FXIX//212, 213, × 100.

Figs 3, 4. *Globorotalia acuta* Toulmin, P. pseudomenardii Z., ZPAL FXIX/214, 215, × 130.

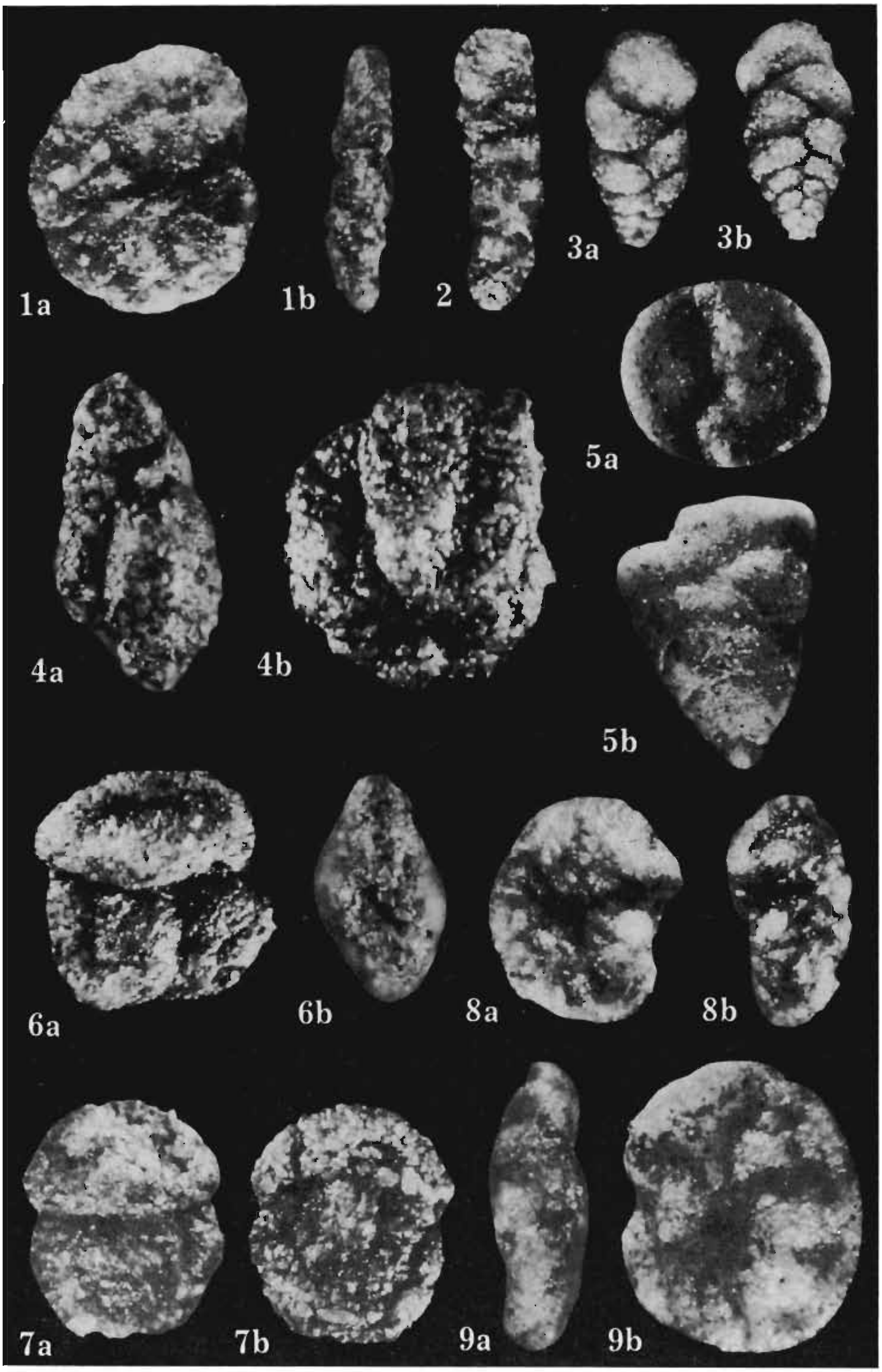
Fig. 5. *Acarinina triplex* Subbotina, G. velascoensis Z., ZPAL FXIX/216, × 110.

Figs 6, 7. *Planorotalia troelseni* (Loeblich & Tappan), P. pseudomenardii Z., ZPAL FXIX/217, 218, fig. 6, × 160, fig. 7, × 110.

Fig. 8. *Acarinina esnaensis* (Le Roy), G. angulata Z., ZPAL FXIX/219, × 160.

Plate XXVII

Fig. 1. *Chiloguembelina wilcoxensis* (Cushman & Ponton), G. inconstans sZ., × 175.
Fig. 2. *Guembelitria irregularis* Morozova, G. pseudobulloides sZ., × 175.
Fig. 3. *Chiloguembelina midwayensis* (Cushman), P. compressa sZ., × 150.
Fig. 4. *Bifarina alabamensis* (Cushman), G. kozlowskii Z., × 150.
Fig. 5. *Globigerina fringa* Subbotina, G. pseudobulloides sZ., × 225.
Figs 6, 7. *Globigerina taurica* Morozova, Globigerina taurica/Globoconusa daubjergensis Z., fig. 6, × 250, fig. 7, × 120.
Fig. 8. *Globigerina ?aquiensis* Loeblich & Tappan, P. compressa sZ., × 200.
Figs 9, 12. *Globigerina tetragona* Morozova, Globigerina taurica/daubjergensis Z., fig. 9, × 125, fig. 12, × 225.
Fig. 11. *Globigerina edita edita* Subbotina, Globigerina taurica/Globoconusa daubjergensis Z., × 200.
Figs 10, 13. *Globigerina sabina* Luterbacher & Premoli Silva, Globigerina taurica//Globoconusa daubjergensis Z., fig. 10, × 300, fig. 13, × 350.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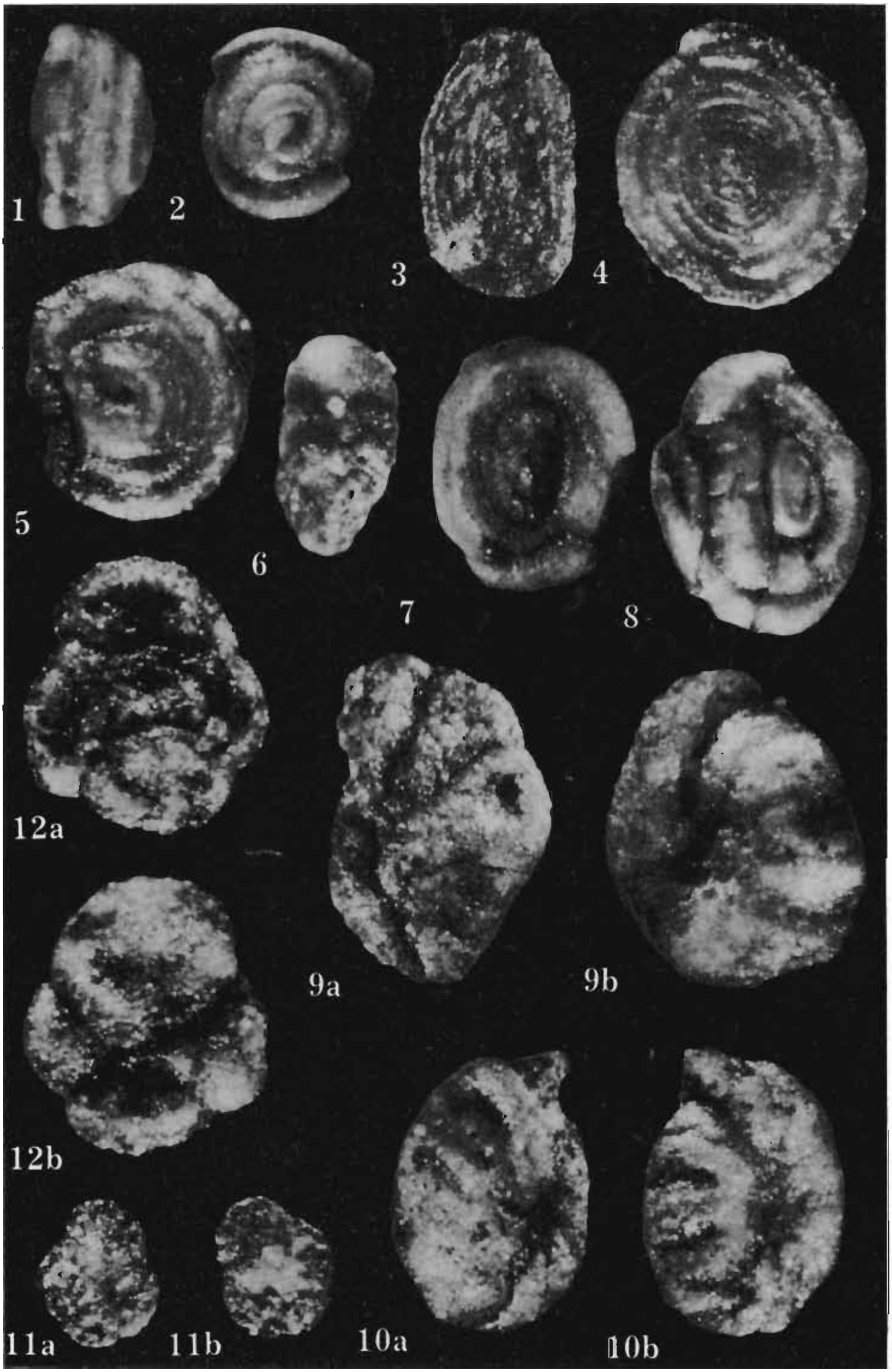
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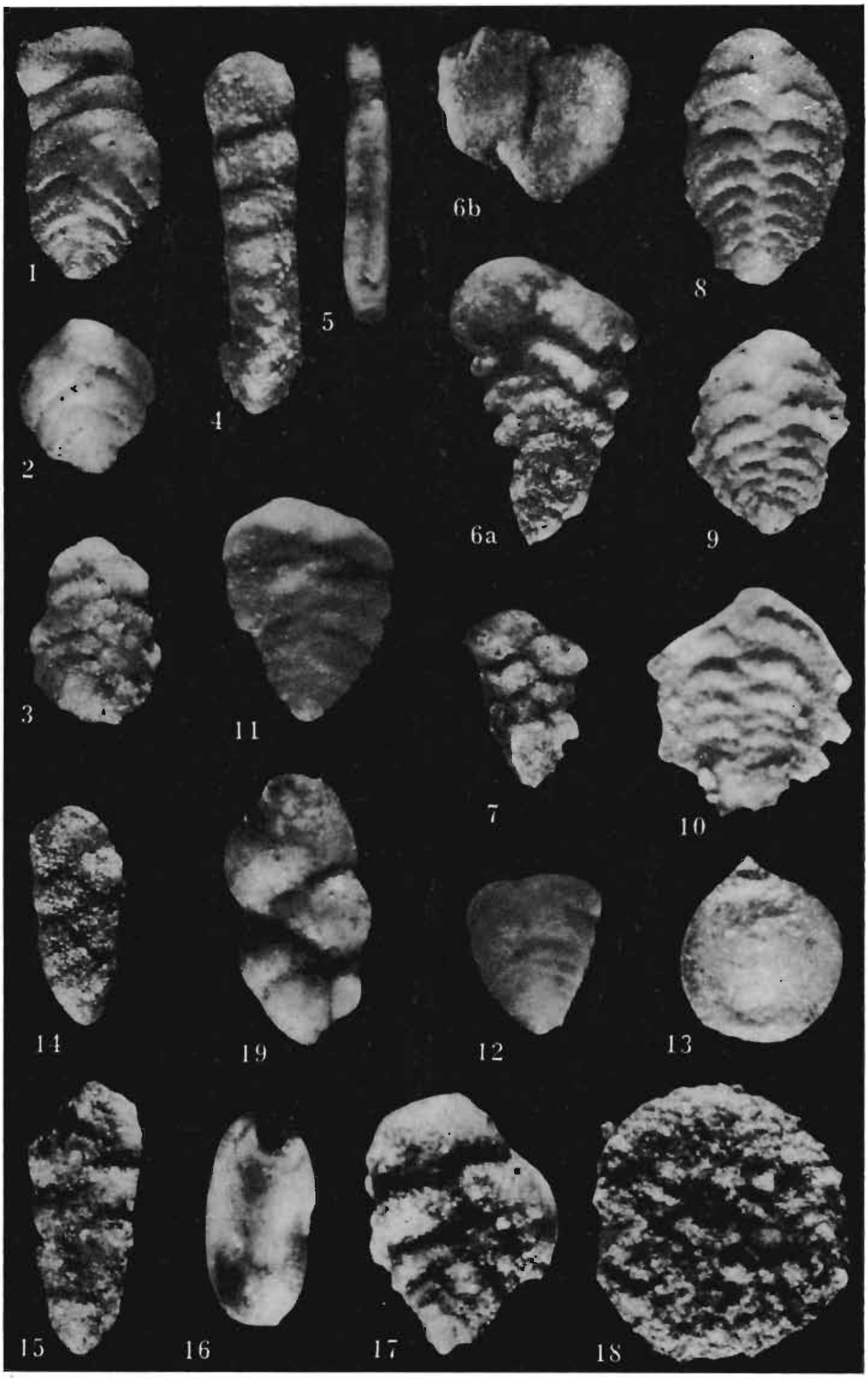
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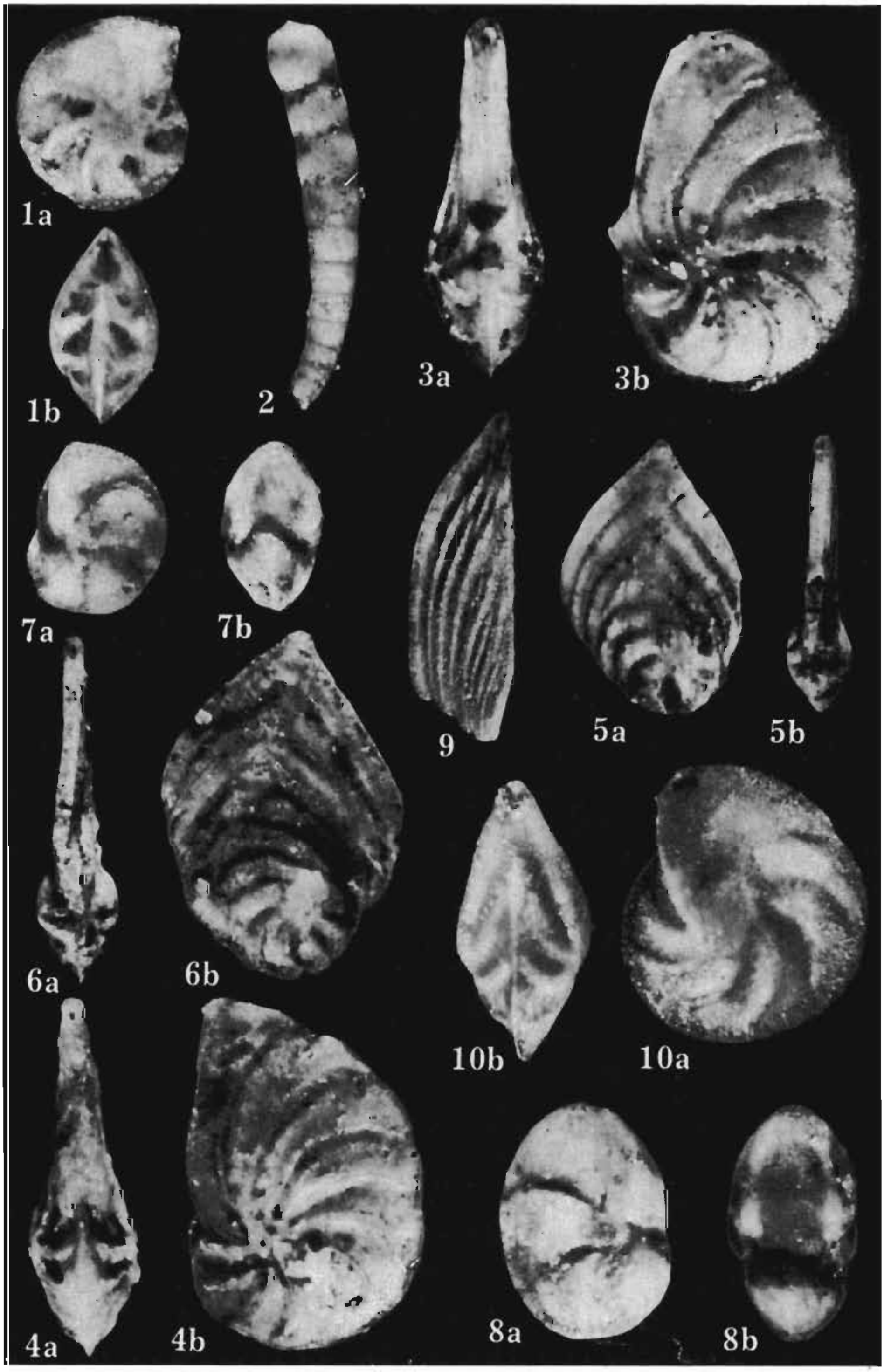
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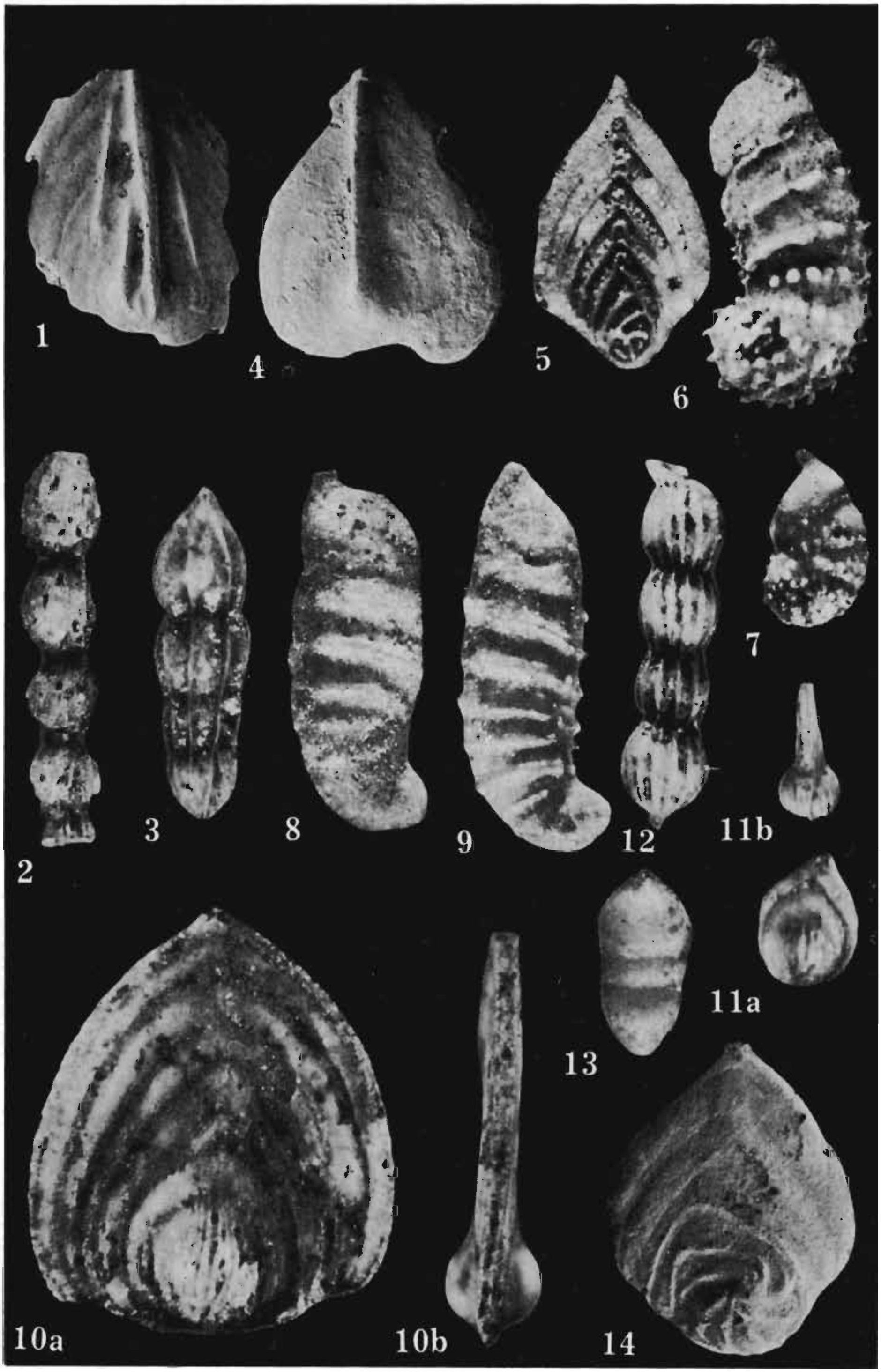
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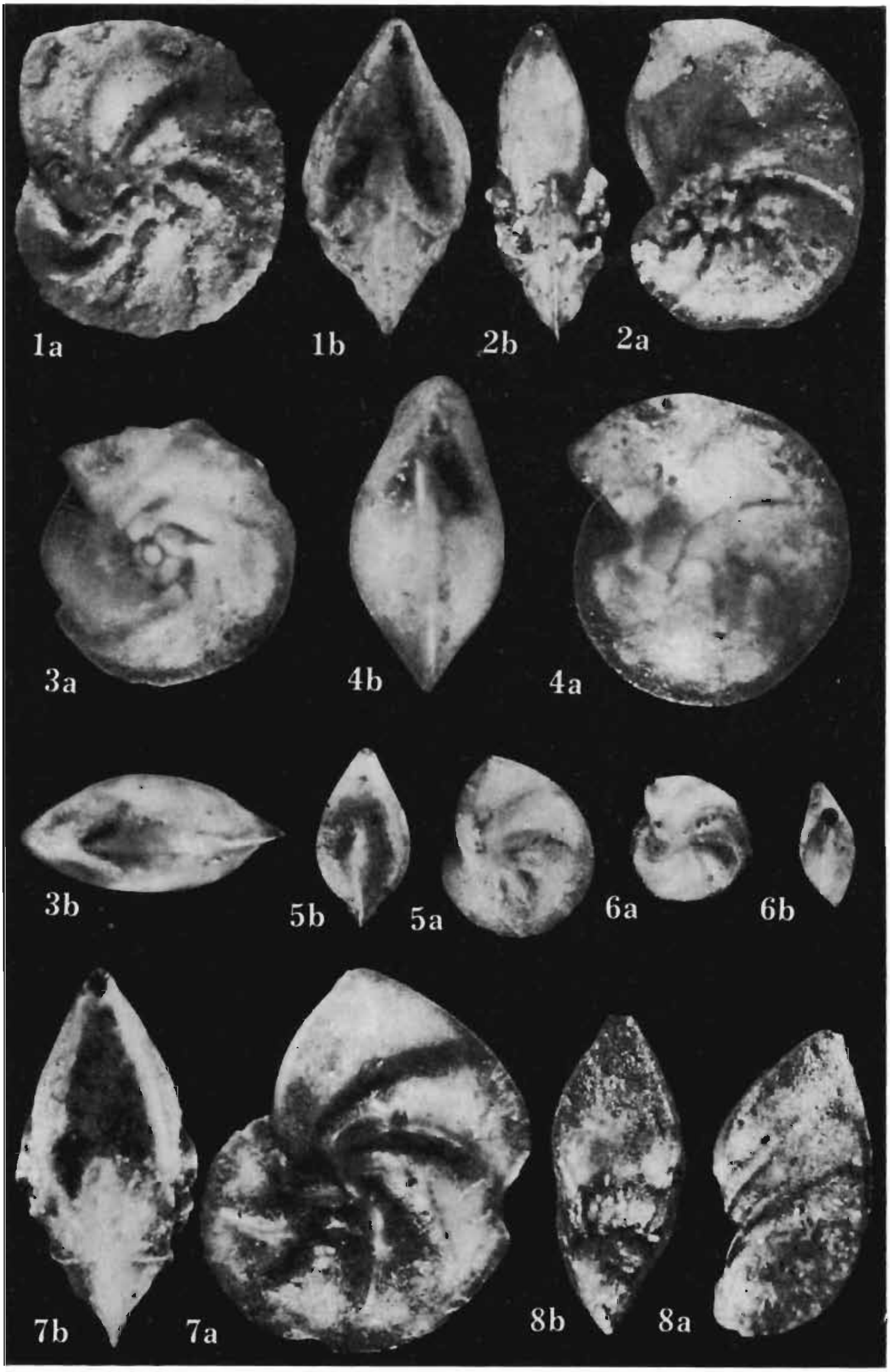
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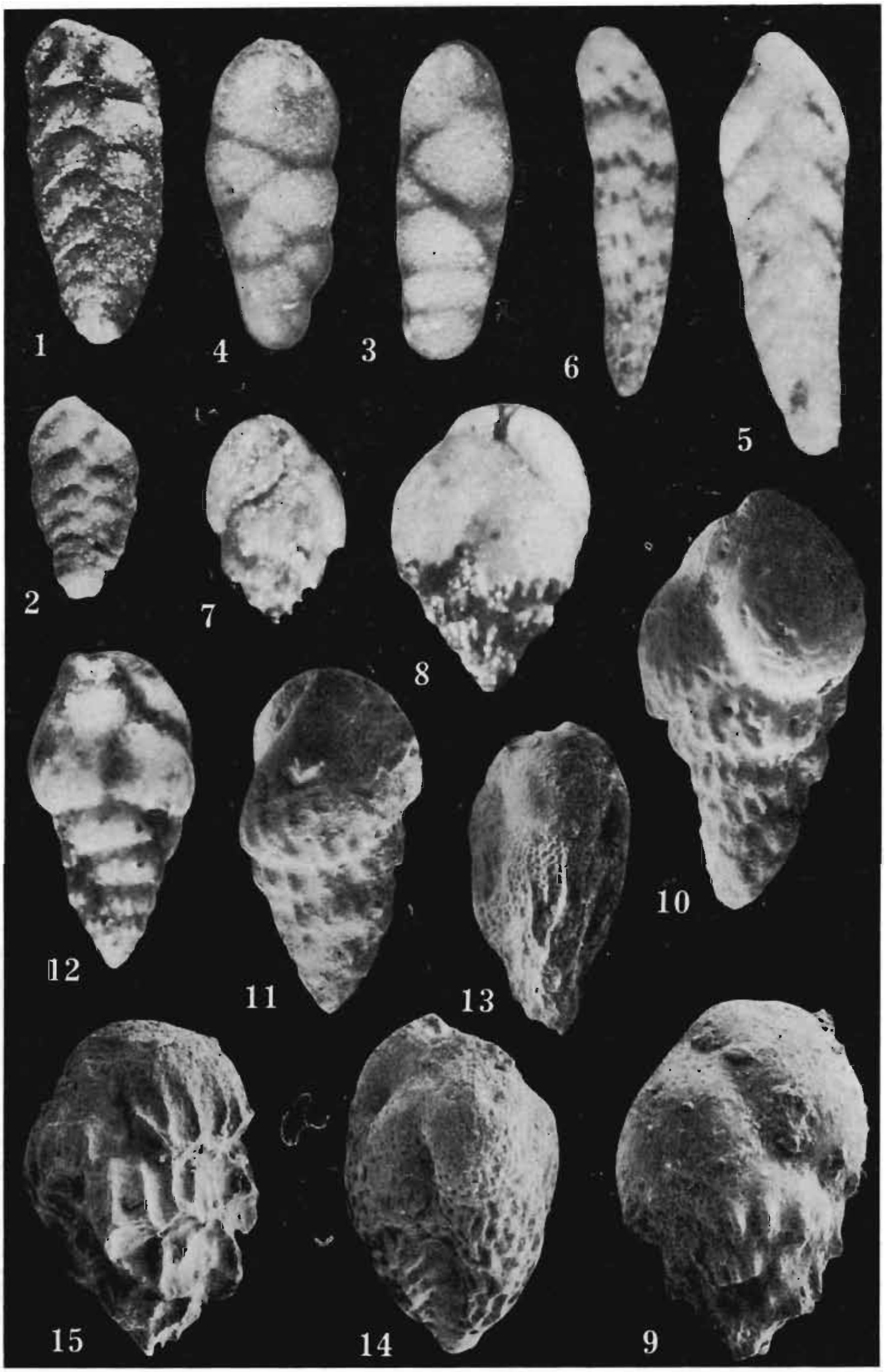
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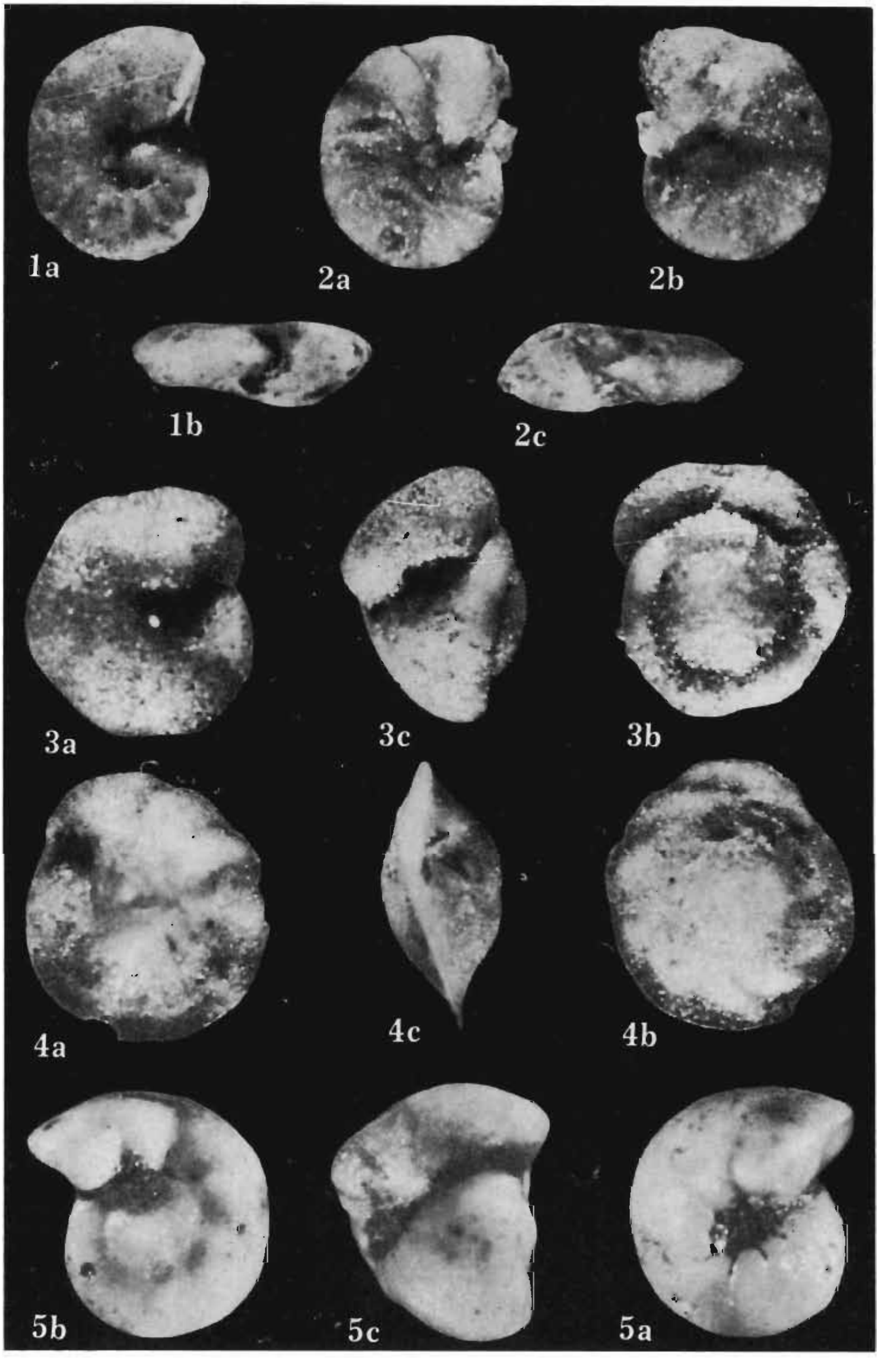
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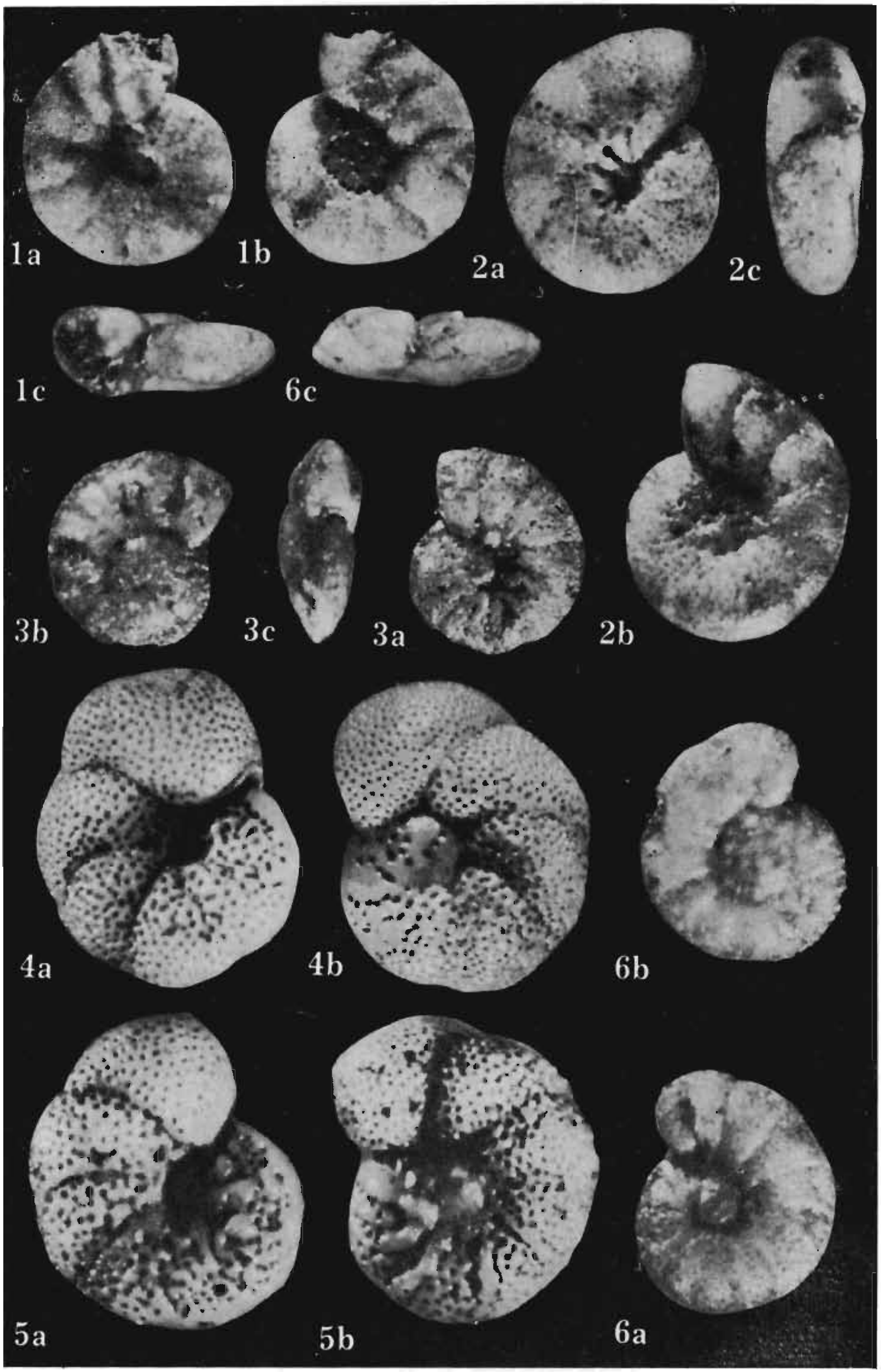
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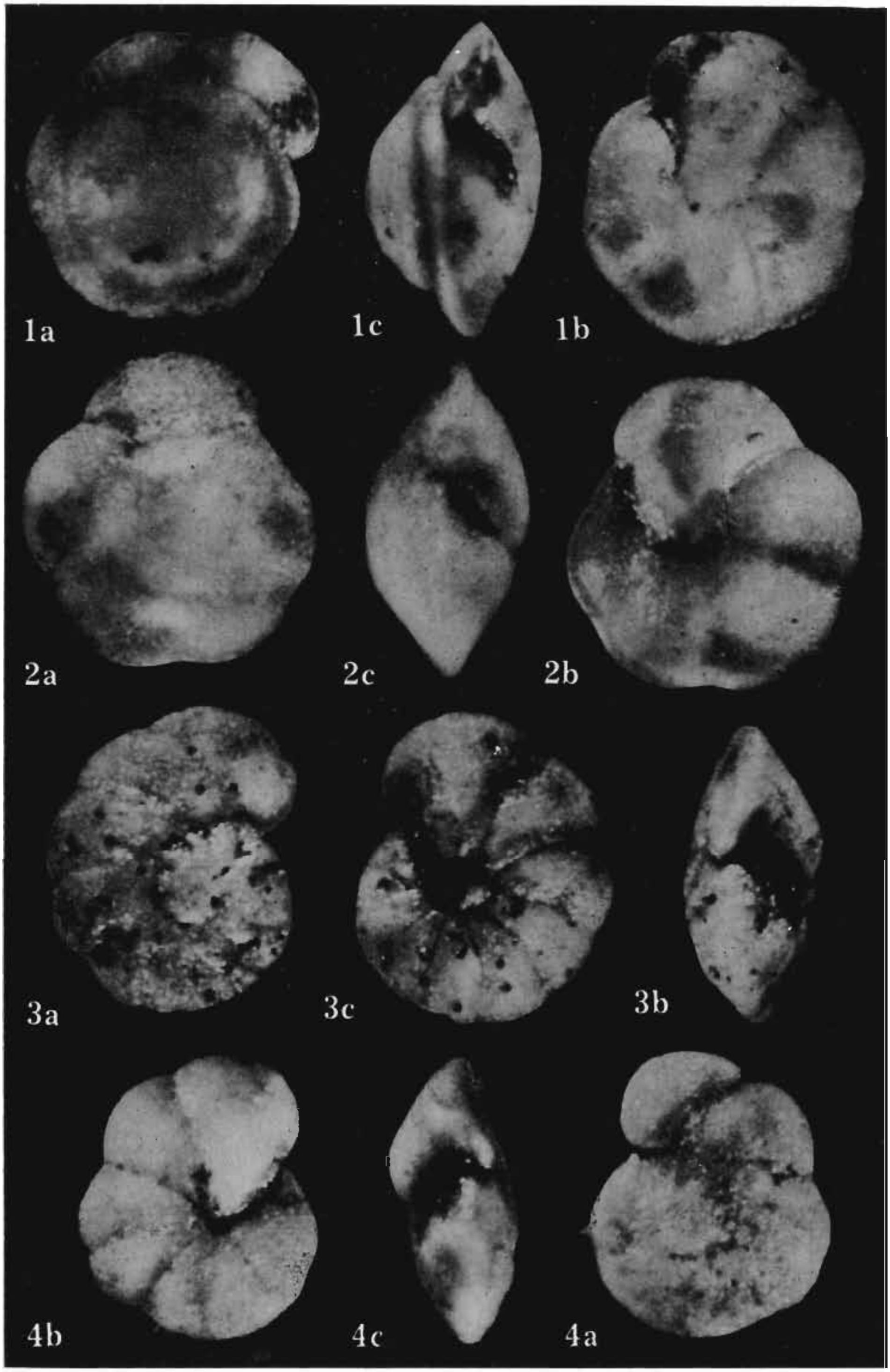
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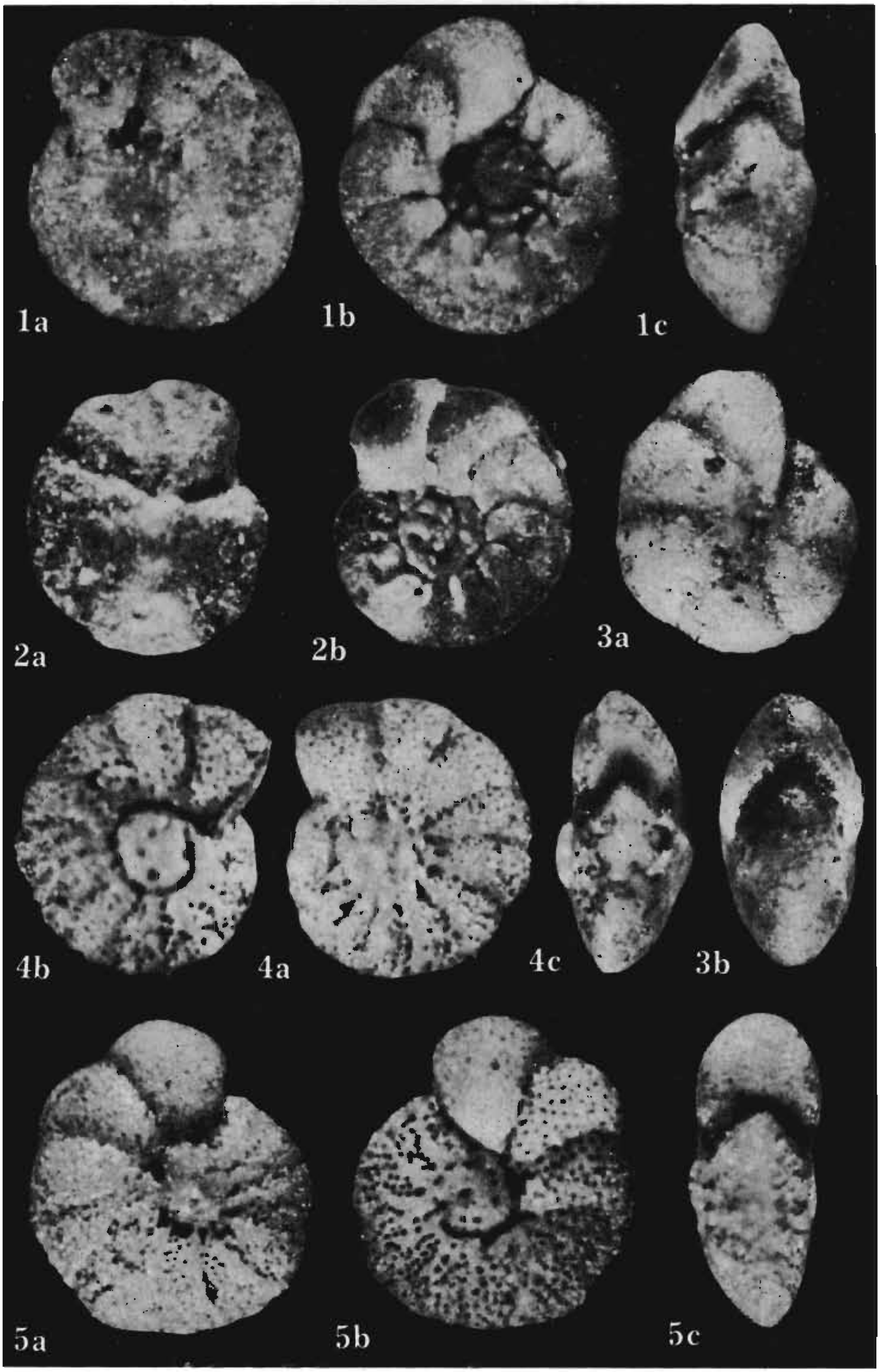
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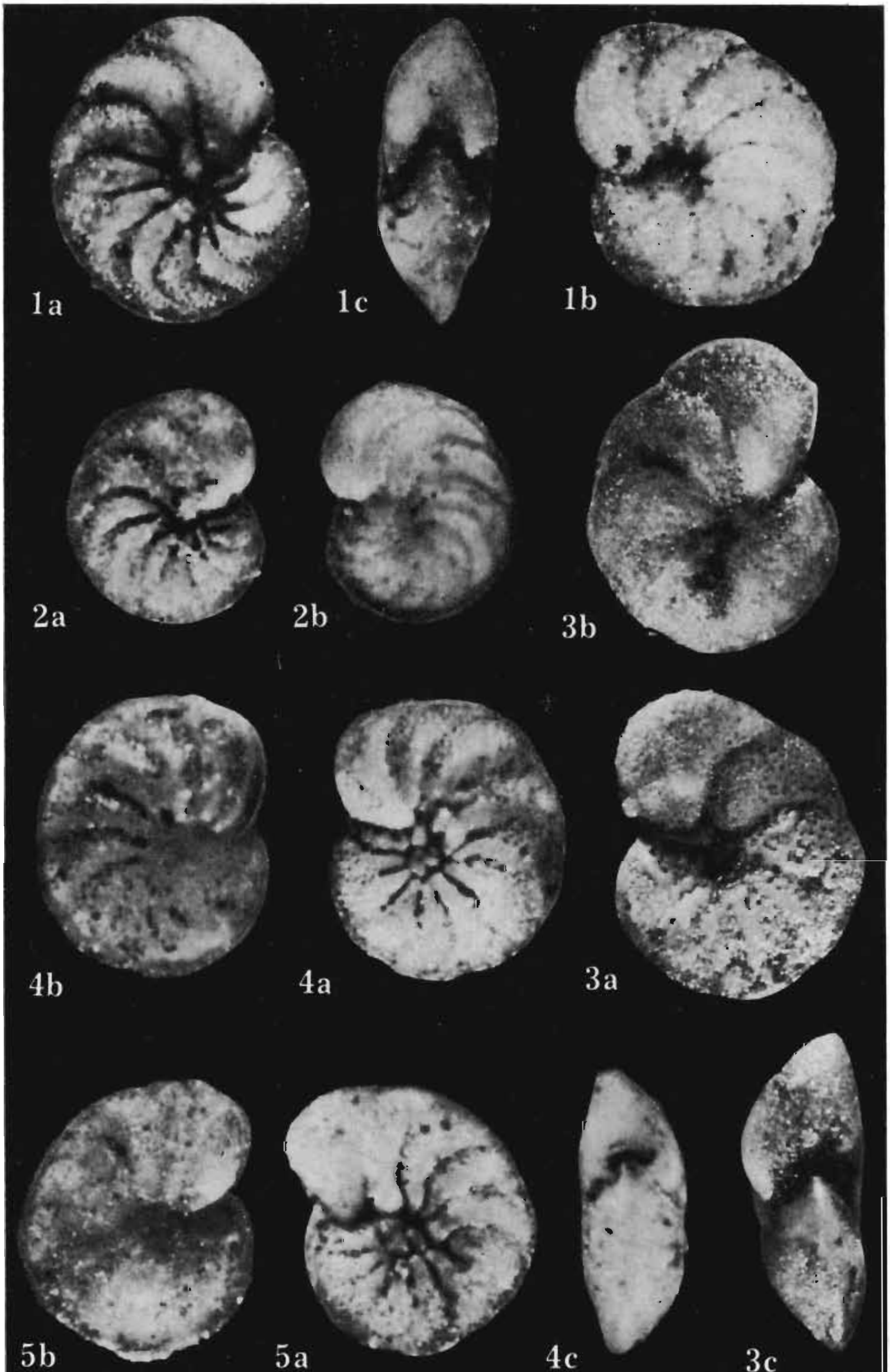
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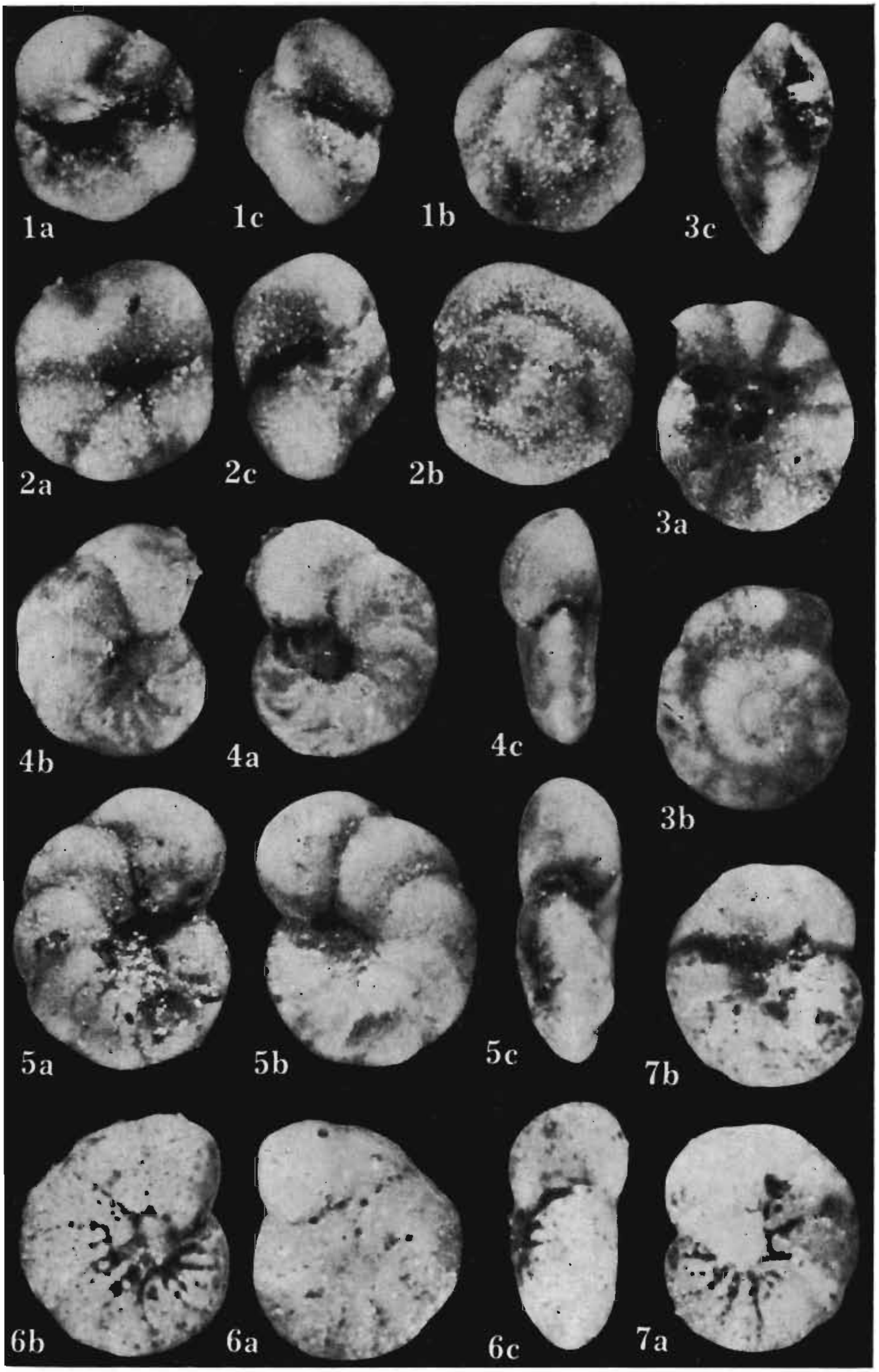
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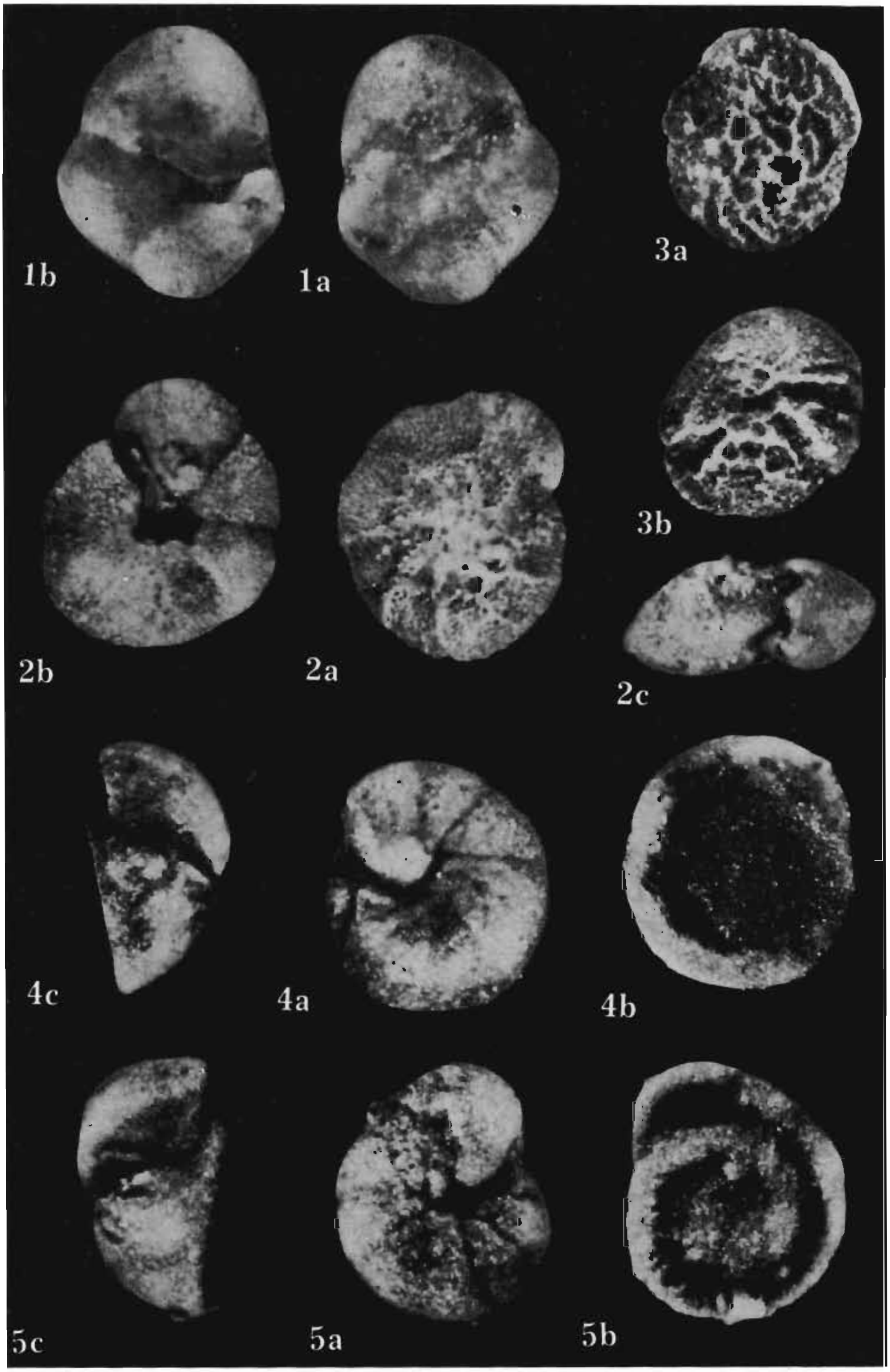
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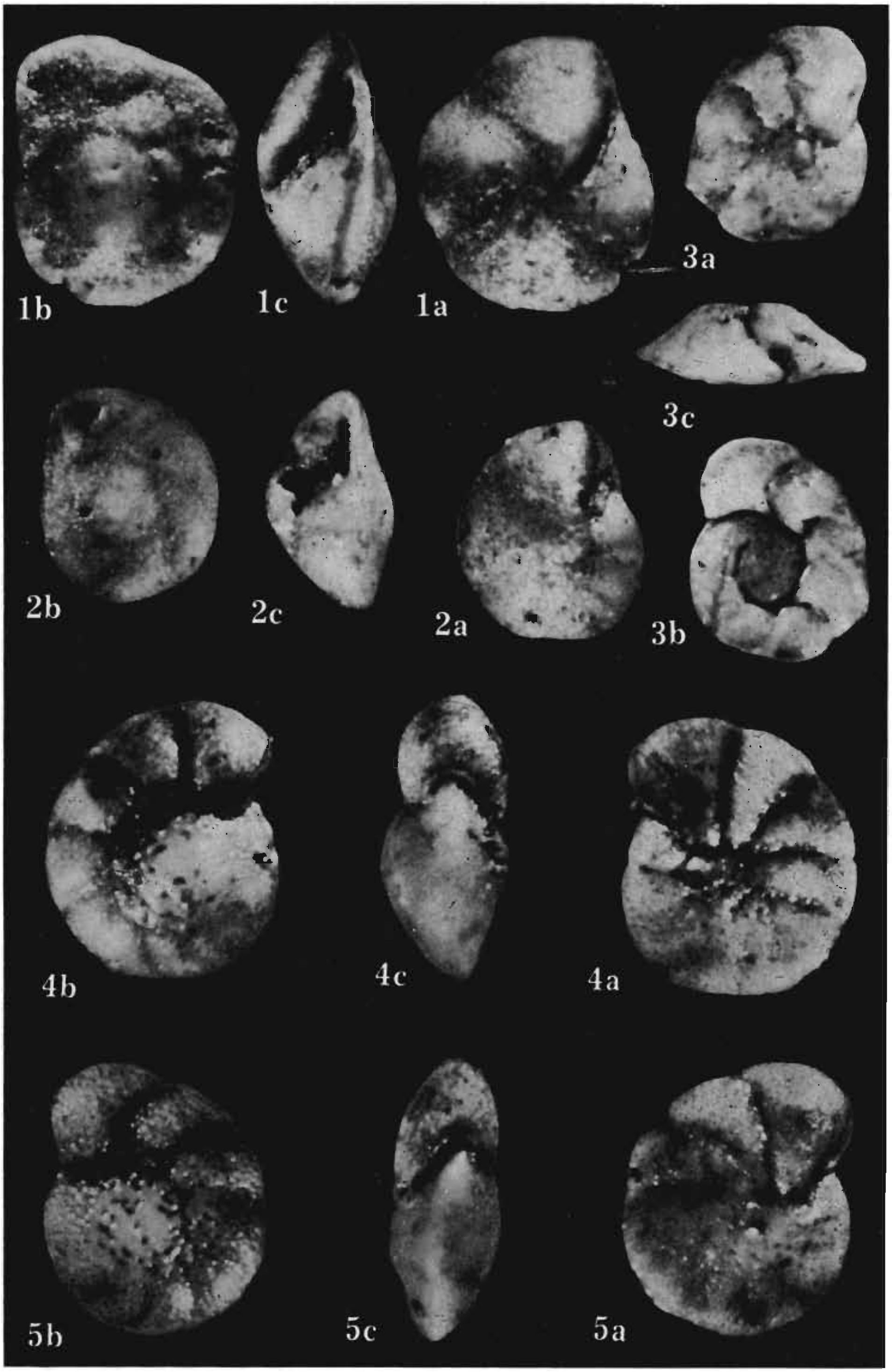
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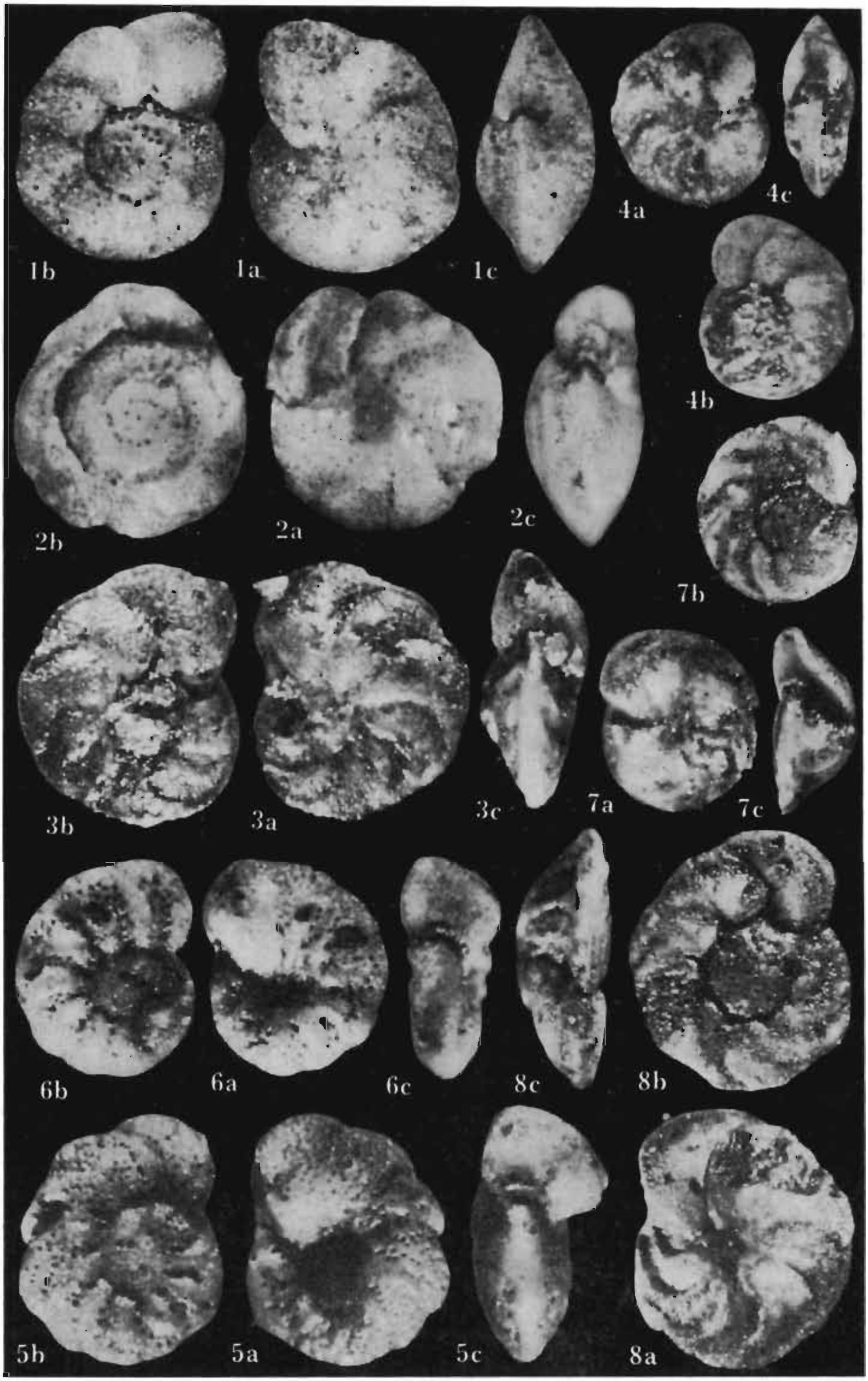
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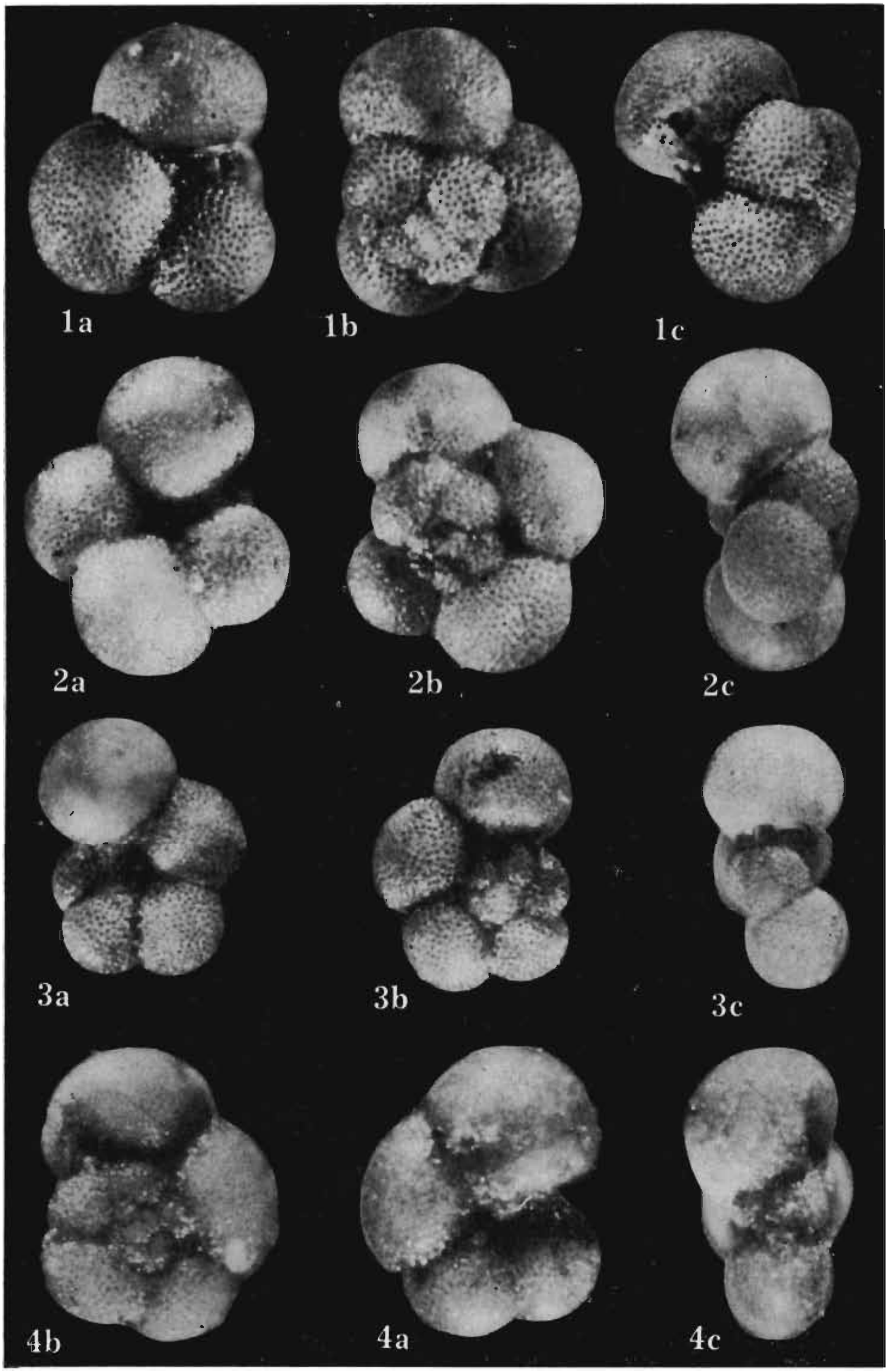
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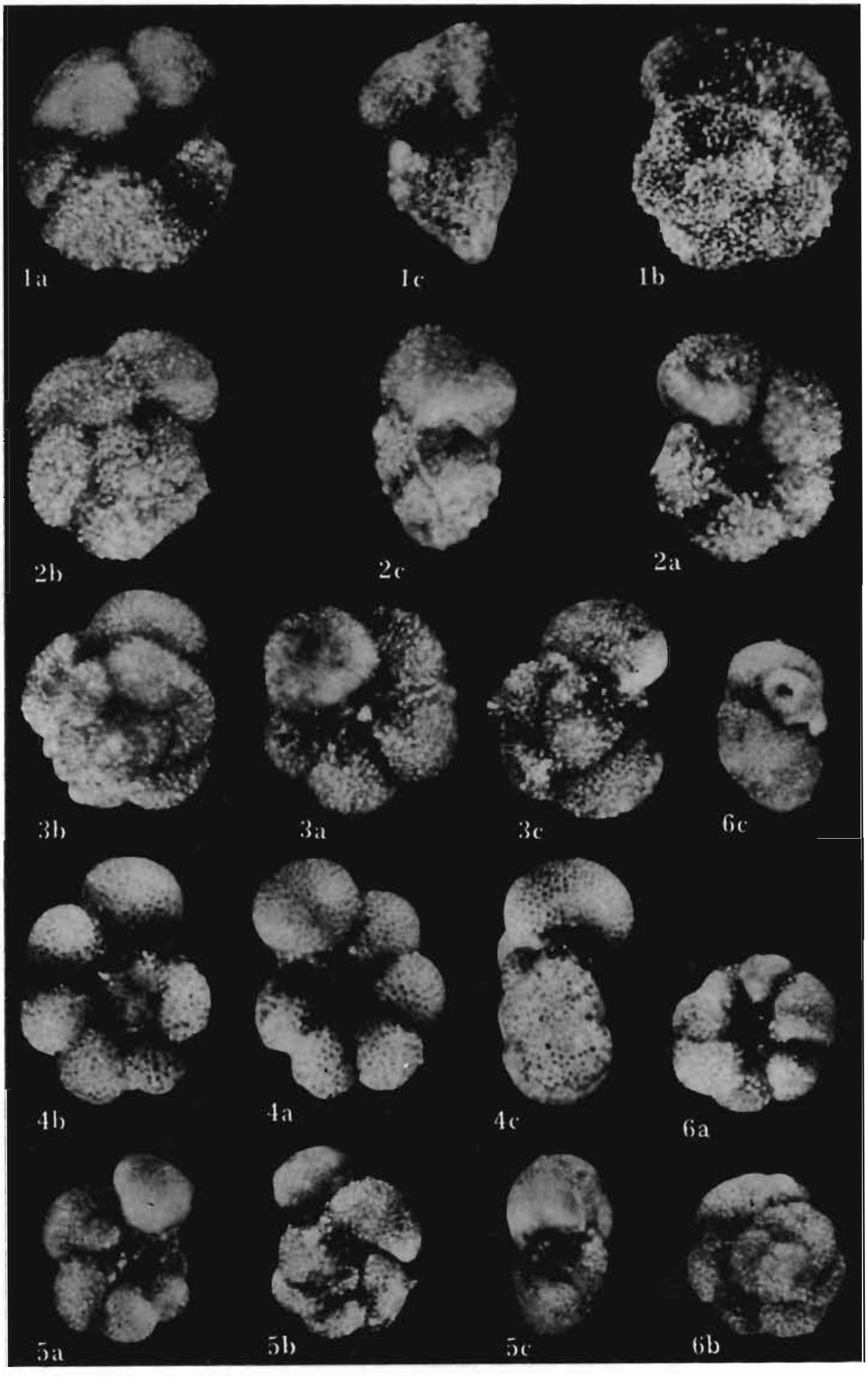
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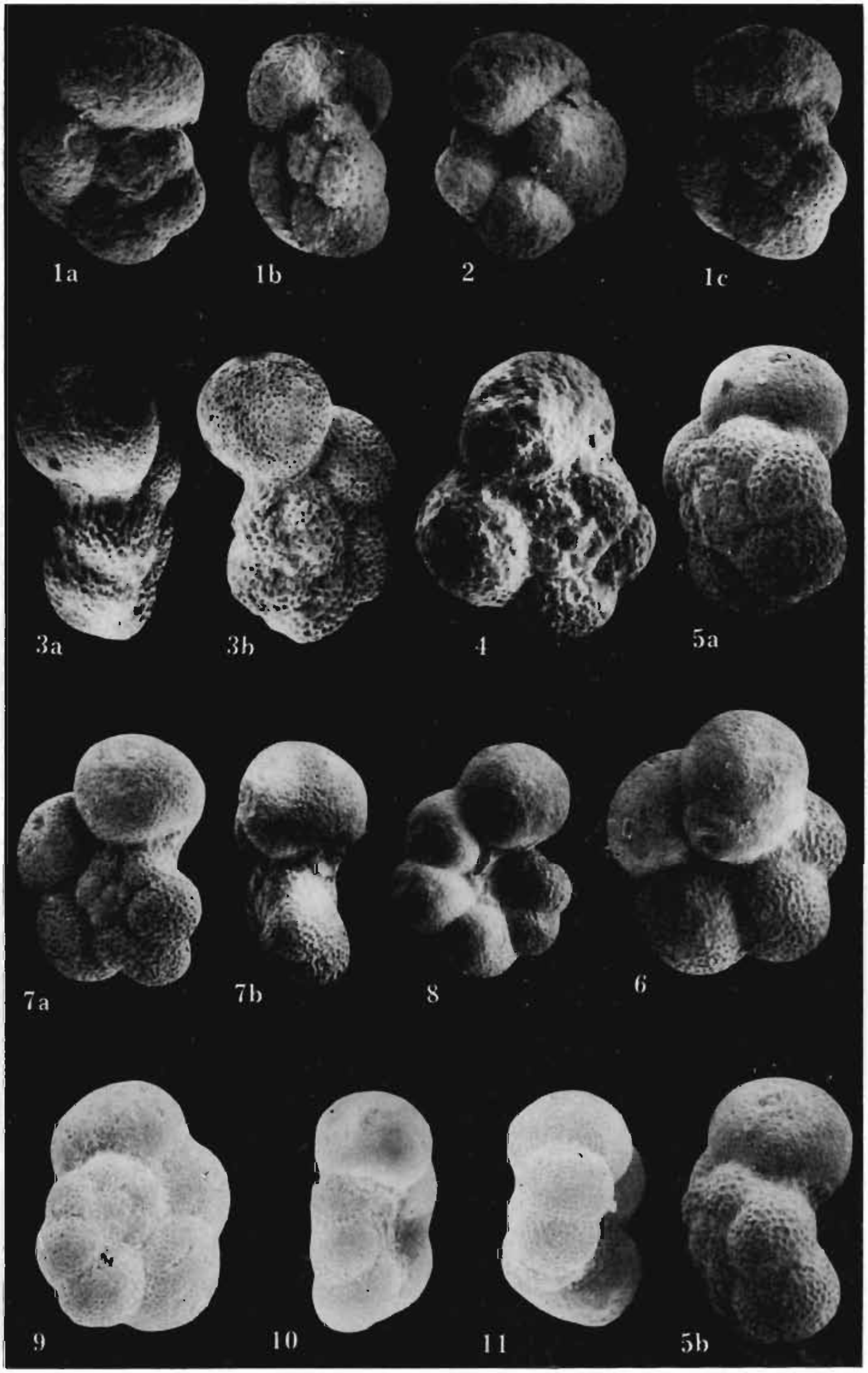
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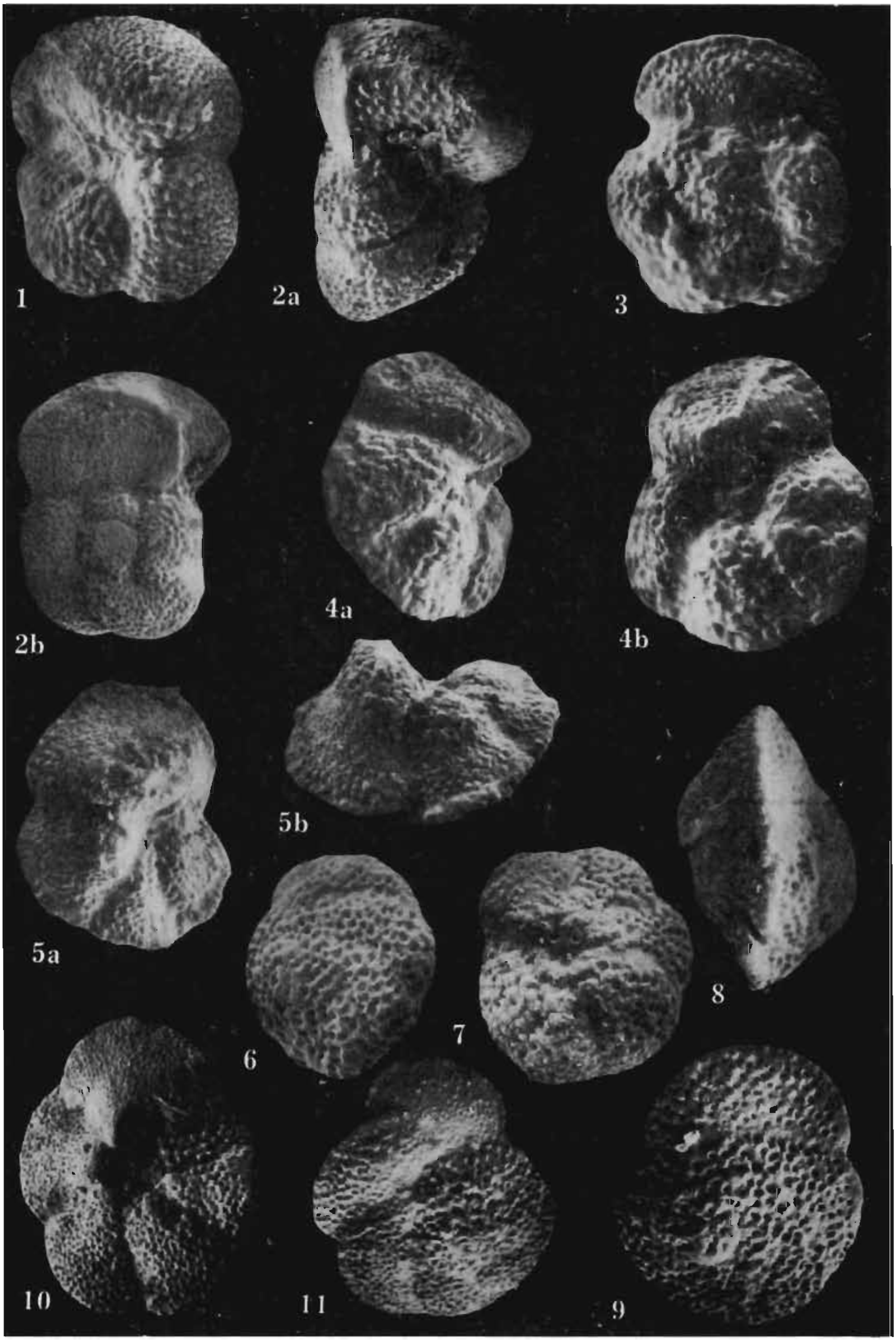
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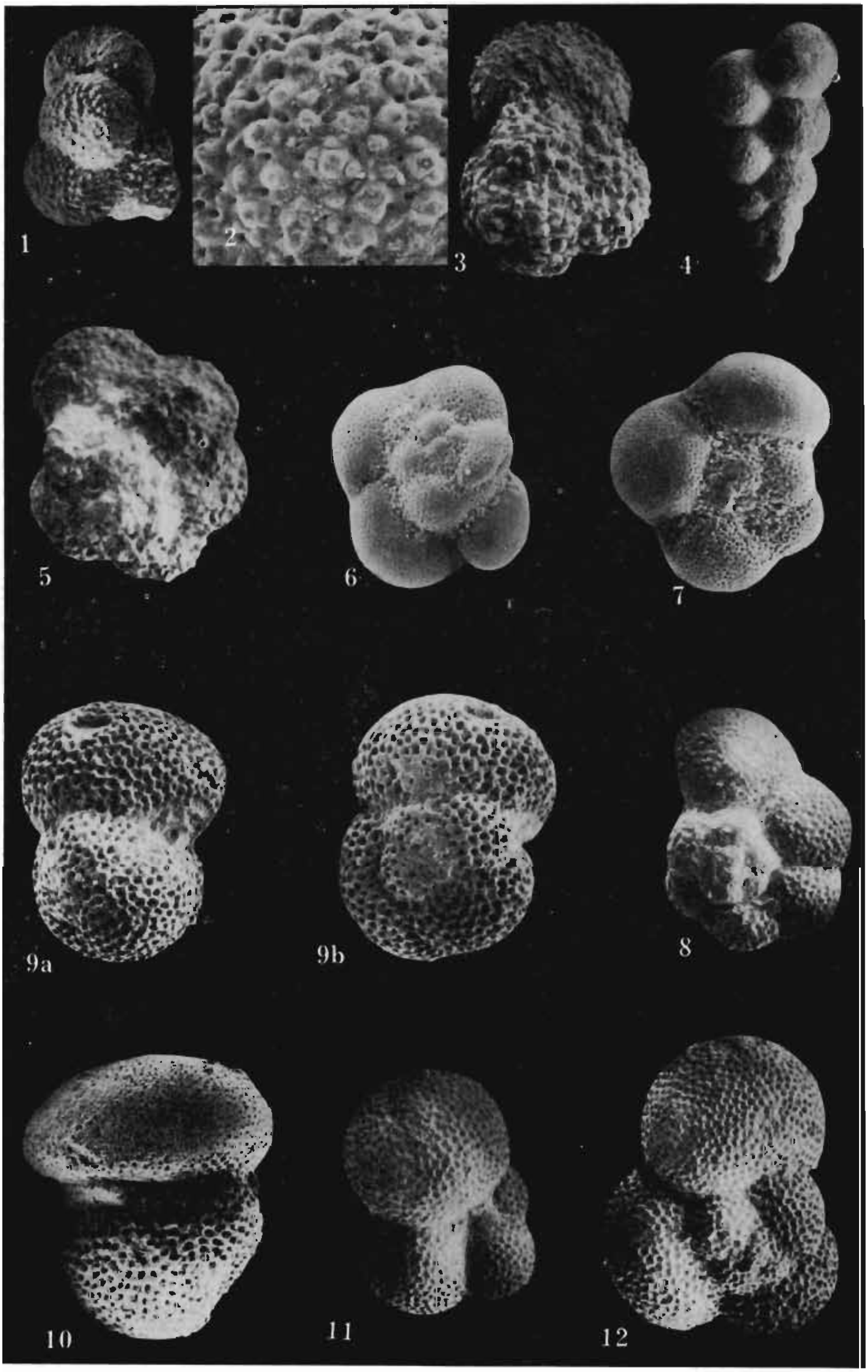
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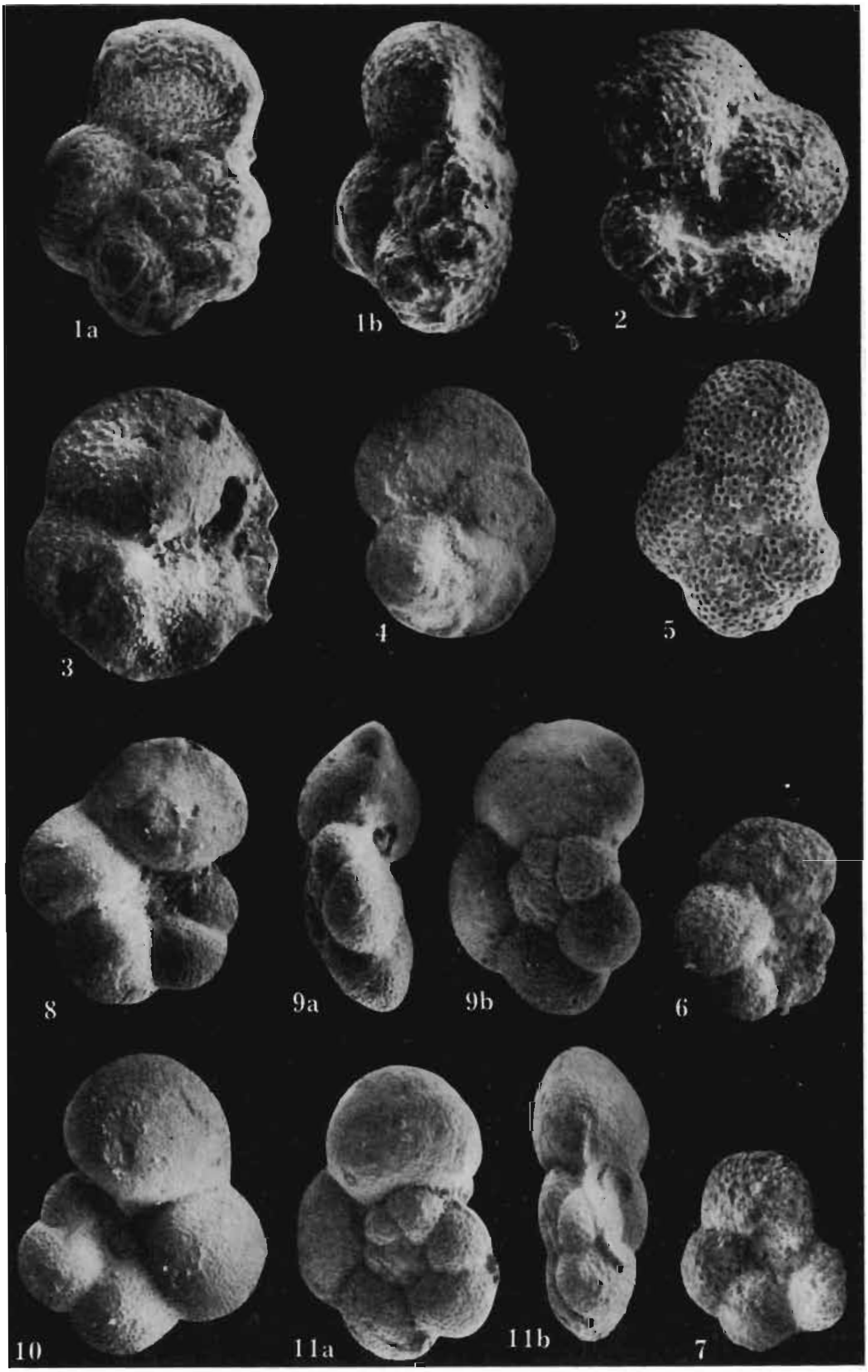
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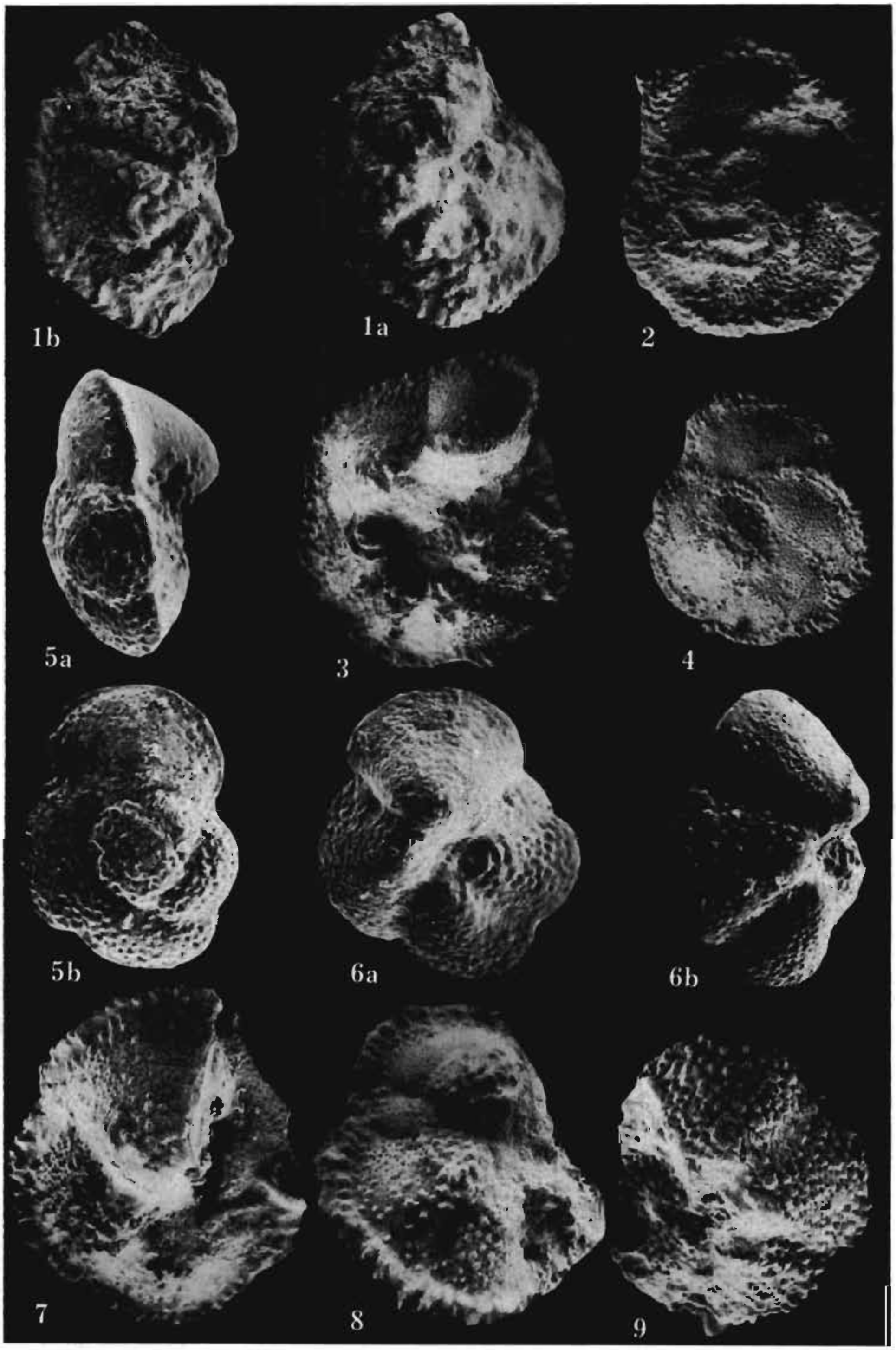
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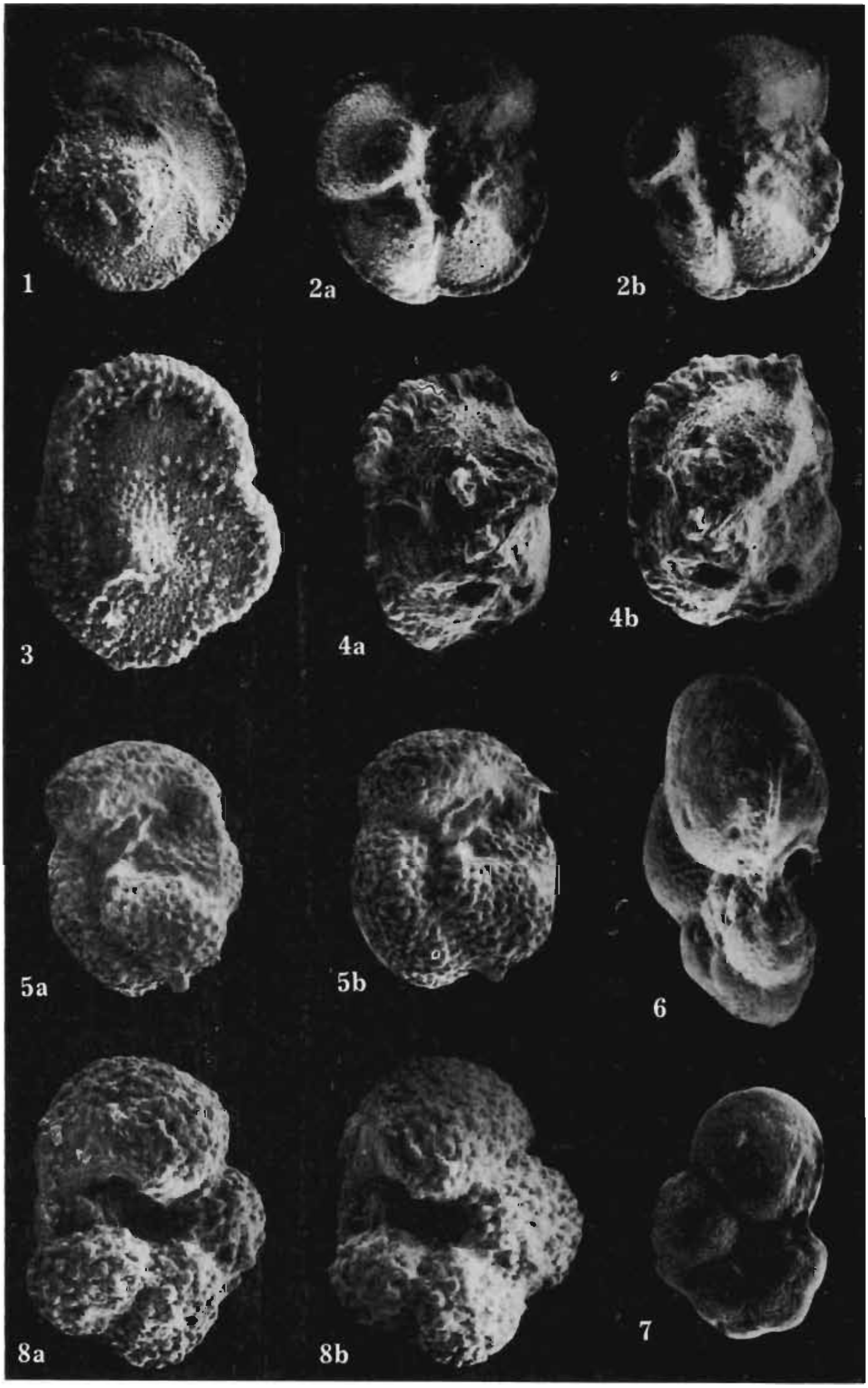
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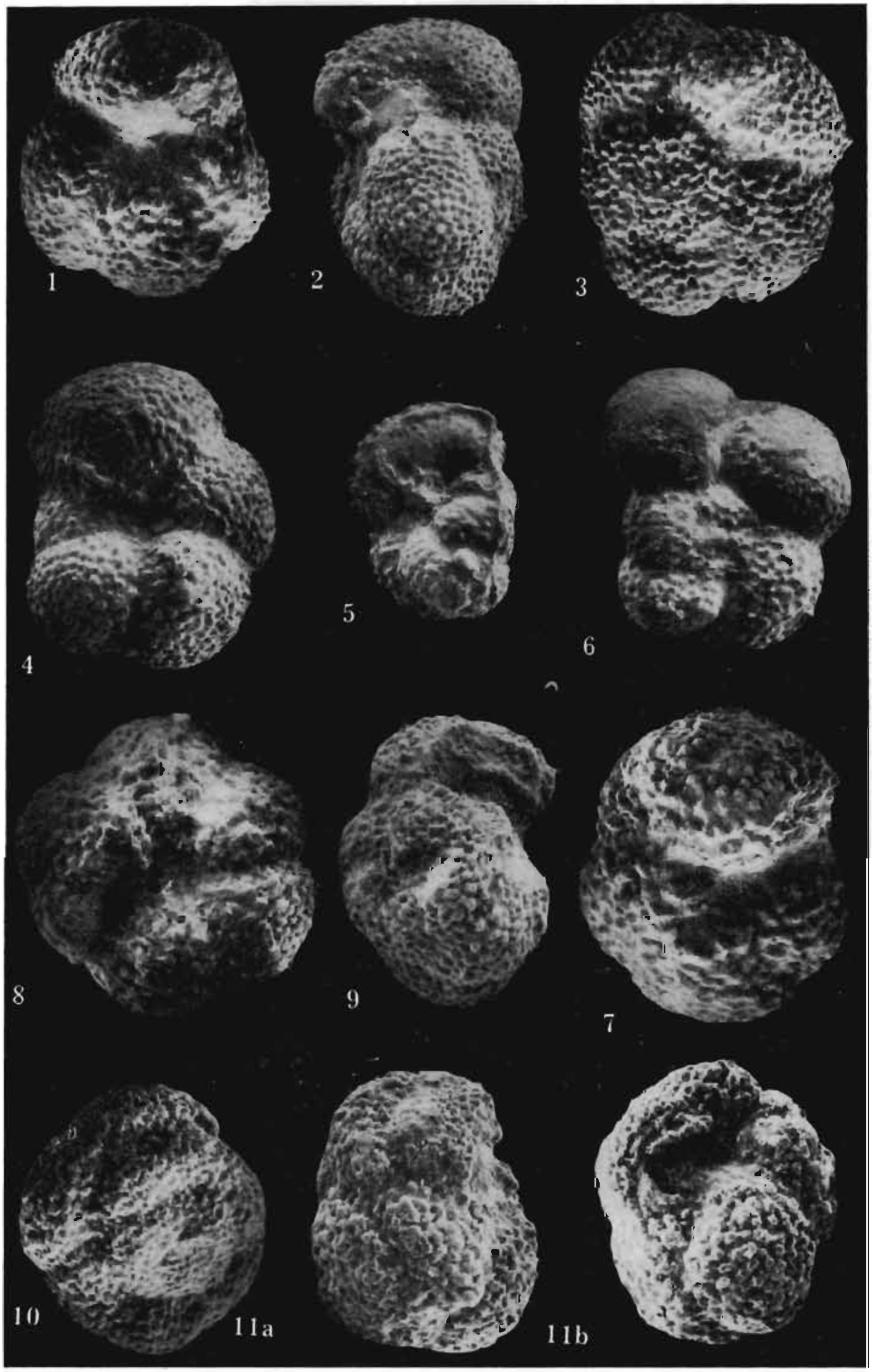
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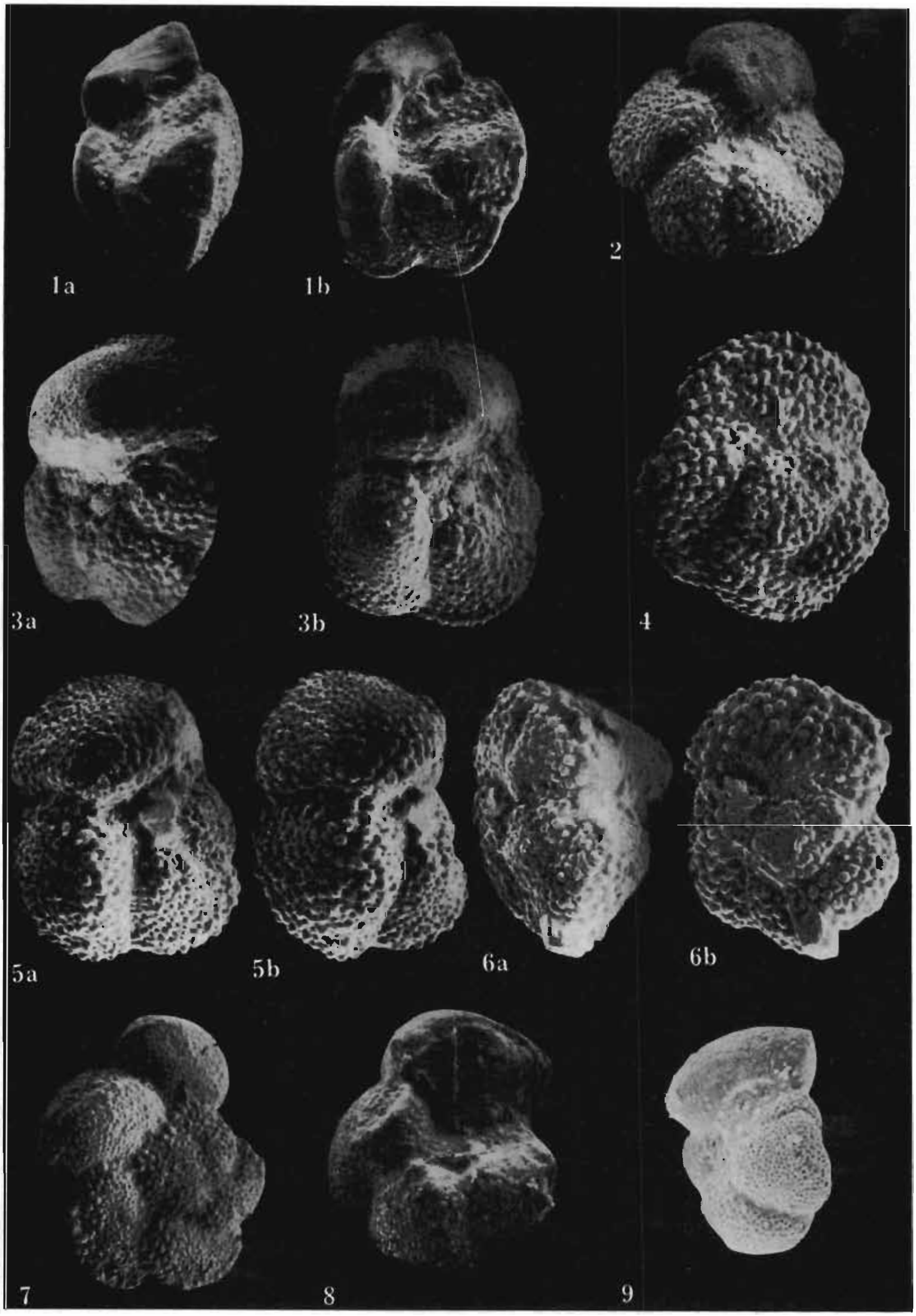
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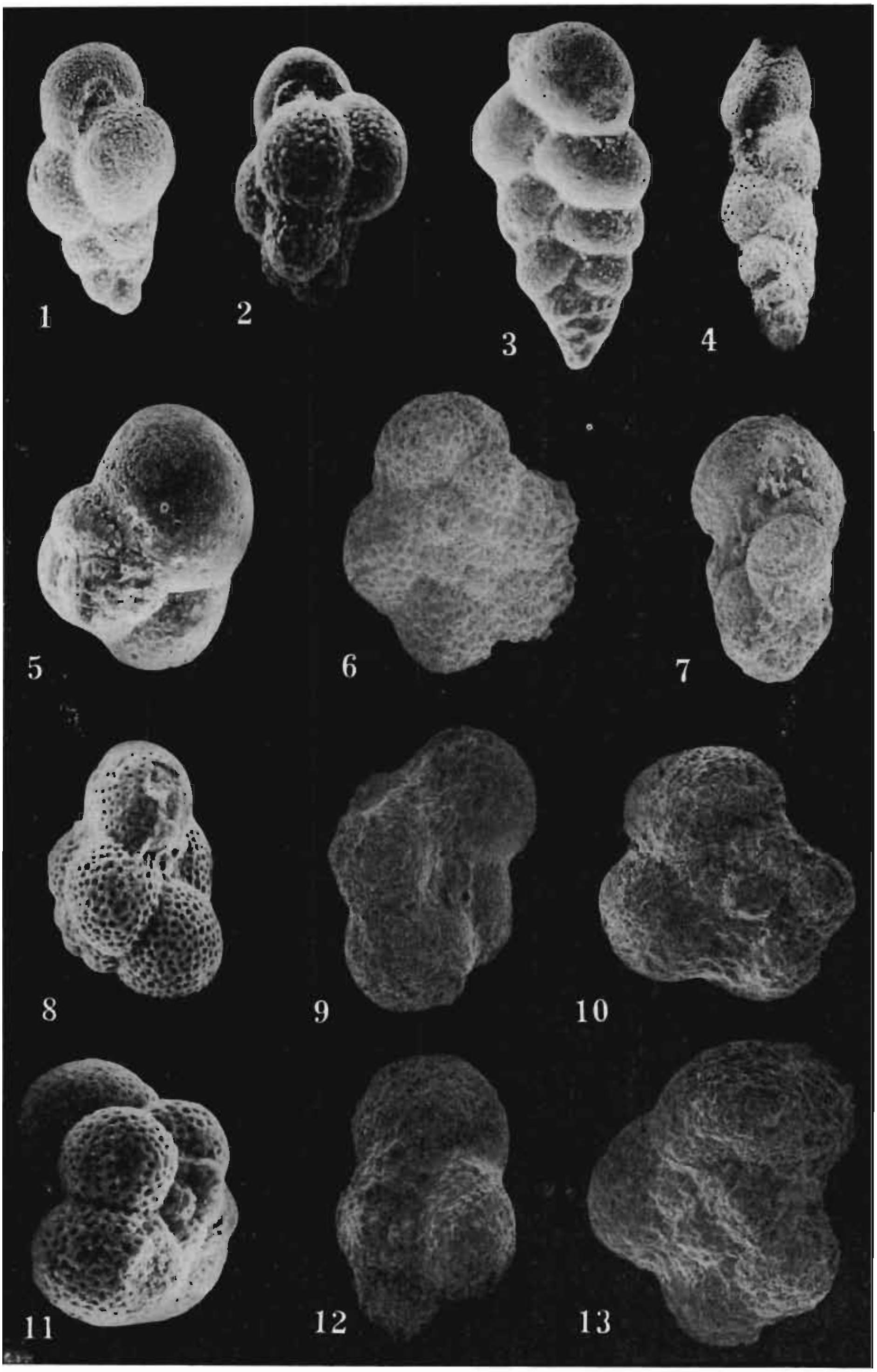
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