ZÁPADNÉ KARPATY

SÉRIA

paleontológia 1

GEOLOGICKÝ ÚSTAV DIONÝZA ŠTÚRA, BRATISLAVA 1975

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Miloš Rakús

Hettangian ammonites from the Strážovská hornatina Mts. (West Carpathians)

1 plate (CIV), 10 text-figs, Slovak summary

The thorough geological — paleontological research of the Mesozoic in the central zone and particularly in the Strážovská hornatina mountains resulted in detailed knowledge of the Hettangian Ammonites. Consequently, a summarizing report may be presented on the ammonites.

The first, and for considerable time the only published report on the Hettangian Ammonites was that by D. Štúr (1868, p. 378) from the locality Rakytov (the Veľká Fatra mountains), viz *A. psilonotus laevis* (Qu.) = *Psiloceras psilonotum* (Quenstedt). Unfortunately, the find has not been repeated so far. Still I suppose that in this case its presence might be regarded as probable, since: a) the species *Psiloceras psilonotum* is a typical, easily identifiable form, and it is almost impossible to mistake it for another species; b) on the locality Rakytov are well-developed sequences of the Upper Triassic (the Rhaetic) to Lower Liassic. Both they yielded rich fauna of lamellibranchiates, so the presence of the Hettangian may be taken for sure there.

In the sixties (M. Rakús in M. Maheľ 1962; V. Andrusovová —D. Andrusov 1968) published were some reports on the finds of the Hettangian Ammonites from the central zone. In the central zone of the West Carpathians, most Hettangian Ammonites come from the Strážovská hornatina mountains (Central Slovakia). Other finds are from these localities:

— the vicinity of Čierna Lehota (text — fig. 1);
— Kozinec (text — fig. 2);
— Trenčianska Teplá.

Stratigraphical position of the Carpathian Hettangian Ammonites

In the classical area of northwestern Europe, the Hettangian is divided into three zones: the planorbis, liasicus and angulata zones. In the Alpine — Carpathian region the division cannot be fully applied — as emphasized by J. W. Arkell 1946, p. 10; W. T. Dean et al. 1961, p. 439 — since in this area no representatives typical of northwestern Europe (index fossils) — and in many cases neither the associated fauna — are known so as to facilitate distinction of the respective zone. For this reason, in the zoning of the Hettangian I keep to F. Wähner 1886, p. 169—170.

* RNDr. M. Rakús, CSc., Geologický ústav Dionýza Štúra, Mlynská dolina 1, Bratislava.

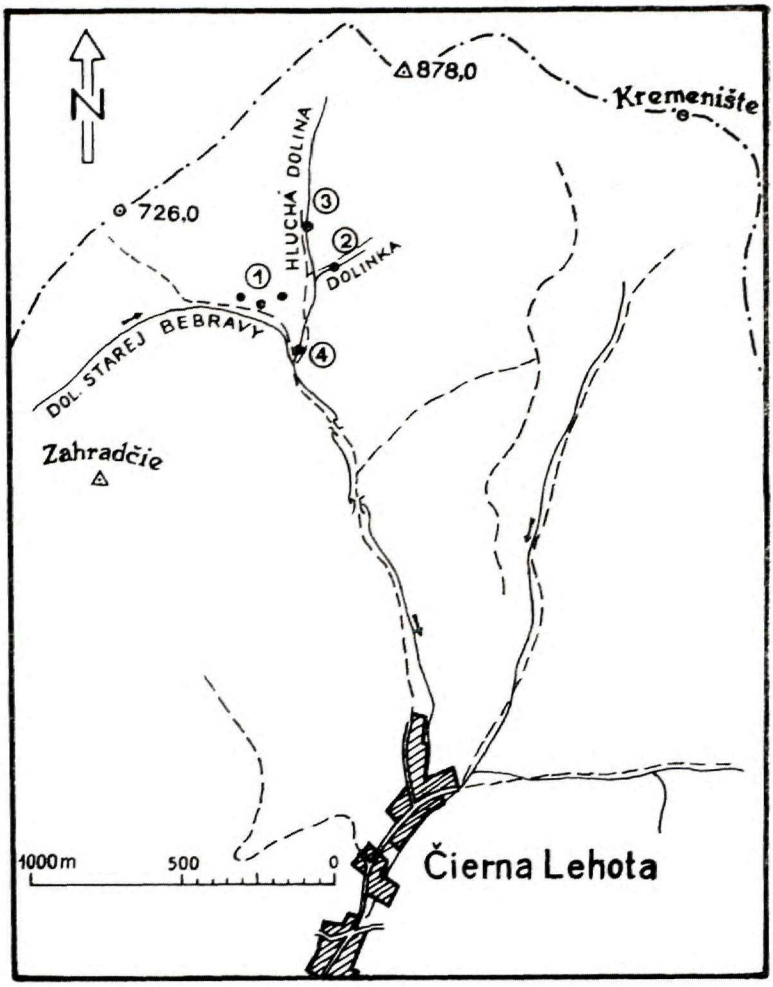


Fig. 1

This author introduced the following zoning for the regions out of the classical area: calliphyllum, megastomaproaries and marmorea zones. This division is well applicable so far as concerns the last two zones. Regarding validity of the calliphyllum zone, W. Blind (1963) pointed to the fact, that in the Apls (Fonsjoch and Breitenberg) the zone is above beds with Psiloceras planorbis and cannot be fully equivalent to the planorbis zone — as assumed by F. Wähner (1886, p. 169). In our opinion, the »calliphyllum zone« — as understood by F. Wähner (1886) and W. Lange (1952, p. 60) is a younger — upper subzone of the planorbis zone.

Consequently, basing upon ammonites, in the Hettangian of the West Carpathians the following zones may be distinguished:

Planorbis zone — so far evidenced by literary data (l. c.) and by the occurrence of *Waehneroceras (Waehneroceras) cf. tenerum* (Neum.) characteristic of its upper part (calliphyllum subzone),

Waehneroceras (Megastomoceras) megastoma (liasicus) zone — characterized by the species: *Alsatites viskupi* sp. n., *Gyrophioceras* aff. *praespiratissimum* (Waeh.)* *Waehneroceras (Curviceras)* cf. *engonium* (Lange).

Schlotheimia marmorea (angulata) zone — characterized by the species:
Schlotheimia cf. *montana* (Wähner)
Schlotheimia cf. *oxygonia* Lange (Andrusovová—Andrusov, 1968)
Gyrophioceras aff. *praespiratissimum* (Wähn.)*
Charmasseiceras charmassei (d'Orb.)**
Charmasseiceras martinischmidtti Lange**
Ectocentrites waehneri sp. n.**

As regards the origin or the paleozoogeographical appurtenance the Carpathian Hettangian ammonites display clear relationship with the Alpine fauna. The fact might indicate more or less immediate connection between the two areas during the Hettangian.

Explanations to the abbreviations used in the text:

GÚDŠ — D. Štúr Institute of geology — collections
SNM-Z — Slovak National Museum — collections
D — total test diameter
Wh — whorl height
d — umbilicus diameter
Wt — whorl width

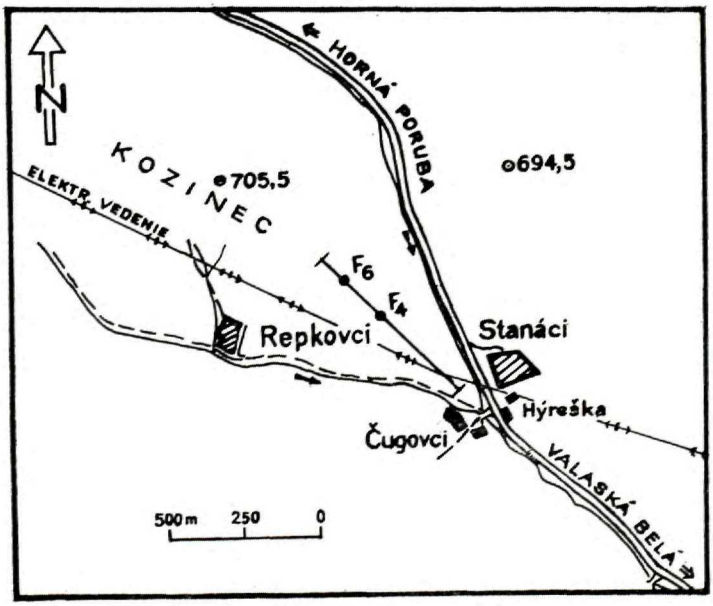
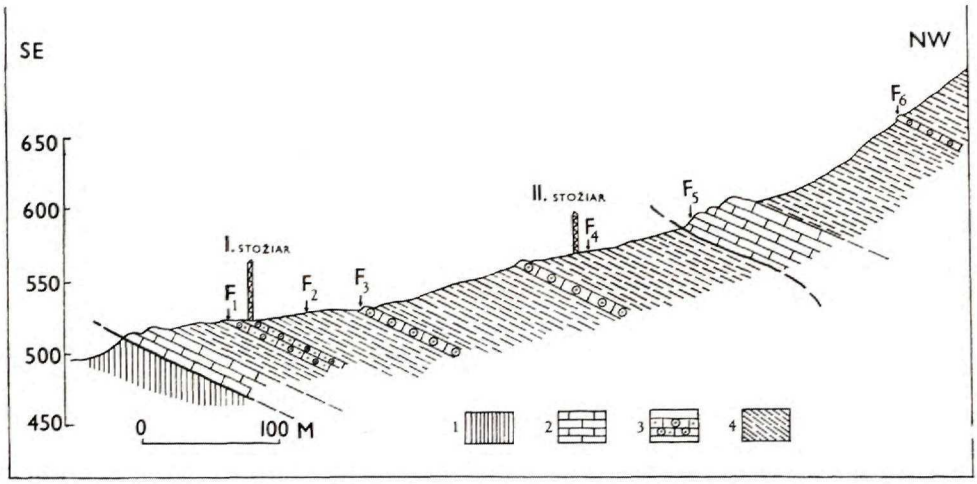


Fig. 2

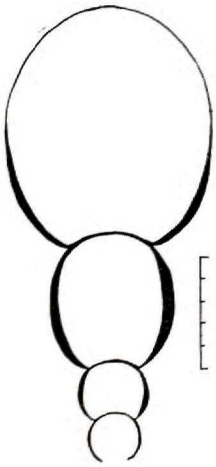
* its position in the West Carpathians is not clear
** unclear stratigraphical position, perhaps the most lower Sinemurian.

R/2 — number of ribs per ½ whorl
+ — Type species
M. — macroconch
m. — microconch



Text-fig. 3. 1 — red Keuperian marlstones; 2 — grey organodetrital bedded limestones of the Rhaetic with lumachellar layers; 3 — darkgrey organodetrital and crinoidal limestones — Hettangian; 4 — darkgrey calcareous and sandy schists — Hettangian.

Obr. 3: 1 — červené slieňovce keuperu; 2 — sivé organodetritické lavicovité vápence rétu s polohami lumachel; 3 — tmavosivé organodetritické až krinoidové vápence; 4 — tmavosivé vápnité a piesčité bridlice.



Paleontology: *Ectocentritidae* Spath, 1926
Ectocentrites Canavari, 1888

Type species: *Ammonites petersi* Hauer, 1856
Ectocentrites waehneri sp. n. text-fig. 4, pl. fig. 1a, 1b
1897 Ectocentrites n. f. ind. Wähner: Unterer Lias etc.; p. 168, pl. 21, fig 7

Text-fig. 4: *Ectocentrites waehneri* sp. n., Holotype; specimen nr. SNM-Z 6321, section through whorls, Hluchá dolina, locality nr. 3 (the Strážovská hornatina mountains)

Obr. 4: *Ectocentrites waehneri* sp. n., Holotyp, exemplár n° SNM-Z 6322; prierez závitmi, Hluchá dolina, lokalita č. 3 (Strážovská hornatina)

Holotypus: the specimen depicted in pl. 1, fig. 1a, b; in the Slovak National Museum (SNM), Catalogue Nr. SNM-Z 6321

Derivatio nominis: in honour of F. Wähner, a prominent expert for the Lower-Liassic Ammonites of the Alps.

Locus typicus, stratum typicum: the Hluchá dolina valley (locality Nr. 3) near Čierna Lehota in the Strážovská hornatina

mountains, most probably the Upper Hettangian — Lower Sinemurian.

Diagnosis: a small, evolute test with distinct prorsiradiate — oriented ribs without ventrolateral tubercle; the articulate stage occupying approx. 2,5 whorls; peristome is simple; suture slightly dissected

Material: an incomplete stony kernel with a partially preserved test

Size in mm:

specimen n°.	D	Wh	Wt	d
SNM-Z 6321	30,5	9,8	7,4	15,0

Description: The test is small, planispiral-coiled, evolute. The whorl section in juvenile stages (up to 10 mm diameter) is circular. Then the height of the whorl becomes decisive, and the section is oval (text-fig. 4). The articulate stage covers 2,5 whorls, diameter being 6,5 mm. The articulate stage fades-out and is replaced by costate stage. The total number of whorls i 5½.

In nuclei the ribbing is distinct. Ribs are simple aligned densely, prorsiradiate. They begin in the periumbilical section of the whorl and cross convexly the ventre without interruption. Ventrolateral tubercles are missing. The diameter being 10 mm, the number of ribs in a half of a whorl is 16. Above the body chamber the ribs are weakened and immediately before the peristome they are only in the periumbilical section Such ribs are thickened. In a half of the whorl height they are fasciculated. The peristome is simple.

Discussion: The new species differs from all other species of the genus Ectocentrites Canavari in the type of ribbing and in the absence of centrolateral tubercles.

The subadult stages of the species *Ectocentrites meneghini* (Canavari 1882) are partially related to the new species. Only the articulate stage of the latter is far smaller, and there are no tubercles on the ribs.

It should be emphasized that *Ectocentrites waehneri* sp. n. is most likely an adult stage, its diameter not exceeding 40 mm; while the adult *Ectocentrites petersi* (Hauer 1856) exceeds 200 mm in diameter. Perhaps the new species is a microconch.

Geographical distribution: The species is only known from the Tethys area. It is found in the Northern Calcareous Alps and in the West Carpathians.

Occurrence in the Carpathians: so far it was only found on the locality Nr. 3, the right slope of the Hluchá dolina valley near Čierna Lehota (the Strážovská hornatina mountains). The specimen is from debris (collector: V. Viskup 1961).

Stratigraphical range: In the Alps the species occurs in limestones with Arietites (F. Wähner 1897, p. 168). Its stratigraphical position in the West Carpathians is not precisely known. The block of limestones in which the specimen was found, is lithologically resembling those containing the Hettangian lamellibranchiates. Perhaps the limestones should better be referred to the Upper Hettangian than Sinemurian, at least as regards the locality in the Carpathians).

Family: *Psiloceratidae* Hyatt, 1867

Subfamily: *Alsatitinae* Spath, 1924

Genus: *Alsatites* Haug, 1894
Type species: *Ammonites liasicus* d'Orbigny, 1888
Syn.: *Proarietites* Lange, 1922

Gonioptychoceras Lange, 1941

Discussion: Basing upon J. W. Arkell's (1957, p. L 235) diagnosis, we should refer to this genus only species with distinctly vertically depressed whorl section (reniform), with more or less acute yet conspicuous keel on the ventre. As quoted by L. F. Spath (1924, p. 201) the assemblage is not completely monophylitic and morhpologically homogeneous. Besides typical forms, in the Hettangian of Europe are species with laterally depressed whorls, with oval whorl section, and with a »chevron« instead of the keel, or with only a slight indication of the keel, e. g.: *Alsatites laqueus* (Quenstedt 1556 *A. viskupi* sp. n. For the time being I refer the group of forms to the genus *Alsatites*. Perhaps they ought to be separated as a particular subgenus from the basical genus.

By the keel missing the genus resembles Laqueoceras, Lange 1941; only its ribbing is much more distinct extending to the end of the body chamber — in contrast to the genus Laqueoceras.

Alsatites viskupi sp. n.
Pl. CIV Fig. 2a, 2b, text-fig. 3.

1962 *Alsatites* aff. *gallbergensis* Lange — Rakús in Maheľ: Map explanations... (sheet Žilina, p. 102.)

Holotypus: the specimen depicted in pl. CIV, fig. 2a, 2b in the depository of the Slovak National Museum in Bratislava, catalogue Nr. SNM-Z6322.

Derivatio nominis: after V. Viskup, the meritorious collector of fossils in the Mesozoic of the West Carpathians.

Locus typicus et stratum typicum: The Kozinec ridge in the Strážovská hornatina mountains. Fauna Nr. 6, the Middle Hettangian, the Megastome zone.

Material: a complete, well-preserved specimen with partially preserved carbonaceous test, and an incomplete stony kernel.

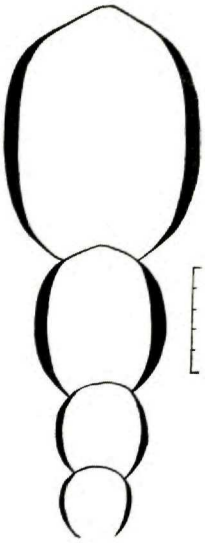
Size in mm:

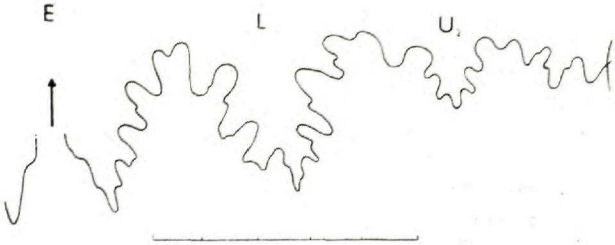
specimen n°.	D	Wh	Wt	d
GÚDŠ 2009	30,4	7,8	—	18,0
SNM-Z 6322	51,7	11,2	7,4	30,8

Diagnosis: the test of medium size, planispiral-coiled, with elliptical section of the last whorl, ventrum »chevron-like«, with a slight indication of the keel. The whorls are covered with densely aligned, first radial, then prorsiradiate ribs. The ribs are considerably weakened to fading-out on the ventre; the body chamber occupying more than a half of the whorl. The peristome is simple with a short ventral apophyse.

Description: the test is of medium size; planulate, evolute. The total number of whorls is 6—7. In subadult stages (up to the test diame-

ter 20 — 20 mm) the ratio of height and width of the whorl is almost equal, and the whorl section is circular. With such diameter the section gets elliptic. Sides are slightly arched tending to parallel. Umbilicus is shallow and wide.





Text-fig. 6: *Alsatites viskupi* sp. n., Holotype, specimen nr. SNM-Z 6322, suture line at the whorl height of 7 mm, the Kozinec ridge F—6 (the Strážovská hornatina mountains)

Obr. 6.: *Alsatites viskupi* sp. n., Holotyp, exemplár n° SNM-Z 6322, prepážková línia pri výške závitu 7 mm, hrebeň Kozinca F—6 (Strážovská hornatina)

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Text-fig. 5; *Alsatites viskupi* sp. n. Holotype: specimen n°. SNM-Z 6322, section through whorls of a mature individual, the Kozinec ridge, F — 6 (the Strážovská hornatina mountains)

Obr. 5: *Alsatites viskupi* sp. n., Holotyp, exemplár n° SNM-Z 6322; prierez závitmi dospelého jedinca, hrebeň Kozinca, F — 6, (Strážovská hornatina)

The »chevron-like« ventre appears with the diameter approx. 30 mm, text-fig. 5. The »chevron« is distinct on the last whorls, fading out above the body chamber, and disappearing before the aperture. Consequently, the whorl profile is oval.

Ribbing is simple, regular. Densely aligned ribs disappear in the periventral part of the whorl. At first the ribs are radial, then they get moderately prorsiradiate. The ribbing begins in young ontogenetic stages (? 2nd — 3nd whorl). Their number R/2 fluctuates within 26 — 29 — 24 on the 3rd — 5th whorls. In the adult stage, on the 6 th — 7 th whorl are 25—37 (R/2) ribs. In both cases ribs appear in the periumbilical part, then they gradually grow (the maximal height is in a half of the whorl height) and bend forward on their passage to the ventre, getting much weaker. The interruption of regular ribbing is only seen immediately before the aperture (about 10 mm).

S u t u r e: with the 8 mm whorl height the suture is as showed in text-fig. 6; E is divided by a narrow, non-dissected ventral saddle, extending to a half of the height S_1. The saddle is comparatively broad, rather shallow; L is narrower than S_1; S_2 — somewhat narrower than S_1.

The body chamber is short, occupying more than a half of the last whorl. Close before the aperture (10 mm), the body chamber is constricted on the ventre. The peristome is simple, with a small ventral rostrum.

D i s c u s s i o n: As mentioned above, the species Alsatites viskupi sp. n. is referred to the group of Alsatites practically without keel. In this they differ from other species referred to the genus.

The next characteristics typical of our species is the elliptical section of the last whorls with the »chevron«.

The subadult stages of the species *Alsatites laqueus* (Quenstedt 1856) are resembling the new species by the nature of ribbing so that their differentiation is difficult. In adult stages differences between both species are mainly in ribbing which is far more distinct in *Alsatites viskupi* sp. n.

The new species differs from *Alsatites gallbergensis* Lange, 1941 having circular profile of whorls, mostly in the elliptical profile of the last whorls. The nature of ribbing is similar in both species.

Geographical distribution: the new species is only recorded in the West Carpathians. Occurrences in the Carpathians: the species is only recorded on the locality of the Kozinec ridge, Fauna Nr. 6 (in the Strážovská hornatina mountains). A specimen (=holotype) was found by V. Viskupin in dark grey slightly sandy organogene limestones. Another specimen was found by M. Kochanová on the same locality and in the same limestones.

Stratigraphical range: Middle Hettangian, the zone with megastoma.

Gyrophioceras Spath, 1924

Type species *Arietites praespiratissimus* Waehner, 1886

Discussion: L. F. Spath (1924, p. 201) and J. W. Arkell (1957, p. L 236) regard *Gyrophioceras* as an independent genus in the subfamily *Alsatitinae*. In contrast to that, W. Blind (1963, p. 101) considers the genus *Gyrphioceras as a taxonomic* synonym of the genus *Alsatites* Haug.

At present we cannot say to what an extent the determination of the taxon as an independent genus is right, since the whole subfamily needs a revision then.

A considerable morphological resemblance of the genera *Alsatites* and *Gyrophioceras* and the only difference in ribbing may be observed.

Fam. *Schlotheimiidae* Spath, 1923*

Waehneroceratinae subfam. nov.

1950 *Schlotheimidae* Spath 1923; partim — J. W. Arkell: A Classification I, p. 361

1952 *Schlotheimidae* Spath, 1923; partim — D. T. Donovan: On Ammonites I, p. 644.

1952 *Schlotheimidae* Spath, 1923; partim — E. Basse in J. Piveteau: Traité de Paleontologie, tom II, p. 614.

1957 *Schlotheimidae* Spath, 1923; partim — J. W. Arkell in Treatise, part L, p. L 236.

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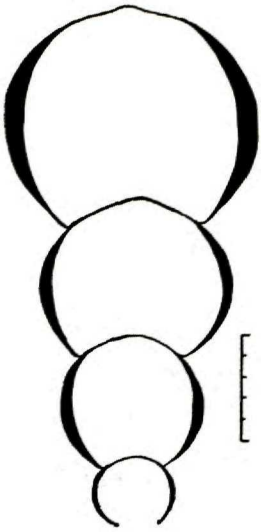
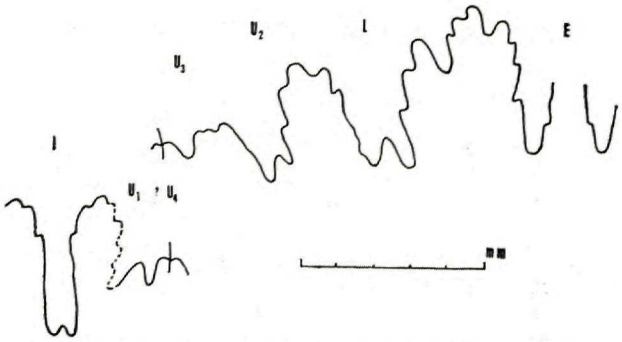
* D. T. Donovan (1952, p. 644) and J. W. Arkell (1950, p. 1957, p. L 236) regard L. F. Spath as the author of the family *Schlotheimiidae* determined in 1923. It is a fact that L. F. Spath (1923, p. 78) wrote: The family *Schlotheimiidae* (see also a Table on p. 84); but the taxon is not provided with »nov. fam.« which would unambiguously express that it was a new taxonomic unit. On the contrary one year later (1924, p. 194) the same author acknowledges the family *Angulatidae* Hyatt only!





Text-fig. 8: *Gyrophioceras* aff. *praespiratissimum* (Waehner, 1886), specimen nr. GÚDŠ/317, suture line at 7,5 mm of the whorl height, Dolinka, locality nr. 2 (the Strážovská hornatina mountains)
Obr. 8: *Gyrophioceras* aff. *praespiratissimum* (Wähner, 1886), exemplár n° GÚDŠ/317, prepážková línia pri výške závitu 7,5 mm, v Dolinke, lokalita č. 2 (Strážovská hornatina)

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Text-fig. 7: *Gyrophioceras aff. praespiratissimum* (Waehner, 1886) specimen nr. GÚDŠ/317, section trough whorls, Dolinka, locality nr. 2 (the Strážovská hornatina mountains)
Obr. 7: *Gyrophioceras aff. praespiratissimum* (Wähner 1886), exemplár n° GÚDS/317, prierez závitmi, v Dolinke, lokalita č. 2 (Strážovská hornatina)

1958 *Schlotheimiidae* Spath, 1923; partim — N. P. Luppov — V. V. Druščic in: Osnovy paleontologii, moljuski-golovonogije,, v. II., p. 65.

Diagnosis: Derivates of ribbed psiloceras with small or large planispiral, evolute test, the more or less conspicuous ribbing passing over the ventre exists either during the whole ontogenesis (m) or in subadult stages only (M.). In adult specimens (M) the ribbing is only on the sides of whorls. The sutural line shows mixed characteristics of psiloceras and schlotheimia.*

The body chamber (m) is comparatively short (about a half of the whorl); the peristome is simple (ajugal type) only with ventral rostrum (orig.).

Discussion: The opinions about the mutual position of the families and the determination of the families *Psiloceratidae* Hyatt 1867 and *Schlotheimiidae* Spath 1923 as independent taxons (assemblages) are rather contradictory. The reason is first of all in the fact, that such a basical taxon as e. g. the genus *Waehneroceras* Hyatt 1889 is once referred to the family *Psiloceratidae* W. Lange (1924, 1926, 1941, 1952), W. Blind (1963), and another time — to the family *Schlotheimiidae,* L. F. Spath (1923, 1924), D. T. Donovan (1952), J. W. Arkell (1957). Morphological study of the representatives of the families *Psiloceratidae* and *Schlotheimiidae* shows that in addition to typical representatives of these families there is fauna representing a transitory (intermediary) link in morphological (?phylogenetical) sense — between the taxon commonly denoted as *Psiloceratidae* (phylogenetically older, and morpholo-

* O. Schindewolf's (1962, p. 448) results concerning ontogenetic evolution of the sutural line show no substantial differences between the families Psiloceratidae and Schlotheimiidae.

gically simpler) and that of *Schlotheimiidae* (phylogenetically contemporaneous and younger, morphologically complicated). The new subfamily and particularly its stratigraphically oldest representatives, still show characteristics indicating their relationship to the family *Psiloceratidae:* the juvenile whorls of subadult stages of the species *Waehneroceras (Waehneroceras) tenerum* (Neumayr) have a very similar type of ribbing as costate psiloceras of the group *Psiloceras (Caloceras) torus* (d'Orbigny) cf. W. Lange 1952, pl. 12, (fig. 2).

At the same time, however, there are forms as *Waehneroceras (Curviceras) subangulare* (Oppel 1862) *Waehneroceras (Curviceras) helmstedtense* (Jüngst 1928) with well-developed ribbing not only on sides; but sigmoidal ribs cross the ventrum — which is a new feature. Sigmoidal ribs tending to grouping in the periumbilical part *(Waehneroceras (Curviceras))*, indications of the ventral belt *(Waehneroceras (Storthoceras)* show considerable resemblances with *Schlotheimiidae*. For this reason I refer the new subfamily to *Schlotheimiidae*.

Basing upon these characteristics I suppose that the new subfamily is morphologically distinguished enough to be regarded as an independent taxonomic unit.

When classifying individual taxones (group genus), I considered the sequence of ontogenetic stages and the theory of sexual dimorphism. I was mainly inspired by the fact, that some species as e. g. *Waehneroceras* (W.) *tenerum* (Neumayr) or *Waehneroceras (Curviceras) subangulare* are adult individuals with the nature of microconch (a small, laterally compressed test, peristomal constriction, well-developed ventral apophyse). A. Quenstedt 1858, p. 43, pl. 3, fig. 1 non fig. 2), M. Neumayr 1879 (p. 31, pl. 3, fig. 4, 5), W. Lange 1952 (p. 98, pl. fig. 5a, b) also postulated them to be adult forms. The forms as *Waehneroceras (Storthoceras) extracostatum* (Wähner) or *Waehneroceras (Megastomoceras) megastoma* (Gümbel in Wähner 1882) show the nature of macroconch. As for nomenclature, I kept to the principle suggested by J. Calomon (1963, 1969), when estimating the taxonomic validity of micro— and macroconch included in the new subfamily. Thus this subfamily comprises the following taxones:

Waehneroceras (Waehneroceras) Hyatt, 1889 m.

(**Aegoceras tenerum* Neumayr 1879, Pl. 3, fig. 5; SD L. F. Spath, 1924, p. 195)

1951 *Teneroceras* — W. Lange: Die Schlotheimiinae ... p. 7.
1951 *Teneroceras* — W. Lange: Die Schlotheimiinae ... p. 119 (obj. syn.)
1952 *Teneroceras* W. Lange 1951 — W. Lange: Der Untere Lias ... p. 97.
1957 *Waehneroceras* Hyatt, 1889 — J. W. Arkell: Treatise ... p. L 236.
1963 *Psiloceras* Hyatt em., partim. — W. Blind: Die Ammonites ..., p. 44.

Lower Hettangian; the upper part of the psiloceras zone.

Waehneroceras (Curviceras) Blind, 1963 m.

(**Ammonites subangularis* Oppel, 1862, p. 130; first illustration A. Quenstedt 1858, Pl. 3, fig. 1 (=Holotype, W. Lange 1941, p. 30); SD. V. Blind 1963, p. 48)

1941 *Waehneroceras* Hyatt, em. — W. Lange: Die Ammonites..., pp. 39, 81.
1952 *Waehneroceras* Hyatt, 1889; partim — D. T. Donovan: On Ammonites... p. 645.
1952 *Waehnaroceras* (Hyatt.) em. W. Lange (1941b) — W. Lange: Der Untere Lias... p. 107.
1957 *Waehneroceras* Hyatt, 1889; partim — J. W. Arkell: Treatise... part L, p. L 236.
1963 *Curviceras* n. subg. — W. Blind: Die Ammonites... p. 48.
1965 *Waehneroceras* A. Hyatt, 1889; partim — S. Elmi — R. Mouterde: Le Lias inférieur... p. 219.
1967 *Curviceras* Blind, 1963 — H. Frebold: Hettangian Ammonite... p. 20.

Lower — Middle Hettangian, ? psiloceras zone — calliphyllum subzone to megastoma zone.

Waehneroceras (Megastomoceras) Lange, 1941/M.
(**Aegoceras megastoma* Gümbel in Wähner, 1882, Pl. 18, fig. 1 (=Lectotype); SD. W. Lange 1941, p. 42)

1941 *Megastomoceras* W. Lange — W. Lange: Die Ammonitenfauna... pp. 41, 111.
1952 *Waehneroceras* Hyatt, 1889; partim — D. T. Donovan: On Ammonites..., p. 645.
1952 *Megastomoceras* (W. Lange 1941) — W. Lange: Der Untere Lias..., p. 134.
1957 *Waehneroceras* Hyatt, 1889; partim — J. W. Arkell: Treatise, part L, p. 236.
1965 *Waehneroceras* A. Hyatt, 1889; partim — S. Elmi — R. Mouterde: Le Lias inférieur... p. 219.

Middle Hettangian — megastoma zone.

Waehneroceras (Storthoceras) Lange, 1941 M
(* *Aegoceras extracostatum* Wähner, 1882, pl. 14, fig. 1. (=Lectotype); SD W. Lange 1941, p. 41)

1938 *Waehneroceras* Hyatt 1889; partim — F. Roman: Les Ammonites... p. 69.
1941 *Storthoceras* gen. nov. — W. Lange. Die Ammonitenfauna... p. 41.
1952 *Waehneroceras* Hyatt, 1889; partim — D. T. Donovan: On Ammonites... p. 645.
1952 *Storthoceras* W. Lange (1941b, s. 41) — W. Lange: Der Untere Lias... p. 126.
1957 *Waehneroceras* Hyatt, 1889; partim — J. W. Arkell: Treatise, part L, p. L 236.
1963 *Psiloceras* (Storthoceras) (W. Lange) — W. Blind: Die Ammonites... p. 54.
1965 *Waehneroceras* A. Hyatt, 1889; partim — S. Elmi — R. Mouterde: Le Lias inférieur... p. 219.

Middle Hettangian, megastoma zone.

Saxoceras Lange, 1924
(**Psiloceras costatum* Lange, 1921; SD Lange 1941, p. 45 liasicus zone Syn. *Macrogrammites* Buckman, 1928

Geographical distribution: ? world-wide, particularly the region of the Alps—Carpathians—Himalaya — N. Caledonia — N. Zeeland, Rif (Maroc).
Stratigraphical range: Lower — Middle Hettangian

Waehneroceras M. *(Waehneroceras)* Hyatt, 1889 m.

Diagnosis: the small, planispiral test with oval whorl section: Conspicuous ribbing of more or less arched ribs, prorsiradiate when passing from sides to the ventre. There the ribs are considerably weakened (reduced to growth lines to fade out). The ventre above the body chamber is obtuse — keeled. The weakened ribs — if passing — form a »chevron«. The aperture is simple, with a ventral rostrum and with peristomal constriction (orig.).

Discussion: The practical application of the taxon *Waehneroceras* since its introduction by A. Hyatt 1889, p. 125, has been confused. The reason is in the fact, that the author of the genus has not appointed the typical of the two species, referred to the new genus (as the first one is quoted *W. subangulare* [Opp.], p. 126). Thus the taxon is understood ambiguously.

In 1924 L. F. Spath (p. 195) denoted *Aegoceras tenerum* Neumayr as the typical species and referred the genus to the family *Angulitidae* Hyatt 1874 (=*Schlotheimiidae* Spath 1923, cf. *Treatise* p. L 236). Later on W. Lange (1926, p. 469) denoted *Ammonites subangularis* Oppel 1862 as the type species of the genus. In contrast to Spath, W. Lange regards it as a component of the family *Psiloceratidae(!)*. Taxonomically it is considered a subgenus. Since then the appurtenance of the genus *Waehneroceras* has been a cause of differences in opinions.

In 1938 F. Roman (p. 69) recognized only one genus *Waehneroceras* Hyatt 1889 with the type species *Ammonites subangularis* Oppel; and referred it phylogenetically to *»Aegoceratides«* (s. l.). Later on W. Lange (1941) because of varied morphology of »costulate psiloceras« of the Hettangian in NW Germany, distinguished two additional taxones within the family *Psiloceratidae:* the genus *Storthoceras* and the subgenus *Megastomoceras* (cf. p. 41 and p. 111).

The situation was, however, complicated by the same author (Lange 1951, p. 119) when he suggested an aditional taxom Teneroceras with the typical species *Aegoceras tenerum* Neum. Although it was already preoccupied since 1924 as the typical species for the genus *Waehneroceras* Hyatt, by L. F. Spath. There were attempts made to solve the situation particularly by the English scientists D. T. Donovan (1952, 1961) and J. W. Arkell (1957). The authors recognized the genus *Waehneroceras* Hyatt with the type species *Aegoceras tenerum* Neum, as the only valid taxon. The taxones: *Storthoceras* Lange 1941 *Megastomoceras* Lange 1941, *Teneroceras* Lange 1951 and *Tenoceras* Lange 1951 (obj.) are considered synonyms by the above authors; basing upon the supposition about the species subangulare and tenerum belonging to the same genus.*

* The author of this article assumes that the species belong to different genera.

In 1963 W. Blind (p. 48) regarded the genus *Waehneroceras* Hyatt as a synonym of the genus *Psiloceras;* and showed that the *Teneroceras* Lange was not valit from the view of taxonomy anymore.

For the forms with well-developed ribbing crossing the ventre, M. Blind introduced the new term *Curviceras* (with the typical species *Ammonites subangularis* Oppel 1862) understood as the subgenus ef the genus *Psiloceras.*

The problem was at last discussed by S. Elmi — R. Mouterde (1965, p. 219—223). They accepted the English conception with the only difference: the taxom *Megastomoceras* was accepted as valid for the forms with ribbing on the sides of whorls only.

Subgenus *Curviceras* Blind, 1963

Type species *Ammonites subangularis* Oppel, 1862; SD W. Blind, 1963, p. 48.

Diagnosis: small and mediumsized evolute forms with oval to high-oval section of the last whorls; the ribbing is conspicuous, consisting of arched to sigmoidal ribs, non-weakened on the ventre; a conspicuous chevron, sometimes with an obtuse »keel«.

Discussion: Blind referred this taxon to the family *Psiloceratidae* as a subgenus. In accordance with Elmi—Mouterde (1965, pp. 221—223) it should be regarded as a primitive representative of *Schlotheimiidae* owing to its qualitatively different type of ribbing from that in psiloceras.

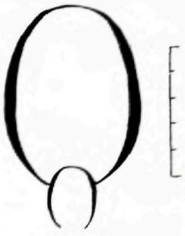
Stratigraphical range: Middle Hettangian.

Waehneroceras (Curviceras) aff. *engonium* (Lange, 1924) m

Pl. CIV Fig. 6—8, text-fig. 9.

The locality in the Carpathians: Kozinec (the Strážovská hornatina mountains), fauna Nr. 4.

Stratigraphical range: Middle Hettangian — megastoma zone



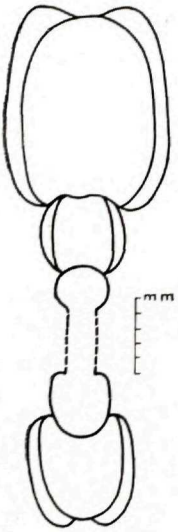
Text-fig. 9: *Waehneroceras (Curviceras)* aff. *engonium* (Lange, 1924), specimen nr. GÚDŠ/503b, section through a whorl of a young individual, the ridge of Kozinec, fauna nr. 4 (the Strážovská hornatina moutains)

Obr. 9: *Waehneroceras (Curviceras)* aff. *engonium* (Lange, 1924), exemplár n° GÚDŠ/503 b, prierez závitom mladého jedinca, hrebeň Kozinca, fauna č. 4 (Strážovská hornatina)

Schlotheimiidae Spath, 1923

Schlotheimia Bayle, 1878

Type species *Ammonites angulatus* Schlotheim, 1820



Schlotheimia cf. *montana* (Wähner, 1882)
text-fig. 10

The locality in the Carpathians: Čierna Lehota, loc. nr. 2 (the Strážovská hornatina mountains
Stratigraphical range: Upper Hettangian, Marmorea zone.

Text-fig. 10: *Schlotheimia* cf. *montana* (Waehner, 1882), specimen nr. GÚDŠ/344, section trough whorls, Dolinka locality nr. 2 (the Strážovská hornatina mountains)

Obr. 10: *Schlotheimia* cf. *montana* (Wähner, 1882), exemplár n° GÚDŠ/344, prierez závitmi, v Dolinke, lokalita č. 2 (Strážovská hornatina)

Explanation of plate CIV

fig. 1a, 1b *Ectocentrites waehneri* sp. n., HOLOTYPE, specimen nr. SNM-Z 6321, natural size, Hluchá dolina, the Strážovská hornatina Mts., locality nr. 3.
Ectocentrites waehneri sp. n., HOLOTYP, specimen n° SNM-Z 6321, skutočná veľkosť, Hluchá dolina, lokalita č. 3, Strážovská hornatina.

fig. 2a, 2b *Alsatites viskupi* sp. n., HOLOTYPE, specimen nr. SNM-Z 6322, natural size, the Kozinec ridge, the Strážovská hornatina Mts., fauna nr. 6 (cf. the profile)
Alsatites viskupi sp. n., HOLOTYP, specimen n° SNM-Z 6322 skutočná veľkosť hrebeň Kozinca, Strážovská hornatina, fauna č. 6 (pozri profil)
Waehneroceras (Waehneroceras) cf. *tenerum* (Neumayr, 1879), specimen nr. GÚDŠ/886, natural size, at a storehouse in Trenčianská Teplá.

fig. 3 *Waehneroceras (Waehneroceras)* cf. *tenerum* (Neumayr, 1879), specimen n° GÚDŠ/886, skutočná veľkosť, pri sklade — Trenčianská Teplá.

fig. 4a, 4b *Gyrophioceras* aff. *praespiratissimum* (Wähner, 1886), specimen nr. GÚDŠ/317, natural size, locality Dolinka, the Strážovská hornatina Mts.
Gyrophioceras aff. *praespiratissimum* (Wähner, 1886), specimen n° GÚDŠ/317, skutočná veľkosť, lokalita Dolinka, Strážovská hornatina.

fig. 5 *Alsatites viskupi* sp. n., PARATYPE, specimen nr. GÚDŠ/2009, approx. 1x, the Kozinec ridge, the Strážovská hornatina Mts. fauna nr. 6.
Alsatites viskupi sp. n., PARATYP, specimen n° GÚDŠ/2009, približne 1×, hrebeň Kozinca, Strážovská hornatina, fauna č. 6.

fig. 6a, 6b *Waehneroceras (Curviceras)* aff. *engonium* (Lange, 1924), specimen nr. GÚDŠ/503a, 1, 2×, the Kozinec ridge, the Strážovská hornatina Mts., fauna nr. 4 (cf. the profile)
Waehneroceras (Curviceras) aff. *engonium* (Lange, 1924), specimen n° GUDŠ/503a, 1, 2×, hrebeň Kozinca, Strážovská hornatina, fauna č. 4 (pozri profil)

fig. 7a, 7b *Waehneroceras (Curviceras)* aff. *engonium* (Lange, 1924), specimen, nr. GUDŠ/503b, 1, 2× the ridge of Kozinec, Strážovská hornatina Mis., fauna nr. 4.
Waehneroceras (Curviceras) aff. *engonium* (Lange, 1924), specimen n° GÚDŠ/503b, 1, 2×, hrebeň Kozinca, Strážovská hornatina, fauna č. 4.

fig. 8 *Waehneroceras (Curviceras)* aff. *engoninum* (Lange, 1924), specimen nr. GÚDŠ/503, natural size, tze Kozinec ridge, Strážovská hornatina Mts., fauna nr. 4.
Waehneroceras (Curviceras) aff. *engonium* (Lange, 1924), specimen n° GUDŠ/503, skutočná veľkosť, hrebeň Kozinca, Strážovská hornatina, fauna č. 4.
Before photographing all specimens were bleached by ammonium chlorid. Photographed by F. Vrbovský.

Translated by E. Jassingerová

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Miloš Rakús

Hetangské amonity zo Strážovskej hornatiny (Západné Karpaty)

Rozšírené resumé anglického textu.

Naše poznatky o hetangských amonitoch Západných Karpát sú v porovnaní s inými faunami dosť fragmentárne. Až v posledných rokoch vďaka systematickým zberom, predovšetkým v Strážovskej hornatine, naše znalosti pokročili.

Prvý a dlho aj jediný publikovaný nález hetangského amonita pochádza od D. Štúra (1868, p. 378), ktorý z lokality Rakytov (Veľká Fatra) uvádza *A. psilonotus laevis* (Q u.) — *Psiloceras psilonotum* (Q u e n s t.). Tento amonit charakterizuje spodný hetang v SZ Nemecku, kde je vedúcou formou planorbisovej zóny. Bohužiaľ, doposiaľ sa tento nález nepodarilo zopakovať, domnievam sa však, že v danom prípade mohli by sme jeho prítomnosť považovať za pravdepodobnú a to z dvoch dôvodov: a) druh Psiloceras psilonotum je typická, ľahko identifikovateľná forma, takže zámena s iným druhom je málo pravdepodobná, b) na lokalite Rakytov je dobre vyvinuté súvrstvie ako vrchného triasu (rétu) tak i spodného liasu. Obidva tieto stupne poskytli bohatú faunu lamellibranchiát, takže výskyt hetangu môžeme považovať za istý.

V šesťdesiatych rokoch počas systematického geologicko-stratigrafického výskumu Strážovskej hornatiny a Veľkej Fatry našlo sa niekoľko nových lokalít hetangskej fauny, v ktorej okrem bohatého spoločenstva lamellibranchiát bolo aj niekoľko amonitov (M. R a k ú s in M. M a h e ľ 1962; M. R a k ú s 1964).

Posledný publikovaný nález pochádza od V. A n d r u s o v o v e j—D. A n d r u s o v a (1968), ktorí z liasu Osobitej (Západné Tatry) popísali *Schlotheimia* cf. *oxygonia* L a n g e.

Keďže výskyty hetangských amonitov v ostatných pohoriach prakticky nepoznáme, zameriavam se v ďalšom predovšetkým na Strážovskú hornatinu, odkiaľ pochádza väčšina tu popísanej fauny.

L o k a l i t y

Ako sme to už spomenuli vyššie, je to predovšetkým Strážovská hornatina, ktorá poskytla najbohatšie nálezy. Najlepšie lokality sa nachádzajú v okolí Čiernej Lehoty (pozri textfig. 1) a na Kozinci — západne od Valaskej Belej (obr. 2 v texte).

Č i e r n a L e h o t a — okolie

V širšom okolí Čiernej Lehoty je spodný lias charakterizovaný pestrým vývinom vápencov, ktoré M. M a h e ľ (1961, 1962, 1967) počíta k rôznym vývinom krížňanského príkrovu. Z paleontologického hľadiska ukázali sa nejdôležitejšie sivé až tmavosivé (niekedy pestré) lavicovité, organodetritické, miestami brekciovité (lokálne hojné akumulácie úlomkov tmavých fosforitov, ktoré často fosilizujú jadrá amonitov) vápence s nepravidelne roztrúsenými hľuzami rohovcov. Tento typ vápencov poskytol bohatú faunu predovšetkým lamellibranchiát (M. K o c h a n o v á 1961), brachiopódov (M. S i b l í k in M. M a h e ľ 1962) a amonitov (M. R a k ú s in M. M a h e ľ 1962). Žiaľ takmer všetka nazbieraná fauna pochádza zo starých zberov a nie je horizontovaná. V súčasnosti sme však započali s detailným štúdiom liasu tejto oblasti so zreteľom práve na horizontovanie fauny. Výsledky budú v blízkej budúcnosti publikované.

Z lokality označenej 2 pochádza táto fauna amonitov:

Schlotheimia cf. *montana* (W ä h n e r 1886)

Gyrophioceras aff. *praespiratissimum* (W ä h n e r 1886)
Charmasseiceras charmassei (d'O r b. 1884)
Charmasseiceras martinischmidti L a n g e (1951).

Táto asociácia poukazovala by na strednú časť vrchného hetangu (marmoreová zóna) až najspodnejší sinemur (rotiforme zóna v zmysle R. M o u t e r d e at al. 1971).

Z lokality označovanej 3 pochádza:
Ectocentrites waehneri sp. n.
Stratigrafická pozícia tohto druhu je totožná s predchádzajúcou lokalitou (ide o ten istý pruh vápencov).

K o z i n e c

Lokalita sa nachádza 3,5 km SZ od Valaskej Belej, medzi lazom Repkovci a štátnou cestou Ilava—Valaská Belá. Tu na hrebeni, ktorý začína na sútoku potokov oproti hostincu Hýreška a ide SZ smerom ku kóte 705, vystupuje vrstevný sled křížňanského príkrovu od keupru až do vrchnej jury. Nad organogénnymi, príp. lumachelickými vápencami rétu (obr. 3 v texte) nasleduje pomerne mocný (mocnosť však môže byť skreslená lokálnym prevrásnením) komplex tmavosivých vápnitých piesčitých bridlic s polohami organodetritických až krinoidových vápencov. Obsah klastík, hlavne kremeňa je 10—10 % (veľkosť 0,005 mm; A. Kullmanová 1959). Pomerne hojné sú drobné lupienky sľudy. Ako v bridliciach, tak i vo vápencoch sa našla bohatá fauna lamelinbranchiát a amonitov. Od spodu smerom nahor ku kóte sa našla fauna:
F—1 (I stĺp elektrického vedenia)
Pinna sp.*, *Chlamys valoniensis* (D e f r.), *Liostrea irregularis* (M ü n s t.), *Cardinia* sp.,
F—2 (na hrebeni vo vápnitých bridliciach)
Lima (Plagiostoma valoniensis (D e f r.), *Plicatula* cf. *oceani* d'O r b., *Cardinia* sp.
F—3 (v krinoidových vápencoch)
Chlamys falgeri (M e r.), *Chlamys (Aequipecten) thiollieri* (M a r t.)
F—4 (II stĺp elektrického vedenia v tmavých vápnitých bridliciach)
Waehneroceras (Curviceras) cf. *engonium* (L a n g e 1924), *Chlamys veyrasensis* (D u m o r t.), *Cardinia crassiuscula* (S o w.), *Pholadomya* cf. *avelana* (D u m o r t.),
F—5 (lumachelové vápence — rét)
Rhaetavicula contorta (P o r t l.), *Dimyodon intusstriatus* (E m m r.), *Lopha haidingeriana* (E m m r.), *Placunopsis alpina* (W i n k l.), *Myophoria inflata* (E m m r.), *Cardita austriaca* (H a u e r)
F—6 (krinoidové vápence)
Alsatites viskupi sp. n., *Entolium calvum* (G o l d f.), Lima *(Plagiostoma) compressa* (T e r g.), *Liostrea irregularis* (M ü n s t.), *Mactromya hesione* (d'O r b.), *Pholadomya castelanensis* (d'O r b.).

Amonity vyskytujúce sa vo faune č. 4 a 6 poukazujú na stredný hetang (megastomová zóna). V nadloží bridličnatého komplexu vystupuje súvrstvie škvrtnitých slieňov, ktoré na základe fauny amonitov (laz Mokrýšovci) počítame už ku sinemuru.

T r e n č i a n s k a T e p l á

Lokalita je situovaná asi 150 m od opusteného lomu východne od Trenčianskej Teplej, kde v suti tvorenej hnedozelenými piesčito-krinoidovými vápencami patriacimi manínskej sérii(?) sa našiel zle zachovaný exemplár *Waehneroceras (Waehneroceras)* cf. *tenerum* (N e u m.). Táto forma sa vyskytuje v calliphyllovej zóne, čo odpovedá vyššej časti spodného hetangu.

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* Lamellinbranchiáty určila M. Kochanová.

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Ružena Lehotayová

Calcareous nannoflora of a Badenian preorbulina-orbulina horizon

14 plates (XXIX—XLII), Slovak summary

Abstract. A horizon of foraminifers, containing preorbulines — orbulines, in the lower part of the Badenian from the borehole ŠO-1 (Chľaba, the southeastern part of the Danube lowland) offered rich nannoassociations of calcareous nannoflora. By the method of scanning electron microscopy determined were 26 taxons in species representing 11 genera.

By the borehole, ŠO-1 at the locality Chľaba (the southeastern part of the Danube lowland, southeast of Štúrovo), found were Badenian sediments (depth interval 0,3—150 m) extremely rich in foraminifers and in calcareous nannoflora. Particularly well-preserved calcareous nannoplankton occurred in slightly sandy aleurites of the lower part of the Badenian, in an horizon with foraminifers, containing preorbulines — orbulines (depth 99,5—150 m).

Neither later study of planktonic foraminifers from sediments regarded as the lowest parts of the Badenian, did testify to the existence of an independent foraminiferal zone with preorbulines as formerly presumed some authors (G. Popescu 1970, a.o.). In foraminiferal associations from sediments in the horizon traced in the lower part of the Badenian from the borehole ŠO-1, preorbulines occur together with forms of the species Orbulina suturalis. Then it is questionable whether an independent zone with preorbulines on the base of the Lower Badenian may be distinguished within the Central Paratethys of the West-Carpathian Neogene and in the Mediterranean Neogene area.

Based on literary data, the genera *Sphenolithus* and *Discoaster* are regarded as stratigraphically most important with respect to the Neogene calcareous nannoflora. E. Martini (1971) made his standard zonation of the Neogene mostly on the basis of these genera.

In H. Stradner's (1961) opinion, the ingression of planktonic foraminifera, and particularly of orbulines (R. Grill 1941, 1943; lagenide foraminiferal horizons) indicates appearance of younger species of discoasters, such as: *Discoaster variabilis, Discoaster challengeri.* From the type locality of the Italian Tortonian, besides *Discoaster challengeri,* H. Stradner quotes further, phylogenetically younger discoasters, such as: *Discoaster brouweri, Discoaster pentaradiatus.*

Nannoassociations of calcareous nannoflora in sediments from the borehole ŠO-1 contain many forms of the species *Discoaster variabilis*

RNDr. R. Lehotayová, CSc., Geologický ústav Dionýza Štúra, Mlynská dolina 1, Bratislava

present also in typical (lagenide foraminiferal associations) Badenian schlieren sediments at the Austrian locality Frättingsdorh (H. Stradner 1963).

Sphenoliths were studied in detail by P. H. Roth, H. E. Franz et W. Wise (1971). After these authors, the last occurrence, i.e. the extinction of the species *Sphenolithus belemnos* is on the line of appearance of phylogenetically younger forms of the genus *Sphenolithus,* as e.g. *Sphenolithus heteromorphus.* This one was not found in the sediments of the borehole ŠO-1. In spite of this, owing to the presence of other associated species, calcareous nannoflora of the horizon with preorbulines — orbulines in the borehole ŠO-1 corresponds to the upper part of the nannoplanktonic zone NN-5, with *Sphenolithus heteromorphus,* as characterized by E. Martini (1971).

Individual species of this zone are almost identic with the forms found in sediments from the lower parts of the Badenian in further localities, where *Sphenolithus heteromorphus* was found as in the Neogene of the West Carpathians (R. Lehotayová 1970), within the Central Paratethys (E. Kamptner 1948, H. Stradner 1963), so in other regions (E. Martini 1968; M. Gardet 1955).

Including the above mentioned species of calcareous nannoflora, most important for stratigraphy, the lower part of the Badenian, the horizon of preorbulines — orbulines in the borehole ŠO-1 is characterized by associations of the below mentioned species:

Braarudosphaera bigelovi (Gran et Braarud) Deflandre — SM, TEM, SEM
Cocclithus pelagicus (Wallich) Schiller — TEM, SEM
Cruciplacolithus tenuiforatus Clocchiatti et Jerković — TEM, SEM
Cyclococcolithus leptoporus (Murray et Blackman) Kamptner — TEM, SEM
Cyclococcolithus rotulus (Kamptner) Kamptner — SM, TEM, SEM
Discoaster adamanteus Bramlette et Wilcoxon — SM, SEM
Discoaster barbadiensis (Tan Sin Hok) — SM, SEM
Discoaster challengeri Bramlette et Riedel — TEM, SEM
Discoaster variabilis Martini et Bramlette — SEM
Discoaster sp. — SEM
Ericsonia ovalis Blac — TEM, SEM
Helicopontosphaera kamptneri Hay et Mohler — SM, TEM, SEM
Helicopontosphaera wallichi (Lohmann) Boudreaux et Hay — TEM, SEM
Holodiscolithus solidus (Deflandre) — SEM
Lithostromatium perdurum Deflandre — TEM, SEM
Micrantholithus vesper Deflandre — SEM
Pontosphaera confossa (Hay, Mohler et Made) nov. comb. — SEM
Pontosphaera cf. *discopora* Schiller — SEM
Pontosphaera multipora (Kamptner) Roth — SM, TEM, SEM
Reticulofenestra pseudoumbilica (Gartner) Gartner — TEM, SEM
Rhabdosphaera clavigera Murray et Blackmann — TEM, SEM
Sphenolithus abies Deflandre — SEM
Sphenolithus cf. *belemnos* Bramlette et Wilcoxon — SEM
Sphenolithus radians Deflandre — SEM
Thoracosphaera sp. — SEM

Coronocyclus nitescens (Kamptner) Bramlette et Wilcoxon — SEM.

Behind each species distinction marked is the method of determination of individual taxons (SM — optical, TEM — transmission-electronic, SEM — scanning electron microscopy). All the scanning — electron-micrographs presented, were made by the scanning-electron microscope JSM-U3, distinction ability 100 A, max. magnif. 75 000 X, at Dionýz Štúr Institute of Geology in Bratislava.

Ordo *Coccolithophorales* Schiller, 1926
Family *Braarudosphaeraceae* Deflandre, 1947
Genus *Braarudosphaera* Deflandre, 1947
Braarudosphaera bigelowi (Gran et Braarud, 1935) Deflandre, 1947
Pl. XXX, Fig. 1, 3

1935 *Pontosphaera bigelowi* Gran et Braarud — H. Gran et T. Braarud: A quantitative study of the phytoplankton etc., Vol. 1, p. 385, text fig. 67.
1947 *Braarudosphaera bigelowi* (Gran et Braarud) — G. Deflandre: *Braarudosphaera* nov. gen. etc., p. 439, text fig. 1—5.

Notes: *Braarudosphaera bigelowi* is regarded as the most frequent form in shallow-water sediment. It is most abundant in sediments of the borehole ŠO-1 from a depth of 107 m.
Stratigraphical range: Jurassic — Recent.

Genus *Micrantholithus* Deflandre, 1950
Micrantholithus vesper Deflandre, 1950
Pl. XXXI, Fig. 1

1950 *Micrantholithus vesper* n. sp. Deflandre — G. Deflandre: Observation coccol. Micrantholithus ... etc., p. 1158, fig. 5—7.
1961 *Micrantholithus vesper* Deflandre — H. Stadner: Tertiäre Discoasteriden aus Österreich ... etc., p. 121—122, tab. 39, fig. 5a, b—6a, b.

Under polarized light the species shows relatedness to the species Braarudosphaera bigelowi. It is a stellate pentalite. Individuals of this species are characterized (in the borehole ŠO-1, 107 m) by regular branches and good preservation.
Stratigraphical range: Eocene — Miocene.

Family *Calyptrosphaeraceae* Boudreaux et Hay, 1969
Genus *Holodiscolithus* Roth, 1970
Holodiscolithus solidus (Deflandre, 1954) Roth 1970
Pl. XXXI, Fig. 3

1954 *Discolithus solidus* Deflandre — G. Deflandre et Ch. Fert: Observation sur les ... etc., p. 141, tab. 12.

1970 *Holodiscolithus solidus* (Deflandre) nov. comb. P. H. Roth: *Oligocene calcareous* Nannoplankton ... etc., p. 867, tab. 9, fig. 5.

Notes: In the horizon with preorbulines — orbulines in the borehole ŠO-1, *H. solidus* is very infrequent at a depth of 138,5 m.
Stratigraphical range: Eocene — Miocene.

Family *Coccolithaceae* Kamtpner, 1928
Genus *Coccolithus* Schwarz, 1894
Coccolithus pelagicus (Wallich, 1877) Schiller 1930
Pl. XXXII, Fig. 1, 2

1877 *Coccosphaera pelagica* Wallich — G. C. Wallich: Observation on the Coccosphaere ... etc., p. 342—350, tab. 17, fig. 1, 3—7, 10.
1930 *Coccolithus pelagicus* (Wallich) Schiller — J. Schiller in L. Rabenhorst, Vol. 10, p. 246, fig. 123.

Notes: *C. pelagicus* is the most frequent form in the sediments studied. Individuals of the species differ in shape and arrangement of calcite lamellae of the central area. E. Martini (1965) regards the species as typically Cenozoic. It is not present in the Cretaceous and earlier formations.

Genus *Cruciplacolithus* Hay — Mohler, 1967
Cruciplacolithus tenuiforatus Clocchiatti et Jerković, 1970

1970 *Cruciplacolithus tenuiforatus* Clocchiatti et Jerković — M. Clocchiatti et L. Jerković: *Cruciplacolithus tenuiforatus,* nouvelle espéce etc., p. 1—6, tab. 1, fig. 1a—d, 2, 3; tab. 2, fig. 1a—c, 2—6.
1970 *Cruciplacolithus devinensis* nov. sp. — R. Lehotayová: Electron-microscopic Examination ... etc., p. 163, tab. 19, fig. 1, 2; tab. 20, fig. 1.

Notes: *C. tenuiforatus* is a form frequent in the Lower Miocene of Germany (C. Müller, 1972), of North Africa (M. Clocchiatti, 1971), Yugoslavia (L. Jerković, 1970). Some authors quote it under the species name Coccolithus pelagicus. It differs from *C. pelagicus* in possessing a thin cross made of fine calcite granules in the aperture of the central area. In the borehole ŠO-1 it is most abundant at a depth of 107 m.

Genus *Cyclococcolithus* Kamptner, 1954
Cyclococcolithus leptoporus (Murray et Blackman, 1898) Kamptner, 1954

1898 *Coccosphaera leptopora* Murray et Blackman — G. Murray et V. H. Blackman: On the nature of the Coccosphaera etc., p. 430, tba. 15, fig. 1—7.
1954 *Cyclococcolithus leptoporus* (Murray et Blackman) — E. Kamptner: Untersuchungen über den Feinbau der Coccolithen etc., p. 23, fig. 20.

Notes: In Central Paratethys the species is most frequent in the Badenian and Sarmatian. In the borehole ŠO-1 are isolated occurrences at a depth of 138,5 m and 107 m.

Stratigraphical range: Miocene — Recent.

Cyclococcolithus rotulus (Kamptner, 1948) Kamptner, 1966
Pl. XL, Fig. 1

1948 *Tremalithus rotula* Kamptner — E. Kamptner: Coccolithen aus dem Torton ... etc., p. 8, tab. 2, fig. 15a.

1956 *Cyclococcolithus rotula* (Kamptner) — E. Kamptner: Zur Systematik und Nomenklatur ... etc., p. 7.

Notes: In Central Paratethys, the species *C. rotulus* is a typical Badenian and Sarmatian form.
In the borehole ŠO-1 it is most abundant in sediments from a depth of 107, 138,5 m.

Genus *Ericsonia* Black, 1964
Ericsonia ovalis Black, 1964
Pl. XXXIV, Fig. 1, 2

1964 *Ericsonia ovalis* Black — M. Black: Cretaceous and Tertiary ... etc., p. 312, 313, tab. 52, fig. 5, 6.

1971 *Ericsonia avalis* Black — U. Z. B. Haq: Paleogene calcareous Nannoflora ... etc., p. 107, tab. 13, figs. 1, 2, 11.

Notes: *E. ovalis* is frequent in the Eocene and Oligocene sediments. In Central Paratethys it is very frequent also in Badenian and Sarmatian deposits. M. Bramlette et F. Sullivan (1961) quoted a very similar species under the name *Coccolithus eopelagicus*. P. H. Roth (1973) applies the species name *C. eopelagicus* for the forms from Eocene and Oligocene sediments, but in the Lower Miocene he uses the term *C. miopelagicus*. In the borehole ŠO-1 it is frequent at depths of 146,5 m, 138,5 m, and 107 m.

Family *Discoasteraceae* Tan Sin Hok, 1927
Genus *Discoaster* Tan Sin Hok, 1927
Discoaster adamanteus Bramlette et Wilcoxon, 1967
Pl. XL, Fig. 3

1967 *Discoaster adamanteus* Bramlette et Wilcoxon — M. N. Bramlette et I. A. Wilcoxon: Middle Tertiary calcareous ... etc., p. 108, 109, tab. 7, fig. 6.

1971 *Discoaster adamanteus* Bramlette et Wilcoxon — M. Clocchiatti: Contribution a l'étude du Nannoplankton ... etc., p. 70, tab. 24, fig. 1a, b, c, d.

Notes: A form of the species, found by myself, is very resembling to the scanning-electron micrograph of this species, presented by

M. Clocchiatti (1971) from the Miocene of North Africa. The only individual in the borehole ŠO-1 was found at a depth of 138,5 m.

Stratigraphic range: Oligocene — Miocene.

Discoaster barbadiensis (Tan Sin Hok, 1927) Bramlette et Riedel, 1954
Pl. XL, Fig. 2

1927 *Discoaster barbadiensis* Tan Sin Hok — Tan Sin Hok: *Discoasteridae incertae* ... etc., p. 119, fig. 14.

1954 *Discoaster barbadiensis* Tan Sin Hok emend. Bramlette et Riedel — H. Bramlette et R. Riedel: Stratigraphic value ... etc., p. 398, tab. 39, fig. 5a—b.

Notes: According to M. N. Bramlette et Riedel (1954) this species possesses a markedly concave — convex shield of a mushroom shape, with 9—13 branches with sharp edges. This form is most frequent in the Paleogene (Eocene). In the borehole ŠO-1 (depths: 138,5 m, 146,5 m) the species *D. barbadiensis* is most probably redeposited.

Discoaster variabilis Martini et Bramlette, 1963
Pl. XLI, Fig. 1

1963 *Discoaster variabilis* Martini et Bramlette — E. Martini et M. N. Bramlette: Calcareous nannoplankton from the experimental ... etc., p. 854, tab. 104, fig. 4—8.

1967 *Discoaster variabilis* Martini et Bramlette — W. Hay et al.: Calcareous nannoplankton zonation ... etc., p. 464, tab. 3, fig. 11.

Notes: The form of *D. variabilis* quoted is very similar to the species *Discoaster challengeri* Bramlette et Riedel. From the latter it only differs in variable thickness of branches. The arms broaden toward the central area of the asterolite. Their ends are bifurcated; and also the central part of the asterolite is more extensive. The form *D. variabilis* is known from the Miocene, and most frequent in the Badenian. In the borehole ŠO-1 it is at a depth of 138,5 m.

Discoaster sp.
Pl. XLI, Fig. 2

Notes: By its diagnostic features the form mostly resembles the specie: Discoaster challengeri. Since the only individual I examined was damaged, I had to do with the only scanning elektron micrograph of the species, I refer it to the genus Discoaster, without more exact determination.

Family *Lithostromationaceae* Haq, 1967
Genus *Lithostromation* Deflandre, 1942
Lithrostromation perdurum Deflandre, 1942

1942 *Lithostromation perdurum* n. sp. Deflandre — G. Deflandre: Foss. morph. Lithostromation etc., p. 917, 918, fig. 1—9.

1971 *Lithostromation perdurum* Deflandre — M. Clocchiatti: Contribution a l'étude etc., p. 99, tab. 21, fig. 1, 2a, 2b.

Notes: Diagnosis and illustration of this form correspond to description and illustration of this species in an original work by G. Deflandre (1942). Its occurrences are known from the Eocene to Pliocene. In Central Paratethys it is very frequent in the Badenian and Sarmatian. In the borehole ŠO-1 it is at a depth 107 m.

Family *Pontosphaeraceae* Lemmermann, 1908
Genus *Helicopontosphaera* Hay et Mohler, 1967
Helicopontosphaera kamptneri Hay et Mohler, 1967
Pl. XXXVI, Fig. 1, 2

1877 *Coccosphaera carteri* Wallich — G. Wallich: Observation on the... etc., p. 348, tab. 17, fig. 3, 6, 7.

1954 *Helicosphaera carteri* (Wallich) — E. Kamptner: Untersuchungen über Feinbuch etc., p. 21, fig. 17—19.

1967 *Helicopontosphaera kamptneri* n. sp. — W. Hay et H. P. Mohler: Calcareous nannoplankton Zonation etc., vol. 17, p. 448, tab. 10, 11, fig. 5.

Notes: The species was found in all Tertiary sediments in a broad stratigraphic range (Eocene — Recent). It is a very frequent form in the borehole ŠO-1, at depths: 107 m, 138,5 m and 146,5 m.

Helicopontosphaera wallichi (Lohmann, 1902) Boudreaux et Hay, 1969
Pl. XXXVII, Fig. 1, 2

1902 *Coccosphaera wallichi* Lohmann — H. Lohmann: Die Coccolithophoridae, eine Monographie etc., Vol. 1, S. 138, Taf. 5. Fig. 58—60.

1969 *Helicopontosphaera wallichi* (Lohmann) — I. E. Boudreaux et Hay: Calcareous nannoplankton etc., vol. 1, p. 272—273, tab. 6, fig. 9.

Notes: The form *H. wallichi* resembles the species *H. kamptneri*. The structure of the central area is distinctly different. I. E. Boudreaux et W. Hay (1964) presented a detailed description and a very good illustration of this species. Diagnostic features agree with those of the form obtained from the material of the borehole ŠO-1, from a depth of 138,5 m.

Occurrences: recent forms from the Adriatic and Caribean Seas.

Genus *Pontosphaera* Lohmann, 1902
Pontosphaera confossa (Hay, Mohler et Wade, 1966) nov. comb.
Pl. XXXVIII, Fig. 2

1966 *Discolithina confossa* nov. spec. Hay, Mohler et Wade (pro parte) — W. Hay, H. Mohler et M. Wade: Calcareous Nannofossils etc., p. 392, tab. 9, fig. 1—6 (non tab. 9, fig. 1).
1971 *Discolithus confossa* (Hay, Mohler et Wade) nov. comb. — M. Clocciatti: Contribution a l'étude etc., p. 46, tab. 9, fig. 1, 2, 4b, 4c.

Notes: The form is related with the species *P. multipora.* The structure of its shell represents a type of shallow lopadolite. Pores on the proximal side are large, irregular, arranged so as to form raised furrows between the internal and external cycles of pores. In this the form differs from the species *P. multipora.* In the borehole ŠO-1 it occurs sporadically (107 m, 138,5 m).
Stratigraphical range: Eocene — Miocene.

Pontosphaera cf. *discopora* Schiller, 1925
Pl. XXXIX, Fig. 1

1925 *Pontosphaera discopora* Schiller — I. Schiller: Die planktonischen Vegetationen etc., p. 11, tab. 1, Fig. 4.
1971 *Pontosphaera discopora* Schiller — M. Clocchiatti: Contribution a l'étude etc., p. 55, tab. 13, fig. 4a, 4b, 4c.

Notes: The form from the borehole ŠO-1 (138,5 m) resembles by its diagnostic features a species described by J. Schiller (1925) as *P. discopora;* and agrees with its illustration by M. Clocchiatti (1971). Since I had only one scanning electron micrograph of its proximal side, I determined the taxon preliminarily as cf. discopora.
Stratigraphic range: Miocene — Recent.

Pontosphaera multipora (Kamptner, 1948 Roth, 1970
Pl. XXXVIII, Fig. 1

1948 *Discolithus multiporus* Kamptner — E. Kamptner: Coccolithen aus dem Torton etc., p. 5, tab. 1, fig. 9a—b.
1970 *Pontosphaera multipora* (Kamptner) nov. comb. Roth — P. H. Roth: Oligocene Calcareous etc., p. 860.
1973 *Pontosphaera multipora* (Kamptner) emended — D. A. Burns: Structural analysis etc., p. 151, tab. 1, fig. 7, 12, tab. 2, fig. 1.

Notes: A thorough description and very good scanning-electron micrographs showing distinctly the variable shape and arragement of pores of the species presented D. A. Burns (1973). It is the most frequent form in the horizon studied in the borehole ŠO-1 (107 m, 138,5 m).
Stratigraphical range: Paleocene — Pliocene.

Family *Prinsiaceae* Hay et Mohler, 1967
Genus *Reticulofenestra* Hay, Mohler et Wade, 1966

Reticulofenestra pseudoumbilica (Gartner, 1967) Gartner, 1969
Pl. XXXV, Fig. 1, 2

1967 *Coccolithus pseudoumbilicus* Gartner n. sp. — S. Gartner: Calcareous Nannofossils etc., p. 4, tab. 6, fig. 1.
1969 *Reticulofenestra pseudoumbilica* (Gartner) — S. Gartner: Correlation of Neogene etc., p. 598, tab. 2, fig. 4.

Notes: Individuals of the species differ in a lesser number of lamellae (33—34) on the distal shield in comparison with a species formerly described by S. Gartner (1969) from the Neogene. The species is frequent in Badenian sediments of Central Paratethys. In materials from the borehole ŠO-1 it is frequent at 83 m, 107 m, 138,5 m and 146,5 m.

Family *Rhabdosphaeraceae* Lemmermann, 1908
Genus *Rhabdosphaera* Haeckel, 1894
Rhabdosphaera clavigera Murray et Blackman, 1898
Pl. XXXI, Fig. 2

1898 *Rhabdosphaera clavigera* n. sp. — G. Murray et V. H. Blackman: On the nature etc., p. 438—439, tab. 15, fig. 13—15.
1965 *Rhabdosphaera clavigera* Murray et Blackman — C. L. D. Cohen: Coccoliths and discoasters etc., p. 22, tab. 3, fig. a—c; tab. 22, fig. a—b; tab. 23. fig. 3.

Notes: C. L. D. Cohen (1965) presented frequent intermediate forms between *R. clavigera* and *R. stylifer* Lohmann. Mc Intyre et Bé (1967) regard *R. stylifer* as a younger synonym to *R. clavigera.*
J. E. Boudreaux et Hay (1969) referred the species *R. stylifer* to the genus *Aspidorhabdus* and presented it as *Aspidorhabdus stylifer* (Lohmann) nov. comb. After obtaining further material, and after detailed examination under scanning-electron microscope it will be necessary to revise some individuals that I determined as *R. clavigera.* In the borehole ŠO-1 it was found at depths: 83 m, 107 m, 138,5 m, 146,5 m.

Family *Sphenolithaceae* Deflandre, 1952
Genus *Sphenolithus* Deflandre, 1952
Sphenolithus abies Deflandre, 1954
Pl. XLII, Fig. 1

1953 *Sphenolithus abies* Deflandre — G. Deflandre: Hétérogénéité etc., p. 1786 (non figuré).
1954 *Sphenolithus abies* Deflandre — G. Deflandre: Observation etc., in G. Deflandre et Ch. Fert, p. 163, tab. 11, fig. 5, 6.
1971 *Sphenolithus abies* Deflandre — M. Clocchiatti: Contribution a l'étude etc., p. 64, tab. 23, fig. 1, 2,—4.

Notes: The scanning electron-micrograph of the species shows accordance with the illustration of the species by M. Clocchiatti (1971) from the Neogene of North Africa.

Stratigraphical range: The form is generally most frequent in the Miocene — Pliocene.
In the borehole ŠO-1 found was only one individual at a depth of 107 m.

Sphenolithus cf. belemnos Bramlette et Wilcoxon, 1967

1967 *Sphenolithus belemnos* Bramlette et Wilcoxon — M. N. Bramlette et I. A. Wilcoxon: Middle Tertiary calcareous nannoplankton etc., vol. 5, pl. 118, tab. 2, fig. 1—3.
1970 *Sphenolithus belemnos* Bramlette et Wilcoxon — P. H. Roth: Oligocene calcareous nannoplankton etc., vol. 63, p. 869, tab. 13, fig. 5, 6.

Notes: Diagnostic features of the original species described remind of the characteristics of the form found in the borehole ŠO-1 (depth: 146,5 m).
It is the only scanning electron-micrograph of a partially damaged form — this is why the taxon is presented as cf. S. belemnos.
Stratigraphical range: Oligocene — Miocene.

Sphenolithus radians Deflandre, 1954

1954 *Sphenolithus radians* Deflandre — in G. Deflandre et Ch. Fert: Observation sur les... etc., p. 163, tab. 12, fig. 36—38.
1971 *Sphenolithus radians* Deflandre — M. Clocchiatti: Contribution a l'étude du Nannoplankton etc., p. 136, 140, tab. 23, fig. 5.

Notes: The species *S. radians* is frequent in the Eocene. M. Clocchiatti (1971) quoted it form the Upper Miocene of North Africa.
From the borehole ŠO-1 only one scanning electronmicrograph was made of a form from a depth of 146,5 m.

Family *Thoracosphaeraceae* Schiller, 1930
Genus *Thoracosphaera* Kamptner, 1927
Thoracosphaera sp.
Pl. XLII, Fig. 2

Notes: K. Perch—Nielsen (1971) presented 19 species of the genus *Thoracosphaera*. She emphasized especially two basic structural types. In the first type the spherical *Thoracosphaera* consists of lamellae forming a kind of mosaic. Sometimes the lamellae are perforated. In the second type Thoracosphaera consists of grains. I have examined a form from the borehole ŠO-1, from a depth od 138,5 m, which resembles rather *Thoracosphaera* of the second structural type. At present it is difficult to determine individual species of Th. more exactly, since most of them were described only on the basis of optical microscopy. Some taxons determined must be revised on the basis of scanning electron microscopy.

Incertae sedis

Genus *Coronocyclus* Hay, Mohler et Wade, 1966
Coronocyclus nitescens (Kamptner, 1963) Bramlette et Wilcoxon, 1967

1963 *Umbilicosphaera nitescens* Kamptner — E. Kamptner: Coccolith. Skelettreste ... etc., p. 187, tab. 1, fig. 5 (non vidi) (fide B. U. Haq, 1971).

1971 *Coronocyclus nitescens* (Kamptner) Bramlette et Wilcoxon — B. U. Haq: Paleogene calc. Nannoflora etc., p. 114, tab. 18, fig. 10—12 (Cum syn.).

Notes: The only scanning electron micrograph of the form *C. nitescens* from the borehole ŠO-1 (depth: 107 m) is in accordance with the description and with a very good illustration of this form by B. U. Haq (1971).

Stratigraphical range: Eocene — Miocene.

Explanation of plates XXIX—XLII

Plate XXIX
Fig. 1 *Orbulina suturalis* Brönnimann, borehole ŠO-1, 138,5 m, magn. 60×
Fig. 2 *Praeorbulina transitoria* (Blow), borehole ŠO-1, 138,5 m, magn. 60×
Fig. 3 *Praeorbulina glomerosa glomerosa* (Blow), borehole ŠO-1, 107 m, magn. 60×
Fig. 4 *Globorotalia periferoronda* Blow et Banner, borehole ŠO-1, 138,5 m, magn. 60×
Illustration of ultrastructure of the wall of Orbulina suturalis and arrangement of nannoflora in pores

Plate XXX
Fig. 1 *Braarudosphaera bigelowi* (Gran et Braarud) Deflandre, borehole ŠO-1, 107 m, magn. 6000×
Fig. 2 *Rhabdospaera* sp., borehole ŠO-1, 138,5 m, magn. 10 000×
Fig. 3 *Braarudosphaera bigelowi* (Gran et Braarud) Deflandre, central area, borehole ŠO-1, 107 m, magn. 12 000×

Plate XXXI
Fig. 1 *Micrantholithus vesper* Deflandre, borehole ŠO-1, 107 m, magn. 10 200×
Fig. 2 *Rhadosphaera clavigera* Murray et Blackman, borehole ŠO-1, 138,5 m, magn. 9600×
Fig. 3 *Holodiscolithus solidus* (Deflandre) Roth, borehole ŠO-1, 138,5 m, magn. 12 000×

Plate XXXII
Fig. 1 *Coccolithus pelagicus* (Wallich) Schiller, borehole ŠO-1, 138,5 m, dist. side, magn. 12 000×
Fig. 2 *Coccolithus pelagicus* (Wallich) Schiller, *Coccosphaera,* borehole ŠO-1, 138,5 m, dist. side magn. 7200×

Plate XXXIII
Fig. 1 *Soccolithus pelagicus* (Wallich) Schiller lateral view of Coccosphaera, borehole ŠO-1, 138,5 m, dist. side magn. 9000×
Fig. 2 *Coccolithus pelagicus* (Wallich) Schiller, dist. side, borehole ŠO-1, 107 m, magn. 12 000×

Plate XXXIV
Fig. 1 *Ericsonia ovalis* Black, prox. side, borehole ŠO-1, 138,5 m, magn. 12 000×
Fig. 2 *Ericsonia ovalis* Blac, dist. side borehole ŠO-1, 138,5 m, magn. 9600×

Plate XXXV
Fig. 1 *Reticulofenestra pseudoumbilica* (Gartner) Gartner, dist. side, borehole ŠO-1, 146,5 m, magn. 12 000 X
Fig. 2 *Reticulofenestra pseudoumbilica* (Gartner) Gartner, *Coccosphaera* dist. view; borehole ŠO-1, 138,5 m, magn. 6000 X

Plate XXXVI
Fig. 1 *Helicopontosphaera kamptneri* Hay et Mohler, proximal side, borehole ŠO-1, 138,5 m, magn. 10 800 X
Fig. 2 *Helicopontosphaera kamptneri* Hay et Mohler, proximal side, borehole ŠO-1, 138,5 m, magn. 12 000 X

Plate XXXVII
Fig. 1 *Helicopontosphaera wallichi* (Lohmann Boudreaux et Hay, proximal side; borehole ŠO-1, 138,5 m, magn. 12 000 X
Fig. 2 *Helicopontosphaera wallichi* (Lohmann) Boudreaux et Hay, dist. side; borehole ŠO-1, 138,5 m, magn. 14 000 X

Plate XXXVIII
Fig. 1 *Pontosphaera multipora* (Kamptner) Roth, proximal side; borehole ŠO-1, 138,5 m, magn. 9600 X
Fig. 2 *Pontosphaera confossa* (Hay, Mohler et Wade) nov. comb., proximal side; borehole ŠO-1, 138,5 m, magn. 12 000 X

Plate XXXIX
Fig. 1 *Pontosphaera discopora* Schiller, proximal side; borehole ŠO-1, 138,5 m, magn. 7200 X
Fig. 2 Association of calcareous nannoflora with *Micrantholithus* and *Rhabdosphaera*, borehole ŠO-1, 107 m, magn. 5400 X

Plate XL
Fig. 1 *Cyclococcolithus rotulus* (Kamptner) Kamptner, proximal side; borehole ŠO-1, 146,5 m, magn. 12 000 X
Fig. 2 *Discoaster barbadiensis* (Tan Sin Hoc) Bramlette et Riedel, proximal side; borehole ŠO-1, 138,5 m, magn. 9600 X
Fig. 3 *Discoaster adamanteus* Bramlette et Wilcoxon, angle 23°; borehole ŠO-1, 138,5 m, magn. 9600 X

Plate XLI
Fig. 1 *Discoaster variabilis* Martini et Bramlette, proximal side; borehole ŠO-1, 138,5 m, magn. 7200 X
Fig. 2 *Discoaster* sp., proximal side; borehole ŠO-1, 138,5 m, magn. 10 800 X

Plate XLII
Fig. 1 *Sphenolithus abies* Deflandre, borehole ŠO-1, 107 m, magn. 8400 X
Fig. 2 *Thoracosphaera* sp., borehole ŠO-1, 138,5 m, magn. 8400 X

Reviewed: H. Bystrická
Translated by: E. Jassingerová

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Ružena Lehotayová

Vápnitá nanoflóra preorbulíno-orbulínového obzoru badenu

Resumé anglického textu

Foraminiferový obzor preorbulín-orbulín spodnej časti badenu z vrtu ŠO-1 (lokalita Chľaba, juhovýchodná časť Podunajskej nížiny) poskytol bohaté nanoasociácie vápnitej nanoflóry.

Metódou scanning elektrónovej mikroskopie určila som z neho 26 taxónov na druhy, patriace do 11 rodov. Asociácie vápnitej nanoflóry zodpovedajú vrchnej časti nanoplanktonickej zóny NN-5, *Sphenolithus heteromorphus,* charakterizovanej E. Martinim (1971).

Ani najnovšie štúdiá planktonických foraminifér zo sedimentov, považovaných u nás za najspodnejšie časti badenu, nepotvrdili existenciu samostatnej foraminiferovej zóny s préorbulínami. I v sedimentoch vrtu ŠO-1, vo foraminiferových asociaciách spodnej časti badenu, préorbulíny vyskytujú sa spolu s formami druhu *Orbulina suturalis*.

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Ružena Lehotayová

Reticulofenestra excavata n. sp. from the Eggenburgian to Karpatian of Central Slovakia

(1 plate)

In the investigation of calcareous nannoflora from Eggenburgian and Karpatian sediments of the Bánovská kotlina and Horná Nitra basins (central Slovakia) a form not described so far has often been found to occur. The age of the investigated sediments is determined on the basis of molluscs and foraminifers.

Genus *Reticulofenestra* Hay, Mohler et Wade, 1966
Reticulofenestra excavata n. sp.
Tab. 1, Fig. 1—6

Holotype: scanning-electron micrograph N. 0908/75 (Tab. 1, Fig. 1) included in the collections of D. Štúr Institute of Geology, Bratislava.

Dimensions of holotype: length 6 μ. width 5,3 μ.

Paratypes: scanning electron micrograph No. 0446/75, 0416/75, 0437/75, 0180/75.

Dimensions of paratypes: length 6,9—8,2 μ.
width 7,0—7,4 μ.

Type level: Eggenburgian (Burdigalian)

Type locality: Čausa near Handlová, borehole ČČ-3, 237—237,5 m Central Slovakia, Czechoslovakia

Denomination: according to markelly excavated central area of the Reticulofenestra

Diagnosis: A broadly elliptical species of Reticulofenestra with an excavated central area whose grille is perforated by about 115 small holes. They are subcircular and circular, distributed in even concentric tiers. The grille is convex in distal view and forms a keel-like crest along the long axis of the ellipse.

Description: The broadly elliptical coccolith consists of a larger distal and a smaller proximal shields. Proximal view: The shields are constructed of about 80—100 delicate segments, their ends forming a jagged periphery. The dish-like central area is excavated and it is about 1/3 the Coccolith diameter. The grille of the central area is constructed of about 115 subcircular and circular small pores.

Distal view: Owing to its excavation, on the periphery of the central area is a ridge. It consists of delicate, tightly aligned, radially

oriented lamelles. The central opening is covered by the grille. On the outer periphery of the grille, small pores are arranged in regular concentric tiers (3—4). Toward the central part of the grille, the arrangement of pores is less regular. A keel-like crest forms along the long axix of the ellipse.

Remarks: The species described is in the best accordance with *Reticulofenestra gartneri* Roth et Hay, only its central area is more excavated, the arrangement of pores in the central grille is more even, and it possesses a keel-like crest along the long axis.

Distribution: This species ranges through the Eggenburgian (Burdigalian) to the Karpathian of the Middle Slovakia.

Explanations to plate 1

Fig. 1 *Reticulofenestra excavata* n. sp., distal view, Čausa borehole ČČ — 3; 237—237,6 m, magn. 5000×.

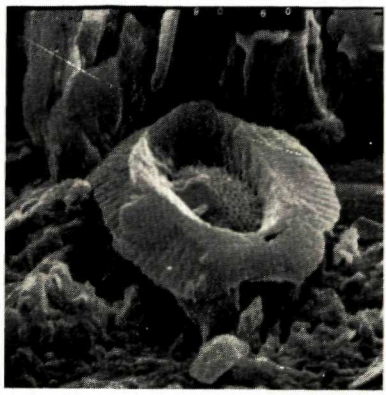
Fig. 2 *Reticulofenestra excavata* n. sp., proximal view, Čausa, borehole ČČ — 3; 237—237,6 m, magn. 4500×.

Fig. 3 *Reticulofenestra excavata* n. sp., distal view, Čausa, borehole ČČ — 3; 237—237,6 m, magn. 5000×.

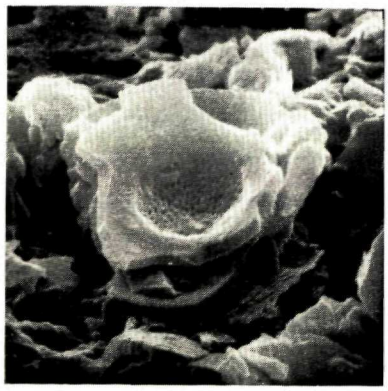
Fig. 4 *Reticulofenestra excavata* n. sp., proximal view, Čausa, borehole ČČ — 3; 237—237,6 m, magn. 5000×.

Fig. 5 *Reticulofenestra excavata* n. sp., distal view, Čausa, borehole ČČ — 3; 237—237,6 m, magn. 5000×.

Fig. 6 *Reticulofenestra excavata* n. sp., distal view, Podlužany, borehole DB — 9; 57—58 m, magn. 4500×.



1



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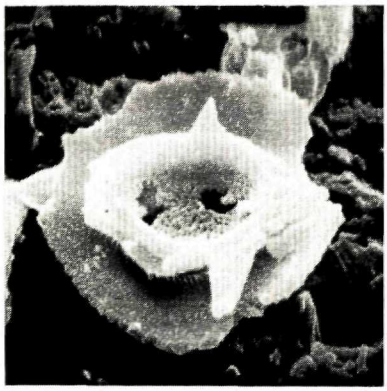

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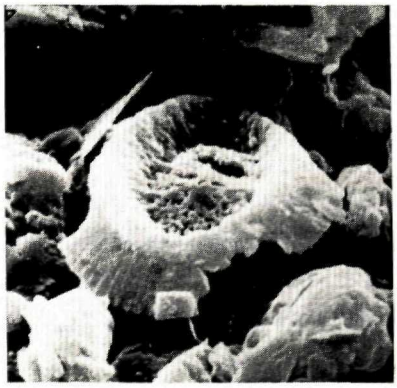
5



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Hedviga Bystrická

Middle-Paleocene Coccoliths of the West Carpathians

12 plates (XLIII—LIV), Slovak summary

Abstract. In the Middle-Paleocene sediments of the Myjava Paleogene found was rich nannoflora. As regards the species of Coccoliths, the association represents the upper part of the biofacies *Heliolithus kleinpelli* zone. Presented is a brief description of the species found.

The Paleogene sediments of the West Carpathians contain rich nannoplanktonic associations. The occurrences of the Eocene associations, and their stratigraphical significance were already presented (H. Bystrická 1963—1972). Recently, nannoflora was also found in the Paleocene sediments, particularly in the Periklippen Paleogene. The nannoflora was recorded at Middle- and Upper-Paleocene localities. It represents the following biofacies zones: *Fasciculithus tympaniformis, Heliolithus kleinpelli, Discoaster gemmeus, Heliolithus riedeli,* and *Discoaster multiradiatus* (H. Bystrická 1973). The Lower Paleocene — Danian nannoplanktonic associations were only recorded in the Žilina Periklippen Paleogene. According to the occurrences of foraminifers, their presence may also be expected in the area of Myjava (O. Samuel — J. Salaj 1968) and in the Dukla—Užok Unit (B. Leško — O. Samuel 1968).

Here description of nannoplanktonic association from the Middle-Paleocene sediments of the Myjava Paleogene, namely from the Kraváriky beds (O. Samuel 1972) is presented. The association was recovered from lightgreen, thin-bedded, calcareous-clayey shales on a field road, 50 m southeast from the elevation point 181 near the village Sinec. The association includes the following species:

Ericsonia cava (Havy et Mohler) Perch — Nielsen
Cyclococcolithus sp. aff. *formosus* Kamptner
Cyclococcolithus sp. 1
Cyclolithella robusta (Bramlette et Sullivan) Stradner
Chaismolithus bidens (Bramlette et Sullivan) Hay et Mohler
Markalius cf. *inversus* (Deflandre) Bramlette et Martini
Markalius sp. 1
Conococcolithus sp. aff. *minutus* Hay et Mohler
Fasciculithus billii Perch — Nielsen
Fasciculithus tympaniformis Hay et Mohler

RNDr. H. Bystrická, Department of geology and paleontology, Faculty of Natural History, Comenius University, Gottwaldovo n. 2, Bratislava.
RNDr. H. Bystrická, CSc., Prírodovedecká fakulta UK, Gottwaldovo nám. 2, Bratislava.

Heliolithus kleinpelli Sullivan
Prinsius cf. *bisulcus* (Stradner) Hay et Mohler
Prinsius martinii (Perch—Nielsen) Haq
Toweius craticulus Hay et Mohler
Toweius eminens (Bramlette et Sullivan) Gartner
Toweius ocultatus (Locker) Perch—Nielsen
Toweius tovae Perch—Nielsen
Toweius sp.
Sphenolithus sp.
Neochiastozygus sp. aff. *concinnus* (Martini) Perch—Nielsen
Zygodiscus sigmoides Bramlette et Sullivan
Discoaster gemmeus Stradner

Stratigraphical classification of the Association

As regards species, the composition of the association is — with the exception of the species *Discoaster gemmeus* Stradner — typical of the nannoplanktonic zone *Heliolithus kleinpelli.* The zone was defined by H. P. Mohler and W. W. Hay (1967), as an interval between the first occurrence of the species *Heliolithus kleinpelli* Sullivan and the first occurrence of *Discoaster gemmeus* Stradner. Stratigraphically it is referred to the Middle Paleocene. According to the standard zonation (E. Martini 1971) it represents the zone NP 6 and is stratigraphically equivalent to the upper part of the foraminiferal zone P 3 *Globorotalia pusilla — Globorotalia angulata,* and to the basal part of the zone P 4 *Globorotalia pseudomenardii* (W. A. Berggren 1969).

In the Czechoslovak Carpathians the zone is correlable with the middle part of the foraminiferal zone *Globorotalia pusilla pusilla* (O. Samuel — J. Salaj 1968). In spite of the presence of the species *Discoaster gemmeus* Stradner, I refer the nannoplanktonic association studied to the upper part of the zone *Heliolithus kleinpelli* for these reasons:

1. The association contains very abundant guide fossils of the zone — *Heliolithus kleinpelli* Sullivan.

2. The species of the other members of the association are typical of the zone, and — with the exception of the only species *Discoaster gemmeus* Stradner — it does not yet contain forms younger than *Discoaster helianthus* Bramlette et Sullivan, *Discoaster delicatus* Bramlette et Sullivan, and *Discoaster aster* Bramlette et Riedel.

3. Former observations showed that associations of the superpositional *Discoaster gemmeus* zone which — in case of strictly keeping to the definition — should include our association, were very rich in the index species of the zone — *Discoaster gemmeus* Stradner.

The presence of the biozone *Heliolithus kleinpelli* in the Czechoslovak Carpathians supports the opinion about its presence all over the world. In the Polish part of the West Carpathians it was recorded as early as 1967 by A. Radomski. His data should, however, be revised, since he correlated the zone with the foraminiferal zone *Globorotalia marginodentata* and *Globorotalia pseudomenardii* (= zone E. K. Gohrbandt 1963), i.e. he put in in the stratigraphical position of the Upper Paleocene *Heliolithus riedeli* zone (cf. Table 5).

Paleontologic discription of species

Order *Coccolithophorales* Schiller, 1926
Family *Coccolithaceae* Kamptner, 1928
Genus *Chiasmolithus* Hay, Mohler, Wade, 1966
Chiasmolithus bidens (Bramlette et Sullivan 1961) Hay et Mohler, 1966
Pl. XLVII, Fig. 1, 2

1961 *Coccolithus bidens* Bramlette and Sullivan, new species — M. N. Bramlette — F. R. Sullivan: *Coccolithophorids* and related Nannoplankton etc. p. 139, tab. 1, fig. 1.

1967 *Chiasmolithus bidens* (Bramlette & Sullivan) — W. W. Hay — H. P. Mohler: Calcareous nannoplankton from early Tertiary rocks etc., p. 1526, tab. 197, figs. 4, 9, 7, tab. 196, figs 23, 24, 25, non figs. 14, 15, 16.

Description: All the electronmicrographs show the distal side of the coccolith. The distal disc is comparatively low, composed of 60—63 narrow trapezoid lamelles dextrally superimposed on each other. The central area is large, covering approximately 7/9 of the coccolith length. Well-preserved specimens show that it is formed of narrow, long lamelles directed toward the central aperture. Most frequently, the lamelles are damaged, and then the central area looks as if formed of irregular granules. The central aperture is crossed with a structure shaped in diagonally declined irregular H. The structure consists of long, narrow lamelles. I have not found any grid between the central aperture and the rays of the central structure, as quoted by W. Hay and H. P. Mohler 1967.

Size: 9,4μ—8,3μ

Stratigraphical range: The first description was that of the Upper Paleocene species from the *Heliolithus riedeli* zone. St. Gartner (1970) refers the first occurrence to the upper part of the Lower Paleocene (= Danian), into the zone *Elipsolithus macellus*. The upper boundary of the occurrence is uncertain. W. W. Hay and H. P. Mohler (1967) regard the species of the Upper-Paleocene *Discoaster multiradiatus* zone as »probably allochthonous«, while in St. Gartner's opinion the species occurrences extend up to the Lower Eocene to develop gradually into the species *Chiasmolithus grandis* (Bramlette et Riedel) Gartner.

Genus *Cyclococcolithus* Kamptner, 1954
Cyclococcolithus sp. aff. *formosus* Kamptner, 1954
Pl. XLV, Fig. 1

Description: A circular form, considerably reminding of the species *Cyclococcolithus formosus* Kamptner. On its distal side are two rims. The outer rim representing the distal disc, consists of about 40—42 longish lamelles partially superimposed on each other. The inner rim consists of an equal number of thin lamelles and confines the central area. The lamelles are narrow rectangles, rounded on outer corners. They

are arranged vertically close to one another, around the central area so as to overlap the distal disc by their narrower side. The central aperture is about 1/5 of the coccolith diameter.
Size: approx. 9 μ

Remarks: It differs from the species *Cyclococcolithus formosus* Kamptner mainly in the overlapping part of the central area, in a greater diameter of the central area, and in stratigraphical range.

Cyclococcolithus sp. 1
Pl. XLIV, Fig. 2

Description: The circular form in Tab. XLIV, Fig. 2 is the proximal side of a representative of the genus Cyclococcolithus. The large central disc consists of about 37 thin narrow trapezoid lamelles, slightly superimposed on each other in dextral sense. The proximal disc is narrow; its width being hardly 1/3 of the width of the distal disc. The proximal disc consists of extremely narrow rectangular lamelles, arranged tightly on one another, sinistrally declined. The central area is large, and occupies almost a half of the coccolith diameter. In the central area are lamelles of broad-rectangular to irregular shape. The central area is about 1/4 of the coccolith diameter.

Dimensions: Distal disc diameter 7,1 μ
Proximal disc diameter 4,6 μ
Central aperture diameter 1,6 μ

Genus *Cyclolithella* Loeblich et Tappan 1963
Cyclolithella robusta (Bramlette et Sullivan 1961), Stradner 1969
Pl. XLVI, Fig. 3

1961 *Cyclolithus? robustus* Bramlette and Sullivan, new species — M. N. Bramlette — F. R. Sullivan: Coccolithophorids and related Nannoplankton etc., p. 141, tab. 2, fig. 7a—c.

1969 *Cyclolithella robusta* (Bramlette & Sullivan) nov. comb. — H. Strandner: The nannofossils on the Eocene flysch etc., p. 414, tab. 86, figs. 1—4.

Description: The circular form consists of two discs. Both are composed of about 35 narrow, vertical rectangular lamelles confining a large central aperture. The distal disc is somewhat larger than the proximal.

Dimensions: Distal disc diameter 7,5 μ
Proximal disc diameter 6,3 μ
Central aperture diameter 3,2 μ

Remarks: The species markedly resembles *Cyclolithella pakistanica* Haq recorded from the Upper Eocene in West Pakistan (B. U. Haq 1971). Both the species have the same number of lamelles, only in our form they are vertical, while in *Cyclolithella pakistanica* they are imbricated.
Stratigraphical range: Middle Paleocene — Lower Eocene.

Genus *Ericsonia* Black, 1964
Ericsonia cava (Hay et Mohler 1967) Perch—Nielsen 1970
Pl. XLIII, Fig. 1, 2; Pl. XLIV, Fig. 1; Pl. XLV, Fig. 3

1967 *Coccolithus cavus* n. sp. — W. W. Hay—H. P. Mohler: Calcareous nannoplankton from early Tertiary rocks etc., p. 1524, tab. 196, figs. 1—3, tab. 197, figs. 5, 7, 10, 12.

1970 *Ericsonia cava* Hay & Mohler, 1967 — K. Perch—Nielsen: Die Coccolithen einiger dänischer Maastrichtien und Danienlokalitäten. p. 61, tab. 2, figs. 7, 8.

Description: Oval to broadly oval coccoliths with a large central area on the distal side. The distal disc consists of 37—52 thin longish lamelles dextrally superimposed on each other. The central area is large, deep, about 2/5—2/3 of the coccolith diameter. In undamaged individual, in the central area are narrow long lamelles extending either to the top periphery of the area, or are somewhat shorter, and a rectangular groove forms between the lamelles of the distal disc and the lamelles of the central area. The groove is very typical of this species. Frequently, the lamelles of the central area are damaged and look as irregular granules arranged in concentric rims. The central aperture is small, oval.

The proximal disc consists of two rims. The inner rim consists of narrow, dextrally declined lamelles. On the outer periphery they are fringed by a rim of granules in alternate position. On the specimens examined it was impossible to see whether the two rims of the proximal disc form one layer — as supposed M. Black when describing the genus *Ericsonia* — or whether the outer rim is the overlapping margin of the central disc situated between the distal and the proximal disc — as postulated K. Perch—Nielsen (1970). The central area is covered by narrow lamelles of the same number as in the proximal disc. When the lamelles are damaged, they look as granules.
Size: 6—11 μ
Stratigraphical range: Paleocene.

Genus *Markalius* Bramlette et Martini 1964
Markalius cf. *inversus* (Deflandre 1954) Bramlette et Martini 1964
Pl. XLVI, Fig. 1, 5

1954 *Cyclococcolithus leptoporuh* Murray et Blackmann var. *inversus* n. v. — G. Deflandre—Ch. Fert: Observations sur les Coccolithophoridés etc. p. 151, tab. 9, fig. 4, 5.

1964 *Markalius inversus* (Deflandre) — M. N. Bramlette—E. Martini: The great change in calcareous nannoplankton fossils etc., p. 302, tab. 2, fig. 4—9, non tab. 7, fig. 2a, b.

1966 *Cyclococcolithus inversus* Deflandre—W. W. Hay—H. Mohler—M. E. Wade: Calcareous Nannofossils from Nalchik etc., p. 389, tab. 7, fig. 2.

On the proximal side are three concentric circular rims. The ouher rim consists of 30—36 rectangular lamelles. Properly it is the basal part of the overlapping distal disc. The central rim = the proximal disc consists of narrow trapezoid radial lamelles, 30—33 in number, forming

a conic depression. In the depression is the third rim consisting of the same number of radial narrow trapezoid lamelles.
Size: 6—6,5 μ.

Remarks: Our forms differ from the typical representatives of this species in a very regular and conspicuous inner rim covering the central aperture, while the typical forms have on their proximal side a central aperture covered by irregular elongated radial lamelles.

Stratigraphical range: After K. Perch—Nielsen 1971, the species appears in the Maastrichtian and lives through the Eocene. The Eocene forms are smaller and have less marginal lamelles.

Markalius sp. 1
Pl. LIII, Fig. 3

Description: A circular form consisting of two almost equal discs closely on each other. The distal disc is somewhat thicker than the proximal. Each of them consists of 29 trapezoid lamelles aligned side by side. They converge to the central aperture which covers 1/3 of the coccolith. Both discs are connected with a tube fringed by a narrow raised segment. It is the overlapping part of the central tube, formed of rhomboid granules.
Size: 6,5 μ. Central aperture diameter 2,1 μ.

Family *Discoasteraceae* Vekshina, 1959
Genus *Discoaster* Tan Sin Hok 1927
Discoaster gemmeus Stradner, 1959
Pl. XLVI, Fig. 4

1959 *Discoaster gemmeus* nov. cent. — H. Stradner: First report on the Discoasters etc., p. 1086, fig. 21.
1961 *Discoaster gemmeus* Stradner — H. Stradner — A. Papp: Tertiäre Discoasteriden aus Österreich etc., p. 77, tab. 1, 2, 4, 8.
1971 *Discoaster mohleri* Bukry and Percival, n. sp. — D. Bukry — S. F. Percival Jr.: New Tertiary calcareous nannofossils, pl. 3, fig. 3—5.

Description: It is a small massive asterolith consisting of 12 rays. Toward the median axis the rays get thicker and form a ridge-shaped segment. They are arranged closely side by side. Sutures among rays are straight, only near the middle of the form they bend into a small central depression. The periphery of the asterolith is dentated.
Size: 7 μ

Remarks: The species *Discoaster gemmeus* was described by H. Stradner in 1959 from the type locality of Mattsse, stat. 133, type level Middle Paleocene (Thanetian). To this species referred are asteroliths with 6—9 keel-like rays mutually connected along predominant part of their length. Emphasized are raised relief segments in the axis of rays, converging into the central depression. In 1961 H. Stradner presented forms with 8—18 rays, and emphasized thickness of asteroliths. As for stratigraphical range, the author quoted a Lutetian type

locality, yet he pointed out to the primary occurrences of the species restricted to earlier Paleocene, and quoted very frequent forms with 14 rays. Systematical classification of the Eocene forms referred to this species is regarded as problematic, and the author admits that these might be juvenile stages of species with similar structure of the central area.

D. Bukry and S. F. Percival in 1971 described the species *Discoaster mohleri* from the Shatsky Rise in the Pacific Ocean. The description fully agrees with that of *Discoaster gemmeus.* All characteristics to differ from *Discoaster gemmeus* Stradner, e.g. number of rays, size, stratigraphical range, ale completely appliable to *Discoaster gemmeus.* The authors of the species *Discoaster mohleri* emphasize mostly the stratigraphical range of the species without considering the fact that H. Stradner pointed out to *Discoaster gemmeus* representing the first occurrence of the genus *Discoaster* (1961, p. 148) in the Thanetian.

The description, depictions by optical and electron microscopes, and stratigraphical range show that the species *Discoaster mohleri* Bukry et Percival is no independent species but a younger, void synonym of *Discoaster gemmeus* Stradner.

Stratigraphical range: Paleocene.

Discoaster gemmeus and *Heliolithus riedeli zone.*

Family *Fasciculithaceae* Hay et Mohler, 1967

Genus *Fasciculithus* Bramlette et Sullivan, 1961

Fasciculithus billii Perch—Nielsen, 1970

Pl. XLVIII, Fig. 2

1970 *Fasciculithus billii* n. sp. — K. Perch—Nielsen: Einige neue Coccolithen aus dem Paleozän der Bucht von Biskaya. p. 352, tab. 4, fig. 11, tab. 5, figs. 5—10, tab. 14, figs. 31—33.

Description: The basal side of the column is broadened and consists of 20 trapezoid segments. Thy are close next to each other and converge to the centre to form a shallow depression. The distal part characterized by prolonged depressions among ribs, is indistinct on our form.

Dimensions: Basal part diameter 6,5 μ
Height about 5 μ

Stratigraphical range: So far the species is only known from the Middle — Paleocene zone. *Fasciculithus tympaniformis* zone. Since in the association examined was only 1 specimen of this species, it might be redeposited.

Fasciculithus tympaniformis Hay et Mohler, 1967

Pl. XLVIII, Fig. 1

1967 *Fasciculithus tympaniformis* Hay & Mohler, n. sp. — W. W. Hay et al. Calcareous Nannoplankton Zonation etc., p. 447, tab. 8, 9, fig. 1—5.

Description: A cylindrical form consisting of 16—20 trapezoid lamelles arranged radially, connected all over their length. The dorsal

side of trapezoid forms a keel-like edge in the middle, to form dentated periphery of the form. The base of the cylinder is slightly concave, the top part convex.

Dimensions: Height 4,6—6 μ
Diameter 4,5—8 μ

Remarks: Besides typical forms the association also contains minor (about 3,5 μ) individuals consisting of even 27 trapezoid lamelles. They do not cover the whole diameter of the cylinder, in the middle an empty area is left.

Stratigraphical range: Middle and Upper Paleocene.

Family *Heliolithaceae* Hay et Mohler, 1967
Genus *Heliolithus* Bramlette et Sullivan, 1961
Heliolithus kleinpelli Sullivan, 1964
Pl. XLIX, Fig. 1, 2; Pl. L, Fig. 1, 2

1964 *Heliolithus kleinpelli*, n. sp. — F. R. Sullivan: Lower Tertiary nannoplankton etc., p. 193, tab. 12, fig. 5a, b.

1971 *Heliolithus kleinpelli* Sullivan 1961 — K. Perch—Nielsen: Neue Coccolithen aus dem Paleozän etc. p. 54, tab. 2, fig. 2, 4, 6, tab. 7, fig. 26, 27.

Description: The form consists of a basal disc on which is a low conical »column«. The basal disc consists of trapezoid rays radially converging toward a small central aperture. The number of rays is 34—38. In the median axis they have raised ribs. Periphery of the basal disc is dentated. Sutures among rays on the proximal side are straight on the distal side indistinct because the whole disc — except a narrow belt at its outer periphery — is covered with irregular granules.

The column occupies approx. 2/3 of the form diameter. It is a broad low cone with a funnel — shaped depression in its centre. The column consists of two rims of rays in alternate position. Rays of the lower rim are in alternate position with respect to the rays of the basal disc. Also rays forming the column have a raised segment in the axial part. In the shallow central funnel-like depression are narrow, long radial lamelles.

Dimensions: Basal disc diameter 9—13 μ
Column diameter 6—7 μ

Stratigraphical range: Middle Paleocene, the *Heliolithus kleinpelli* zone. Occurrences in the superpositional zone *Discoaster gemmeus* are problematic.

Family *Prinsiaceae* Hay et Mohler, 1067
Genus *Prinsius* Hay et Mohler, 1967
Prinsius cf. *bisulcus* (Stradner 1963) Hay et Mohler, 1967
Pl. XLVI, Fig. 2

1963 *Coccolithus bisulcus* n. sp. — H. Stradner in K. Gohrbandt: Zur Gliederung des Paläogens im Helveticum etc., p. 72, tab. 8, fig. 3—6, text fig. 3a, b.

1967 *Prinsius bisulcus* (Stradner) — W. W. Hay—H. P. Mohler: Calcareous nannoplankton from early Tertiary rocks etc., p. 1529, tab. 196, figs 10—13, tab. 197, fig. 6.

Description: Two forms from the association examined are referred — with some reserve — to the species *Prinsius bisulcus* (Stradner) Hay et Mohler. In both cases, electronmicrographs show distal sides. The broadly oval form consists of three layers above each other. The basal layer consists of 36—37 thin trapezoid lamelles aligned close to each other. On this layer is a narrow rim composed of the same number of dextrally declined keel-like segments with conspicuous dentated periphery. The third layer forms the central area. It consists of elongated irregular granules, oriented radially. In the direction of the long axis they form two large, irregular pores in the middle of the central area. They are close to each other.

Size: 6,5—7 μ

Remarks: Although the species is well identifiable under optical microscope, there are problems in its identification on electronmicrographs. In the author's description based on examination under the optical microscope the central area is divided by two grooves along the long axis. Between the grooves — at phase contrast — observed are irregularly distributed pores which may be missing on larger specimens. The first electronmicrograph of the species was published by W. W. Hay and H. P. Mohler (1967, Tab. 197, fig. 6). On this specimen the central area is covered by irregular elongated lamelles forming an irregular slot along the long axis of the area. Pores in the central area are missing. Electronmicrographs published by A. S. El Dawoody (1972, tab. 1, fig. 1—6) show pores in the central area, but the electronmicrographs are not of *Prinsius bisulcus* (Stradner) Hay et Mohler but *Toweius craticulus* Hay et Mohler (fig. 1—3) and *Toweius eminens* (Bramlette et Sullivan) Gartner (fig. 4). Forms referred here to the species mentioned, have a different microstructure of the central area. For an exact identification it will be necessary to make elektronmicrographs of species from the type locality.

Stratigraphical range: Danian — Paleocene. The *Cruciplacolithus tenuis* zone — the *Discoaster multiradiatus* zone.

Prinsius martinii (Perch — Nielsen, 1969) Haq, 1971
Pl. LI, Fig. 1—6

1969 *Ericsonia? martinii* n. sp. — K. Perch — Nielsen: Elektronenmikroskopische Untersuchungen der Coccolithophoriden etc., p. 324, tab. 32, fig. 3b, 5, 7, text fig. 2.
1971 *Toweius* sp. — D. Bukry: 29 Coccolith stratigraphy Leg 6 etc., tab. 7, fig. 5, 6.
1971 *Prinsius martinii* (Perch — Nielsen) n. comb. — B. U. Haq: Paleogene calcareous nannoflora Part I, p. 18, tab. 5, fig. 1, 5—7, tab. 10, fig. 2, 3.

Description: A broadly oval form. The distal part consists of three layers above each other, of which the lower two form concentrically arranged rims, and the upper layer is the central area. The basal rim consists of about 36—40 narrow, longish lamelles aligned close to each other. On the basal rim is another one composed of narrow trapezoid dextrally superimposed lamelles. This one has a distinctly dentated periphery. The central area is covered with irregularly arranged granules.

The proximal disc is plate shaped. It is formed of two almost equal discs, resting on each other. They consist of the same number of lamelles

like the distal side. The lamelles are trapezoid. They are close to each other and converge toward the central area. Near its margin they bend to form its wall. Bending is very distinct, emphasized with a seeming rim of minor pores. The central area in larger forms is comparatively smaller than in smaller ones. It occupies approximately 1/3—2/5 of the proximal disc diameter. It is covered by a plate composed of 7—11 granules of pentagonal shape. They are arranged in two lines along the long axis, in an alternate position. Near the periphery of the central area, among individual granules are small pores.

On the periphery of the proximal disc the overlapping part of the basal rim of the distal side is visible.

Size: 4,8—8,5 μ

Remarks: Microstructure of the proximal side is completely identic with microstructure of the representatives of the genus *Toweius*.

Stratigraphical range: Paleocene, the *Cruciplacolithus tenuis* to *discoaster multiradiatus* zone.

Genus *Toweius* Hay et Mohler, 1967
Toweius craticulus Hay et Mohler, 1967
Pl. LIII, Fig. 5

1967 *Toweius craticulus* n. sp. — W. W. Hay — H. P. Mohler: Calcareous nannoplankton from early Tertiary rocks etc., p. 1530, tab. 196, fig. 7—9, tab. 197, fig. 2, 3.

1971 *Toweius craticulus* Hay & Mohler — K. Perch — Nielsen: Einige neue Coccolithen etc., p. 360, tab. 13, fig. 7—10, tab. 14, fig. 1, 2.

Description: Electronmicrographs represent the proximal side of this species. They have broadly oval to subcircular shape. Two discs are visible on them. A narrow rim on the periphery is the overlapping part of the distal disc. It consists of two layers above each other. The lower is somewhat larger, and about twice as thick as the upper one. Both they consist of the same number of narrow lamelles converging to the central area. On its periphery they bend to form the wall of the shallow central area. The bending is emphasized by a cycle of apparent pores. The central area occupies approx. 2/5 of the proximal disc diameter. It is covered by a grid with large, irregularly arranged pores.

Size: 4—4,9 μ

Stratigraphical range: Paleocene; the *Ellipsolithus macellus* to *Discoaster multiradiatus* zone.

Toweius eminens (Bramlette et Sullivan, 1961) Gartner, 1971
Pl. LII, Fig. 1

1961 *Coccolithus eminens* Bramlette and Sullivan, new species — M. N. Bramlette — F. R. Sullivan: Coccolithophorids and related Nannoplankton etc., p. 139, tab. 1, fig. 3a—d.

1967 *Cruciplacolithus eminens* (Bramlette et Sullivan) — W. W. Hay — H. P. Mohler: Calcareous nannoplankton from early Tertiary rocks etc., p. 1527, tab. 196, fig. 26, 27, 28, tab. 198, fig. 9, 10.

1971 *Toweius eminens* (Bramlette & Sullivan) n. comb. — St. Gartner Jr.: Calcareous nannofossils from the Joides Blacke Plateau cores etc. p. 114, tab. 5, fig. 4a—c (april).

1971 *Toweius eminens* (Bramlette & Sullivan, 1961) n. comb. — K. Perch—Nielsen: Einige neue Coccolithen etc., p. 360, tab. 13, fig. 4, 6, tab. 14, fig. 3, 4 (june).

Description of the distal side: The circular form consists of three layers. The outer layer consists of a rim of 40—50 almost vertical narrow trapezoid lamelles. From the middle layer visible is only a narrow belt of dextrally superimposed lamelles with the typical dentated periphery. The upper layer covers the central area. Its microstructure is rather indistinct. It looks as if composed of narrow, radially converging lamelles forming four pores in the middle of the area. The lamelles are radially arranged only along the periphery of the central area. The remaining part — except four pores — is covered with irregular granules or scales.

Size: 6—8,5 μ

Stratigraphical range: Middle and Upper Paleocene; the *Heliolithus kleinpelli* to *Discoaster multiradiatus* zone.

Toweius cf. *ocultatus* (Locker, 1967) Perch—Nielsen, 1971
Pl. LII, Fig. 2

1967 *Coccolithus ocultatus* sp. n. — S. Locker: Neue, stratigraphisch wichtige Coccolitophoriden etc., p. 764, tab. 1, fig. 5, tab. 2, fig. 9, 10.

1971 *Toweius ocultatus* (Locker 1967) n. comb. — K. Perch—Nielsen: Elektronenmikroskopische Untersuchungen an Coccolithen etc., p. 32, tab. 17, fig. 1, 2, 4, 7, tab. 2, fig. 9, 10.

Description: From the locality studied available are only electronmicrographs of distal sides of specimens. The broadly oval from shows typical structure of the genus Toweius with three lines of large, differently oriented lamelles, placed above one another. In the middle of the area they form two large apertures — characteristic of this species.

Remarks: The species was described at first from the Upper Eocene of Germany, and till the present it has been regarded as an Eocene form. Paleocene forms do not completely agree with the Eocene. While in the Eocene forms, the lamelles of the central area are arranged diagonally the lamelles of the Paleocene forms are arranged radially. Perhaps after the examination of more material it will be possible to classify the Paleocene forms as subspecies.

Stratigraphical range: Our find replaces the lower boundary of the occurrence of the species to the Middle Paleocene — the Zone *Heliolithus kleinpelli* zone. The last occurrence is restricted to the Eocene.

Toweius tovae Perch—Nielsen, 1971
Pl. LIII, Fig. 4

1971 *Toweius tovae* n. sp. — K. Perch—Nielsen: Einige neue Coccolithen aus dem Paleozän der Bucht von Biskaya, p. 359, tab. 13, fig. 1, 2, 3, 5, tab. 14, fig. 8, 9.

Description: Among the material examined is the only electronmicrograph of the proximal side of this species. It is circular, with three rims. The outer rim is the basal part of the distal disc. It looks as if composed of rectangular lamelles, placed tightly besides one another, slightly declined sinistrally. On the distal disc rests the proximal. It is slightly concave, and consists of two layers on each other. The lower is thicker and somewhat larger, composed of elongated lamelles placed closely beside one another. The upper layer is extremely thin (about 1/4 of the lower). It is formed of radially arranged lamelles, bending at the central aperture. The number of lamelles is the same in all the three rims — about 42. The central aperture is covered with a grid with 6 large apertures in one rim.
Size: 8 μ

Stratigraphical range: Middle to Upper Paleocene: the *Heliolithus Kleinpelli* to *Discoaster multiradiatus* zone.

Toweius sp.
Pl. LIV, Fig. 1, 2; Pl. XLV, Fig. 2

1972 *Cribrocentrum reticulatum* (Gartner) — K. Perch—Nielsen: Remarks on late Cretaceous etc., tab. 7, fig. 5.

Description: Subcircular or circular forms show the typical structure of the proximal side of the genus *Toweius*. The proximal disc is concave, formed of two layers close above each other: the lower is thicker, broader, and the upper one which is approximately 1/4 of the lower in thickness. The structure of both is the same. They consist of radially convergent, narrow, trapezoid lamelles close to one another. They are about 40 in number. In the middle of the disc is a circular central aperture occupying about 1/3 of its diameter. It is covered by a plate consisting of narrow, on sides waved lamelles, aligned in two lines along the central axis (Pl. XLV, fig. 2). Most frequently the central lamelle is damaged and looks as if formed of irregular granules (Pl. LIV, fig. 1, 2).

The proximal disc is fringed with a rim of rectangular lamelles on its periphery. It is the overlapping part of the distal disc.

Remarks: K. Perch—Nielsen (1972, tab. 7, fig. 5) presents electronmicrograph of this form of the Eocene of the North Atlantic, under the name *Cribrocentrum reticulatum* (Gartner). The structure of its shell indicates its appurtenance to the genus *Toweius*.

Family: *Sphenolithaceae* Deflandre, 1952
Genus *Sphenolithus* Deflandre, 1952
Sphenolithus sp.
Pl. XLV, Fig. 4

1971 *Sphenolithus* sp. 1 — K. Perch—Nielsen: Einige neue Coccolithen etc., p. 358, tab. 12, fig. 1, 6.

Description: The specimen has the form of a broad cone. Its basal side is formed of the proximal disc consisting of 14 trapezoid lamelles converging to the centre so as to form a funnel-like depression on the bottom side. The structure of the apical part is indistinct. It seems that among apical segments are large, elongated depressions.
Dimensions: Height about 5,5 μ
Basal disc diameter 4,2 μ

K. Perch—Nielsen (1971) recorded the specimen in the Upper Paleocene of the Gulf of Biscaya.

Family *Zygodiscaceae Hay* et *Mohler,* 1967
Genus *Zygodiscus* Bramlett et Sullivan, 1961
Zygodiscus sigmoides Bramlette et Sullivan, 1961
Pl. LIII, Fig. 2

1961 *Zygodiscus sigmoides* Bramlette & Sullivan, new species — M. N. Bramlette — F. R. Sullivan: Coccolithophorids and related Nannoplankton etc., p. 149, tab. 4, fig. 11a—c.
1961 *Zygodiscus simplex* Bramlette et Sullivan, new species — ibidem p. 151, tab. 6, fig. 19—22.
1967 *Zygodiscus simplex* (Bramlette & Sullivan) — W. W. Hay — H. P. Mohler: Calcareous nannoplankton from early Tertiary rocks etc., p. 1532, tab. 199, fig. 11, 15, 22, tab. 200, fig. 2, 3. 5, 6, tab. 201, fig. 3.

Description: The oval form consists of the only rim of rectangular, dextrally imbricated lamelles. The number of lamelles is about 40. It is crossed by a ridge along the short axis. The ridge consists of narrow prisms converging to the central aperture where they meet and form a massive column.
Size: 6,5—8,5 μ

Stratigraphical range: Paleocene, the *Cruciplacolithus tenuis* to *Discoaster multiradiatus* zone.

Genus *Neochiastozygus* Perch—Nielsen, 1971
Neochiastozygus sp.
Pl. LIII, Fig. 1

Description: In the association examined included are some damaged forms with the wall structure typical of the genus Neochiastozygus. The oval coccolith consists of a rim of two walls. The outer wall consists of thin, sinistrally declined and imbricated lamelles, 35—40 in number. Lamelles of the inner wall are rectangular. They are placed next to each other to connect with their longer side. They are about 30—35 in number. The central structure is damaged in all individuals and it makes the species identification impossible.
Size: 7,2—9 μ

Translated by E. Jassingerová
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Explanation of Plates XLII—LIV

Plate XLIII

Fig. 1 *Ericsonia cava* (Hay et Mohler) Perch—Nielsen — part of coccosphere; magn. 9000×

Fig. 2 *Ericsonia cava* (Hay et Mohler) Perch—Nielsen — distal side; magn. 8000×

Plate XLIV

Fig. 1 *Ericsonia cava* (Hay et Mohler) Perch—Nielsen — proximal side; magn. 10 000×

Fig. 2 *Cyclococcolithus* sp. — proximal side; magn. 10 000×

Plate XLV

Fig. 1 *Cyclococcolithus* sp., aff. *formosus* Kamptner — distal side; magn. 10 000×

Fig. 2 *Toweius* sp. — proximal side; magn. 8000×

Fig. 3 *Ericsonia cava* (Hay et Mohler) Perch—Nielsen — proximal side; magn. 9000×

Fig. 4 *Sphenolithus* sp.; magn. 9000×

Plate XLVI

Fig. 1, 5 *Markalius* cf. *inversus* (Deflandre) Bramlette et Martini — proximal side; magn. 10 000×

Fig. 2 *Prinsius bisulcus* (Stradner) Hay et Mohler — distal side; magn. 10 000×

Fig. 3 *Cyclolithella robusta* (Bramlette et Sullivan) Stradner — proximal side; magn. 10 000×

Fig. 4 *Discoaster gemmeus* Stradner; magn. 9000×

Plate XLVII

Fig. 1, 2 *Chiasmolithus bidens* (Bramlette et Sullivan) Hay et Mohler — distal side; magn. 9000×

Plate XLVIII

Fig. 1 *Fasciculithus tympaniformis* Hay et Mohler; magn. 9000×

Fig. 2 *Fasciculithus billii* Perch—Nielsen — proximal side; magn. 9000×

Plate XLIX

Fig. 1, 2 *Heliolithus kleinpelli* Sullivan — proximal side. Fig. 1 magn. 8000×, Fig. 2 magn 7500×. In the top side of Fig. 2 *Neochiastozygus* sp. and. *Prinsius martinii* (Perch—Nielsen) Haq.

Plate L

Fig. 1 *Heliolithus kleinpelli* Sullivan — distal side; magn. 8000×

Fig. 2 *Heliolithus kleinpelli* Sullivan — proximal side; magn. 9000×

Plate LI

Fig. 1, 3, 4 *Prinsius martinii* (Perch—Nielsen) Haq — distal side; magn. 10 000×

Fig. 6 The same; magn. 8800×

Fig. 2, 5 *Prinsius martinii* (Perch—Nielsen) Haq — proximal side; magn. 10 000×

Plate LII

Fig. 1 *Toweius eminens* (Bramlette et Sullivan) Gartner — distal side. To the right *Prinsius martinii* (Perch—Nielsen) Haq — distal side; magn. 10 500×

Fig. 2 *Toweius* cf. *ocultatus* (Locker) Perch—Nielsen — distal side; magn. 10 000×

Plate LIII

Fig. 1 *Neochiastozygus* sp. — distal side; magn. 9000×

Fig. 2 *Zygodiscus sigmoides* Bramlette et Sullivan — distal side; magn. 9000×

Fig. 3 *Markalius* sp. 1 — proximal side; magn. 10 000 X
Fig. 4 *Toweius tovae* Perch—Nielsen — proximal side; magn. 5000 X
Fig. 5 *Toweius craticulus* Hay et Mohler — proximal side; magn. 15 000 X

Plate LIV
Fig. 1, 2 *Toweius* sp. — proximal side from various angles; magn. 10 000 X.

Photographs made under scanning — electron microscope JSM U3 at D. Štúr Institute of Geology Bratislava — by M. Švec.

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Hedviga Bystrická

Strednopaleocénne kokolity Západných Karpát

Resumé anglického textu

Paleogénne sedimenty Západných Karpát obsahujú lokálne bohaté nanoplanktónové spoločenstvá. Na výskyt eocénnych asociácií a ich stratigrafický význam už bolo poukázané (H. Bystrická 1963—1972). V novšej dobe bola zistená nanoflóra v strednopaleocénnych a vrchnopaleocénnych sedimentoch (H. Bystrická, 1973) a súdiac podľa výskytu foraminifér (O. Samuel — J. Salaj 1968, B. Leško — O. Samuel 1968) možno predpokladať jej prítomnosť aj v spodnopaleocénnych súvrstviach.

V predloženej práci je podaný opis druhov zistených v biofaciálnej zóne *Heliolithus kleinpelli*. Túto zónu definovali H. P. Mohler a W. W. Hay (1967) ako interval medzi prvým výskytom druhu *Heliolithus kleinpelli* po prvý výskyt druhu *Discoaster gemmeus*. Stratigraficky je zaraďovaná do stredného paleocénu. Podľa štandardného zónovania (E. Martini 1971) predstavuje zónu NP 6 a je stratigrafickým ekvivalentom vrchnej časti foraminiferovej zóny P3 *Globorotalia pusilla — Globorotalia angulata* a bazálnej časti zóny P4 *Globorotalia pseudomenardii* (W. A. Berggren 1964). V oblasti československých Karpát možno túto zónu korelovať so strednou časťou foraminiferovej zóny *Globorotalia pusilla pusilla* (O. Samuel—J. Salaj 1968).

V študovanom spoločenstve som okrem druhov typických pre túto zónu zistila aj 1 exemplár druhu *Discoaster gemmeus* Stradner, čo však nepovažujem za dostatočný dôvod pre zaradenie spoločenstva do superpozičnej zóny *Discoaster gemmeus*. Za príslušnosť do vrchnej časti zóny *Heliolithus kleinpelli* hovoria tieto fakty:

1. V spoločenstve je veľmi výrazne zastúpený vedúci druh tejto zóny — *Heliolithus kleinpelli* Sullivan.

2. Druhové zastúpenie ostatných členov spoločenstva je typické pre túto zónu a až na jediný spomínaný výskyt druhu *Discoaster gemmeus* Stradner sa v ňom ešte neobjavujú mladšie formy, ako *Discoaster helianthus* Bramlette et Sullivan, *Discoaster delicatus* Bramlette et Sullivan a *Discoaster aster* Bramlette et Riedel.

3. Podľa doterajších pozorovaní sa asociácie zóny *Discoaster gemmeus* v oblasti Slovenska vyznačujú veľmi bohatým výskytom vedúceho druhu tejto zóny — *Discoaster gemmeus* Stradner.

Zistenie biozóny *Heliolithus kleinpelli* v oblasti čsl. Karpát potvrdzuje doterajšie predpoklady o jej celosvetovom rozšírení.

Západné Karpaty • séria paleontológia (1) • P. 59—71 • GÚDŠ • Bratislava • 1975

Eva Planderová

ESM study of spore Ectexine in some recent species of the genus Aneimia and its application in Palinology

28 plates (I—XXVIII), 16 text-figs, Slovak summary

Abstract. In the present paper is reached the morphological description of some species of the genus *Aneimia,* by rasterelektron microscope. The species of studied genus is extremely frequent in Mesozoic and early Tertiary and therefore is particularly important to identify the species of this genus according to comparison with recent spores. This is the purpose of the study of the exine microstructure in some species of the genus *Aneimia.*

The authoress deals with the study of ectexine microstructure of spores of some species of the genus *Aneimia.* The existing literature presented the results of the study of some recent species of the genus *Aneimia* by optical microscope (M. Tardieu — L. Blot 1966) and of the fossil genus of the family *Schizeaceae,* which were denoted by an artificial generic name Cicatricosisporites (R. Pot. et Gell 1933).

The species of the genus extremely frequent in our Mesozoic and earlier Tertiary was not paid attention as yet. At present, the family *Schizeaceae* is regarded as relict. Species of the genus *Aneimia* grow in tropical and subtropical regions, and require a humid warm climate, such as was in our region by the end of the Mesozoic and during thethe earlier Cenozoic.

Therefore it is particularly important to identify the species of this genus according to the study of the recent spores. This is the purpose of the study of the exine microstructure of spores of some species of the genus *Aneimia.* The results of examination by optical microscope and by ESM are presented here. The basical and characteristic feature of spores of the genus *Aneimia* is their structure and ornamentation of the exine. In the species described are mostly trilete spores with conspicuous striate sculpture of ectexine. Striae are either smooth or almost smooth, or sometimes with variously long and formed excrescences on their surface.

The size of spores examined is 55—110 μ.

The terminology used for morphological description of the spore is not sufficient for the description of spores examined by ESM. Therefore the original terminology was completed by some terms which were most

RNDr. E. Planderová, CSc., Geologický ústav Dionýza Štúra, Mlynská dolina 1, Bratislava

suitable for the description of the character of a morphological feature. The distinguishing features of the species are the form of spores, the size and sculpture of the exine.

The structure of the exine in the species examined consists of the uppermost layer, tho so-called ectexospore (ect), of the middle part of the mesexospore (mes) and of the lowermost part — the endexospore (end). Under the transmissional electronic microscope the structure of the exine looks as showed in Fig. 2. The ectexospore is constructed differently, in the species *Aneimia* the heightened parts — muri (mu) alternate with lowered — striae (st).

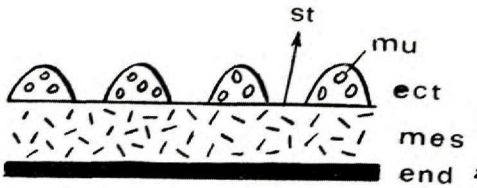


Fig. 1

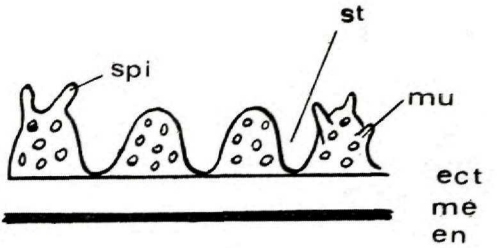


Fig. 2

On the muri are also secondary excrescents (spinulae) sometimes. They are also important as systematic features in differenciating the species, and in comparison with fossil spores denoted by artificial names.

Of the Earlier Paleogene very characteristic is the species *Cicatricosisporites dorogensis* R. Pot. et Gell. 1933. It was also quoted, described and depicted by ESM by S. K. Srivastava (1972).

The artificial species mentioned is considerably resembling the recent species *Aneimia schimperiana* Presl. which I have examined by optical and stereoscan microscope. Most probably the fossil species was identic with the recent species mentioned.

In the present work I present the description of 13 species of *Aneimia*, viz.:

Aneimia schimperiana Presl.
Aneimia longistipes Christ.
Aneimia sachrae mortae Christ.
Aneimia anthriscifolia Schrad.
Aneimia fraxinifolia Raddi
Aneimia radicans Raddi
Aneimia collina Raddi
Aneimia phyllitides Sw.
Aneimia hirsuta Sw.
Aneima rotundifolia Schrad.
Aneimia aurita Sw.
Aneimia microphylla Sw.
Aneimia hirta Sw.
Aneimia centralis Sw.

The spores were acetolysed and photographed in glycerine — gelatine by means of inverse oil.

Aneimia schimperiana Presl.
Pl. I, Fig. 1—2; Pl. II, Fig. 1—4

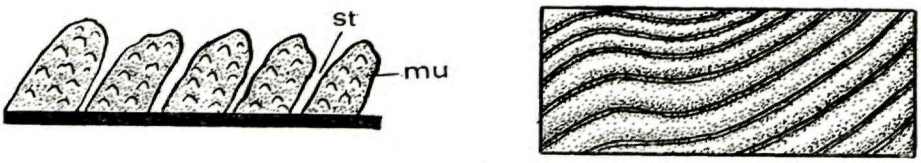


Fig.3

A trilete spore of triangular shape. The size of the spore is about 100 μ. The spores show striate sculpture whose arrangement traces the Y-scar. The muri are 7 μ wide, regular, slightly undulated on their margins. Optical microscope shows secondary granulate sculpture (Pl. I, Fig. 1), of small excrescents. They may be observed at multiple magnification of the ectexospore. The spinulae are 0,5—1 μ in average, aligned close along one another. The lower part of the ectexospore (striae), visible at multiple magnification, also shows minute excrescents.

Aneimia longistipes Christ.
Pl. III. Fig. 1—2; Pl. IV. Fig. 1—4

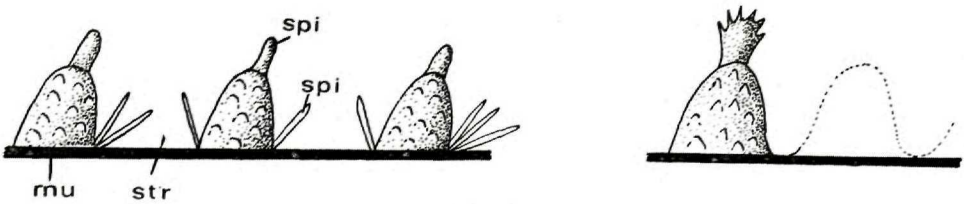


Fig. 4

Spores of the species are trilete, rounded, of triangular shape. The size of spores is around 100 μ. The sculpture of the ectexospore is striate. On the muri aligned in 10—12 μ distance along one another are spinulae 7—10 μ long. When examined by ESM, visible are very regular muri with characteristic pointed spinules. Besides those on the sides of the muri are narrow, forked, 6—7 μ long, rod-like excrescents. They grow out in another direction than spinulae, on the top of the muri.

The morphology of the spinulae on the tops of the muri is important for the species characteristics. The height of the spinulae is 10 μ, their width — 2,5 μ. At the end the spinulae are variously serrated. Lateral excrescents are 0,7 μ wide; with isolated secondary ledges in their top. The exine among striae, i.e. the furrow is almost smooth, shallow, transversally grooved (Fig. 4). Knob-like excrescents are quite rare.

Aneimia sachrae mortae Christ.
Pl. V, Fig. 1—3

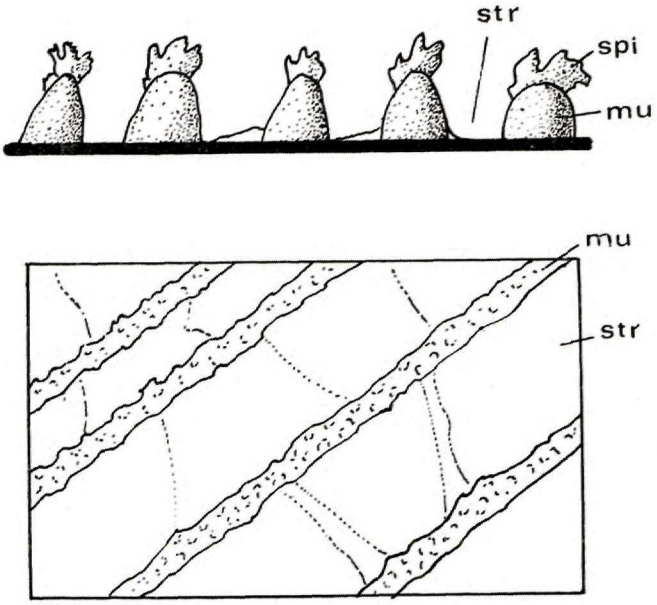


Fig. 5

A trilete spore of triangular shape. Size: 100—110 μ. The Y-mark extends to 1/3 of the spore body. The sculpture of the ectexospore is striate. The muri are regular, narrow, grooved. They are 7—8 μ wide. The striae among the muri are broader (9—10 μ); on their surface are dense spinulae, irregularly aligned, in places thinned into ravelled rosette-shaped forms. They are rounded at ends, forming globular clusters.

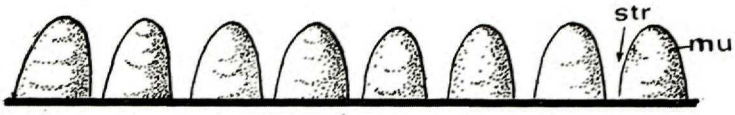
The shallow striae among the muri have also small excrescents passing sometimes into broader ribs connecting the muri Pl. V, Fig. 3.

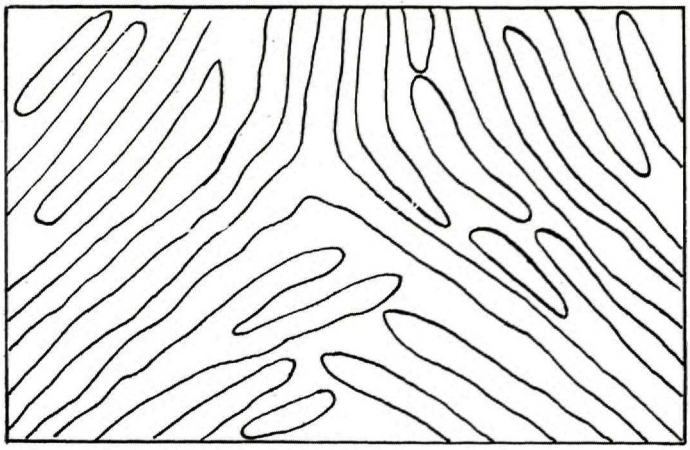
The sculpture is absolutely different from other species of the genus Aneimia.

Aneimia anthriscifolia Schrad.
Pl. VI, Fig. 1, 2; Pl. VII, Fig. 1, 2

A triangular trilete spore. Size: 90 μ. The sculpture is distinctly striate. The Y-mark extends to 4/5 of the spore body of the exospore. When examined by optical microscope, showed is striate sculpture with very broad muri and narrow-striae among them. The sculpture of the muri is fine-punctate. ESM shows the character of sculpture at multiple magnification (6000 X, Fig. 2) and at lesser magnification (600 X, Fig. 1). At lesser magnification the striae are wide, parallel, fine-knobbed. A multiple magnification shows irregularly cyllindrical striae, ring-thickened, and in places slightly thinned. Differences in thickness and in the shape of the muri may only be observed at multiple magnification.

The muri have minute spinulae as on the Y-mark. The width of the muri is 2,5 μ, their height — 2,5 μ.





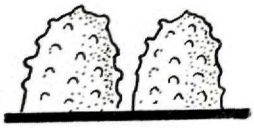
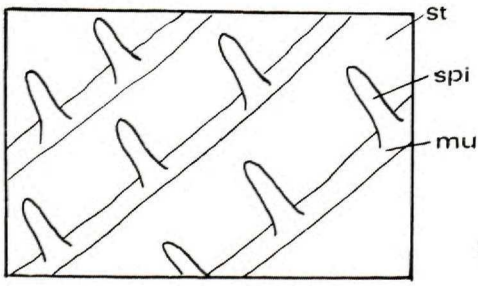


Fig. 6

Aneimia fraxinifolia R a d d i.
Pl. VIII, Fig. 1—2; Pl. IX, Fig. 1—2

A trilete spore. Size: 55—60 μ. The sculpture is striate with long, rod-like spinulae with rounded ends. The Y-mark extends to 4/5 of the spore body. When examined by ESM, the ectexospore shows rather shallow muri forming ribbed sculpture. By multiple (6000 X—8000 X) magnification we may observe that the ectexospore is irregularly fine-papillate, in places even shallow-grooved. Spinulae on the muri are up to 5μ long and 1,7 μ wide. They are not smooth-as showed by optical microscope, but equally papillate as the ectexospore of the muri. At the ends of the spinulae are also secondary globular excrescents too small to affect the shape of the excrescents.



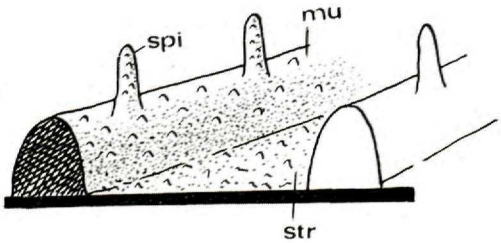


Fig. 7

Aneimia radicans R a d d i.
Pl. X, Fig. 1—6; Pl. XI, Fig. 1—3

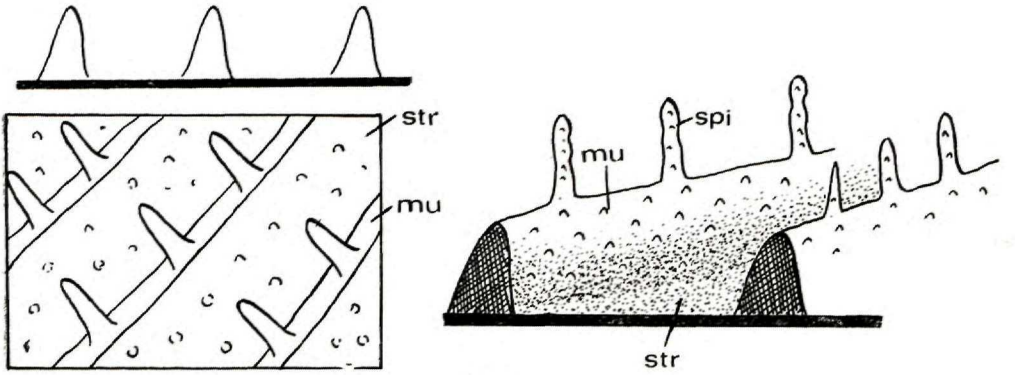


Fig. 8

A trilete spore of the size of 75 μ including spinulae. The size of the spore body is 50 μ. The sculpture is striate. Very distinct are excrescents. They are visible also by optical microscope. An equatorial view shows their circular diameter (Pl. X, Fig. 3). When observed by ESM, the exine shows few muri, comparatively narrow, with shallow striae among them. In places they are crossed with transversal riblike eminences connecting the striae. The ectexospore is not smooth, it has irregularly distributed fine globular granules on its surface. They are rather loosely distributed on the ectexospore and on the excrescents of the eminences among the muri. The excrescents are 9—10 μ long, cyllindrical, rounded at points. Some of them are provided with small secondary spinulae on their points. They are, however, indistinguishable by optical microscope.

Aneimia collina R a d d i.
Pl. XII, Fig. 1—4; Pl. XIII, Fig. 1—3

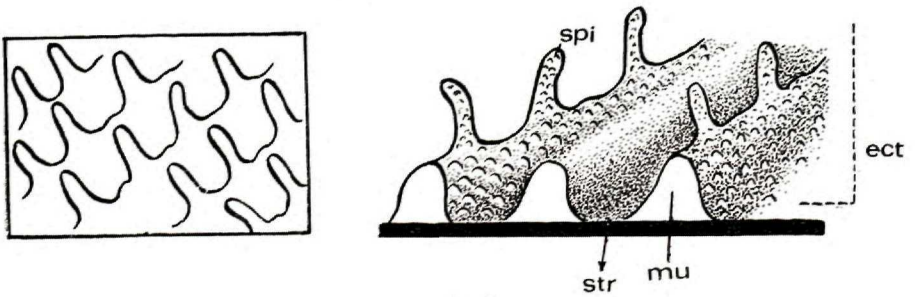


Fig. 9

A trilete spore of the size of 85—90 μ. The size of the spore body is about 60 μ. The spinulae are 12—14 μ long. Optical microscope shows a very complicated sculpture of the ectexospore, and mutually overlapping spinulae of the ectexospore and of the muri.

The examination of the ectexine by ESM shows less distinct striate sculpture than in other species examined. The striae are garland-like

heighthened in places of long spinulae of the ectexospore. The ectexospore is thickly papillate as seen by multiple magnification (10 000 X, Fig. 3). The spinulae, being long, are intertwined and seem unsettled. The sculpture of the ectexospore differs in many features from other species examined.

Aneimia phyllitidis S w.
Pl. XIV, Fig. 1—2; Pl. XV, Fig. 1, 2; Pl. XVI, Fig. 1, 2

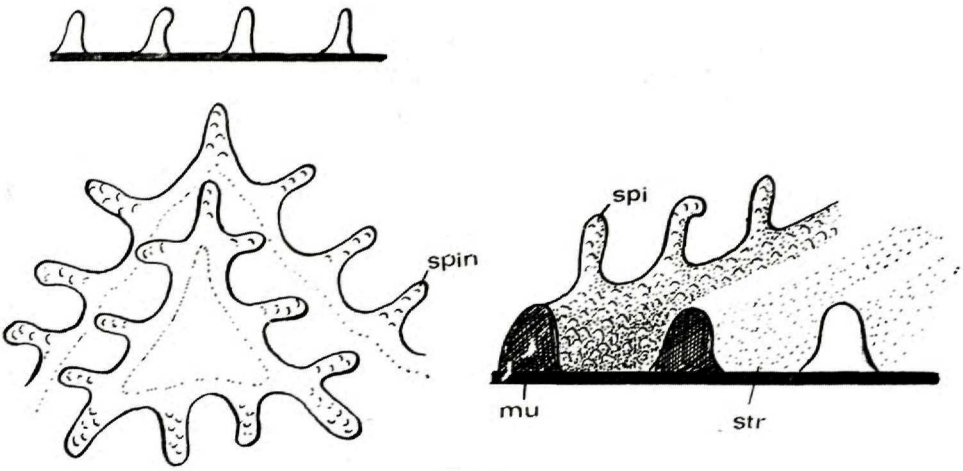


Fig. 10

A trilete spore of the size of 70—80 μ; including the spinulae of the ectexospore. The spinulae are 12—13 μ long. The Y-mark extends to 5/5 of the spore body. The sculpture is striate, with very conspicuous spinuale of the ectexine on the muri. The examination by optical microscope shows a punctate sculpture of the ectexine (Pl. XIV, Fig. 2). The sculpture of the ectexospore under ESM is striate, with regular alignment of the muri and the striae. They are comparatively rarely distributed. On the muri are spinose ledges of the exine. They are long, cyllindrical, rounded at their ends. The secondary sculpture is missing. The sculpture of the exospore, as observed by ESM at a lesser magnification is smooth, only slightly papillate. At a greater magnification (4000 X) it is seen to be covered with broad, irregular flat papillate spinulae. They are composed of small granules, and form small facets separated by shallow grooves. The microstructure is different from that of the other species of the genus Aneimia described.

Aneimia hirsuta S w.
Pl. XVII, Fig. 1—2; Pl. XVIII, Fig. 1—3

A trilete spore of the size of 80—90 μ. Its shape is circular-triangular. The sculpture of the exospore is distinctly striate, also when examined by optical microscope. The Y-mark extends to 4/5 of the spore body. The

ectospore is comparatively smooth, without spinose ledges on the muri, as observed in some species of the genus *Aneimia*. The muri on the corners of the spore form more conspicuous ledges. They are cyllindrical slightly undulated. The surface of the ectexospore on the muri is papillate. The grooves among the muri are deep, with fine, rarely dispersed, rounded granules, observable at greater magnification.

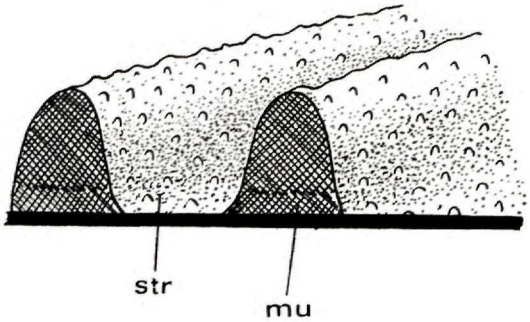


Fig. 11

Aneimia rotundifolia Schrad.
Pl. XIX, Fig. 1—4

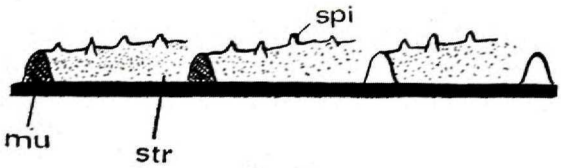


Fig. 12

An almost globular, trilete spore, of the size of 75—80 μ. In its sculpture and shape it differs from the other species of the genus Aneimia described. The sculpture is striate, yet indistinct. When examined by optical microscope (Fig. 1—2), only small, circular spinulae are visible. Under ESM a distinct striate sculpture may be observed. The muri are very shallow, marked only by short, thin spinose ledges extending between poles in regular, scarce rows. In their shape and sculpture they differ from the other spores of the genus Aneimia examined.

Aneimia aurita Sw.
Pl. XX, Fig. 1—4; Pl. XXI, Fig. 1—2

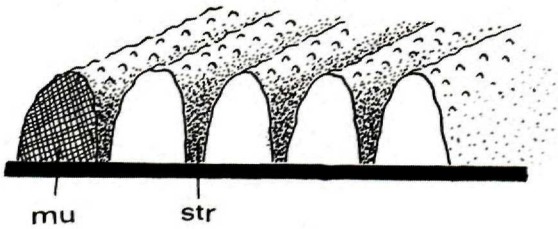


Fig. 13

A triangular trilete spore. Size: 60—70 μ. By optical microscope its distinct sculpture may be observed, and the Y-mark extending to 5/5 of the spore body. On the striae the ectexine is thickly granulate. ESM shows conspicuous striate sculpture of ectexospore. The muri are cylindrical, broad, separated by narrow, deep striae. The spinulae of the ectexospore are missing. The whole ectexospore is distinctly granulate, which appears as irregular papillae of varied size at great magnification (Pl. XXI, Fig. 2).

Aneimia microphylla Sw. Fee.
Pl. XXII, Fig. 1—2; Pl. XXIII, Fig. 1—2; Pl. XXIV, Fig. 1—3

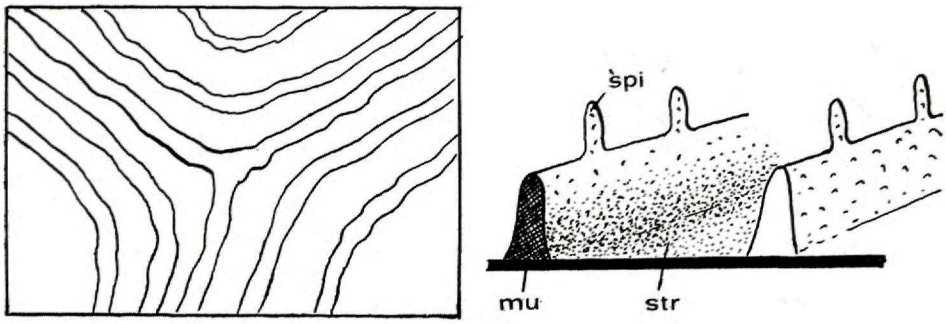


Fig. 14

A triangular trilete spore. The Y-mark extends to 5/5 of the spore body. Size: 90—100 μ. The sculpture is ornamental, striate, with comparatively, irregularly arranged spinulae of the ectexospore on the muri. Examination of the exospore microstructure under ESM showed spinulae more thickly arranged on the muri in the corners of the spore body than on the outer side of the Y-mark. The spinulae are 5 μ long and 4 μ broad. The ectexospore is covered with small globular granules. The muri are parallel, cylindrical with irregularly arranged spinulae. The striae are smooth and broader than the muri. The spores of the species differ in their sculpture from other species of the genus Aneimia.

Aneimia hirta Sw.
Pl. XXV, Fig. 1—2; Pl. XXVI, Fig. 1—4

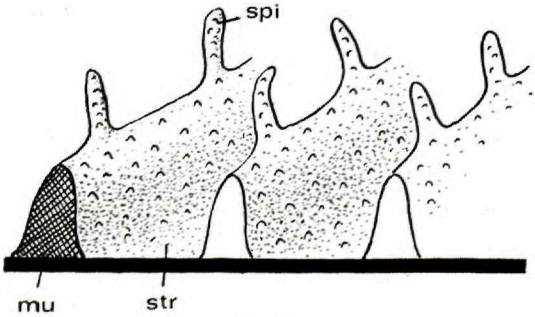


Fig. 15

A trilete spore of rounded triangular shape. Size: 80—90 μ. The Y-mark extends to 5/5 of the spore body. The muri are narrow, with long ledges variously twisted. Under ESM observable is ornamental regular sculpture of the ectexospore. The sculpture consists of regular muri alternating with striae. On the striae are spiny ledges aligned in equal distance from one another. The ledges are 8—9 μ long, scaly. Microstructure of the exospore is smooth, without secondary ledges.

Aneimia centralis S w.
Pl. XXVII, Fig. 1—2; Pl. XXVIII, Fig. 1—2

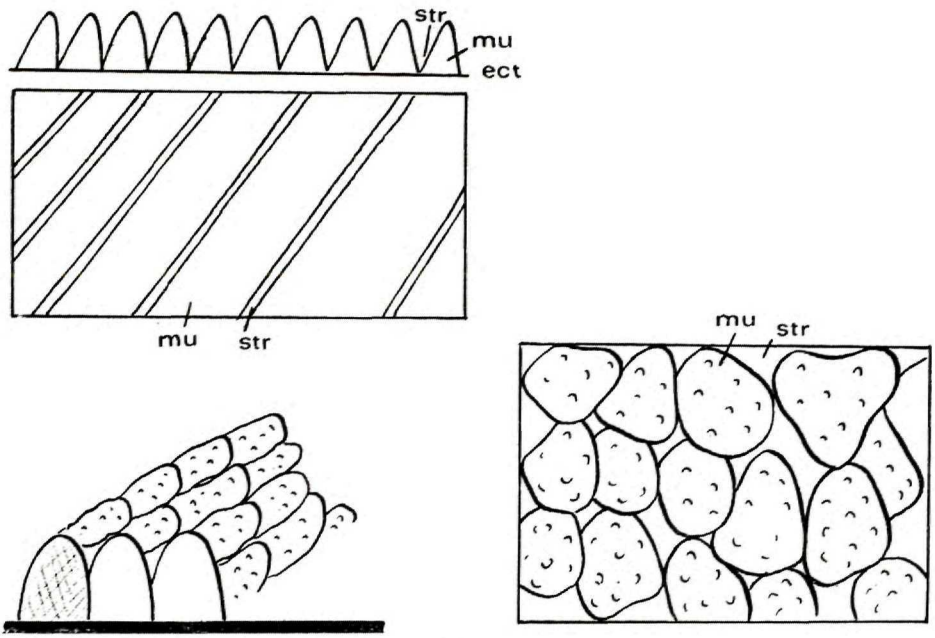


Fig. 16

A trilete spore with very distinct sculpture. Size: 90 μ. Under optical microscope distinct is striate sculpture with broad muri and very narrow striae. The ectexine examined under ESM is quite different from that of the species described above. The muri are less distinct, and consist of large flat facets overlapping one another with their margins. The shape of the facets is irregular, and on their surface is a secondary, very fine-granulate sculpture. A general view shows that even on the exospore with such a structure are the muri, more or less regularly aligned in rows; only the striae among them are indistinct. Under optical microscope more distinct is striate sculpture.

In their shape, and especially in their sculpture the spores of the species differ considerably from the species of the genus Aneimia, as described above.

Explanations to plates I—XXVIII

Plate I *Aneimia schimperiana*
Fig. 1—2 photographed under OM, magnified 1200×

Plate II *Aneimia schimperiana*
Fig. 1 photogr. under ESM, magn. 800×, Nr. 2487
Fig. 2 photogr. under ESM magn. 6000×, Nr. 2488
Fig. 3 photogr. under ESM magn. 800×, Nr. 2485
Fig. 4 photogr. under ESM magn. 3000×, Nr. 2486

Plate III *Aneimia longistipes*
Fig. 1—2 photogr. under OM, magn. 1000×

Plate IV *Aneimia longistipes*
Fig. 1 photogr. under ESM, magn. 1000×, Nr. 2477
Fig. 2 photogr. under ESM, magn. 3000×, Nr. 2478
Fig. 3 photogr. under ESM, magn. 1000× Nr. 2479
Fig. 4 photogr. under ESM, magn. 3000×, Nr. 2480

Plate V *Aneimia sachrae mortae*
Fig. 1 photogr. under OM, magn. 1400×
Fig. 2 photogr. under ESM, magn. 950×, Nr. 2475
Fig. 3 photogr. under ESM, magn. 3000×, Nr. 2476

Plate VI *Aneimia anthriscifolia*
Fig. 1—2 photogr. under OM, magn. 1000×

Plate VII *Aneimia anthriscifolia*
Fig. 1 photogr. under ESM, magn. 600×, Nr. 2472
Fig. 2 photogr. under ESM, magn. 3000×, Nr. 2469

Plate VIII *Aneimia fraxinifolia*
Fig. 1 photogr. under optical microscope, magn. 1000×
Fig. 2 photogr. under ESM, magn. 1400×, Nr. 2465

Plate IX *Aneimia fraxinifolia*
Fig. 1 photogr. under ESM, magn. 3000×, Nr. 2466
Fig. 2 photogr. under ESM, magn. 6000×, Nr. 2467

Plate X *Aneimia radicans*
Fig. 1—6 photogr. under OM, magn. 1000×

Plate XI *Aneimia radicans*
Fig. 1 photogr. under ESM magn. 1200×, Nr. 2489
Fig. 2 photogr. under ESM magn. 3000×, Nr. 2490
Fig. 3 photogr. under ESM magn. 6000×, Nr. 2491

Plate XII *Aneimia collina*
Fig. 1—2 photogr. under OM, magn. 1000×
Fig. 4 photogr. under ESM, magn. 1000×, Nr. 2484

Plate XIII *Aneimia collina*
Fig. 1 photogr. under ESM, magn. 1000×, Nr. 2481
Fig. 2 photogr. under ESM, magn. 3000×, Nr. 2482
Fig. 3 photogr. under ESM, magn. 10 000×, Nr. 2483

Plate XIV *Aneimia phyllitidis*
Fig. 1—2 photogr. under OM, magn. 1000×

Plate XV *Aneimia phyllitidis*
Fig. 1 photogr. under OM, magn. 1000×
Fig. 2 photogr. under ESM, magn. 1400×, Nr. 2494

Plate XVI *Aneimia phyllitidis*
Fig. 1 photogr. under ESM, magn. 1400×, Nr. 2492
Fig. 2 photogr. under ESM, 4000×, Nr. 2493

Plate XVII *Aneimia hirsuta*
Fig. 1 photogr. under OM, magn. 1200×

Plate XVIII *Aneimia hirsuta*
Fig. 1 photogr. under ESM, magn. 1000×, Nr. 2495
Fig. 2 photogr. under ESM, magn. 3000×, Nr. 2496
Fig. 3 photogr. under ESM, magn. 6000×, Nr. 2497

Plate XIX *Aneimia rotundifolia*
Fig. 1—2 photogr. under OM, magn. 1000×
Fig. 3 photogr. under ESM, magn. 1000×, Nr. 2449
Fig. 4 photogr. under ESM, magn. 6000×, Nr. 2448

Plate XX *Aneimia aurita*
Fig. 1—4 photogr. under OM, magn. 1000×

Plate XXI *Aneimia aurita*
Fig. 1 photogr. under ESM, magn. 2800×, Nr. 2462
Fig. 2 photogr. under ESM, magn. 4000×, Nr. 2463

Plate XXII *Aneimia microphylla*
Fig. 1—2 photogr. under OM, magn. 1000×

Plate XXIII *Aneimia microphylla*
Fig. 1 photogr. under ESM, magn. 1000×, Nr. 2453
Fig. 2 photogr. under ESM, magn. 3000×, Nr. 2454

Plate XXIV *Aneimia microphylla*
Fig. 1 photogr. under ESM, magn. 1000×, Nr. 2455
Fig. 2 photogr. under ESM, magn. 4000×, Nr. 2456

Plate XXV *Aneimia hirta*
Fig. 1 photogr. under OM, magn. 1000×

Plate XXVI *Aneimia hirta*
Fig. 1 photogr. under ESM, magn. 1000×, Nr. 2458
Fig. 2 photogr. under ESM, magn. 3000×, Nr. 2459
Fig. 3 photogr. under ESM, magn. 3000×, Nr. 2460
Fig. 4 photogr. under ESM, magn. 6000×, Nr. 2461

Plate XXVII *Aneimia centralis*
Fig. 1—2 photogr. under OM, magn. 1000×

Plate XXVIII *Aneimia centralis*
Fig. 1 photogr. under ESM, magn. 1000×, Nr. 2450
Fig. 2 photogr. under ESM, magn. 3000×, Nr. 2451

Translated by E. Jassingerová
Reviewed by P. Snopková

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Eva Planderová

Aplikácia štúdia mikroštruktúry exiny niektorých recentných druhov rodu Aneimia pomocou elektronscanového mikroskopu v palinológii

Resumé anglického textu
tab. I—XXVIII

V práci sa pojednáva o štúdiu mikroštruktúry exiny niektorých druhov rodu *Aneimia*. Tento rod bol veľmi rozšírený u nás v druhohorách a v starších treťohorách, a preto je dôležité porovnávať štruktúru fosílnych spór so spórami recentných druhov. Napr. porovnaním umelého druhu *Cicatrisporites darogensis* R. Pot. et Gell. 1933 s recentnými spórami sa podarilo s najväčšou pravdepodobnosťou usúdiť, že ide o druh *Aneimia schimperiana* Presl. Určenie fosílnych spór a peľov na základe porovnania s recentnými druhmi má veľký význam pri paleoekologickom aj paleogeografickom vyhodnotení prostredia.

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Ladislava Ožvoldová

Upper Jurassic Radiolarians from the Kysuca Series in the Klippen Belt

5 plates (XCIX—CIII), Slovak summary

Abstract. Presented are results of the study of radiolarians from radiolarites of the Kysuca Series in the Klippen Belt, from the hill »Keblie« near Púchov. In an association of radiolarians indicating Upper Jurassic to Lower Cretaceous age, described are two new genera — *Heitzeria* nov. gen., *Spinosicapsa* nov. gen., and six new species — *Staurolonche grandipora* n. sp., *Heitzeria spinosa* n. sp., *Spinosicapsa ceblienica* n. sp., *Dictyomitra pinna* n. sp., *Lithocampe ruesti* n. sp., *Lithostrobus brevicostatus* n. sp.

Introduction

So far only a partial attention has been paid in many lithological and stratigraphical papers to occurrences of radiolarians. As a predominant organic group, radiolarians characterize some petrographical types of rocks, and occur also in associations of planktonic organisms in more stratigraphic formations. Their significance in stratigraphy has not been studied in this country.

At present, the world investigations are considerably facilitated by modern devices, as for example by the scanning-electron microscope, and the morphologically varied organic group of radiolarians may be examined in detail, with respect to individual stratigraphic formations.

Information on the radiolarian association from radiolarites from the hill »Keblie« near Púchov, as presented here, is an introduction to a systematical investigation of the organic group in individual stratigraphical-lithological units of the West Carpathians.

Radiolarians from the radiolarites of the locality quoted, were prepared by treating with HF.

The photos of all the forms described in the systematic part were made by the scanning-electron microscope at GÚDŠ, Bratislava.

RNDr. L. Ožvoldová, Prírodovedecká fakulta UK, Katedra geológie a paleontológie (Department of geology and paleontology, Faculty of Natural History, Comenius University), Gottwaldovo n. 2, Bratislava

Lithological and stratigraphical characteristics of the sequence

It is a merit of Academician D. Andrusov, that I. Heitzerová (1930) carried out the only investigation of radiolarians from the Slovak West Carpathians, and besides several localities did also examined thin sections from radiolarites of the locality, including a rich association of genera and species.

Radiolarites are in a Doggerian — Malmian bed sequence of the Kysuca Series in the Klippen Belt. Basing upon analogy with radiolarites in the Podhradská dolina valley (north of Pruské), between two layers of nodular limestones containing ammonites, they are referred to Kelloway —Argovian as for their age (A. Began 1959). They are red and grey--green radiolarites, and radiolarians in them are filled with fibrous chalcedony or with finegrained or cryptocrystalline quartz, and to a smaller extent partially or completely with calcite.

Evaluation of the radiolarian association

In the rich radiolarian association, spumellines slightly dominate over nasselines, as regards the number of forms and of species.

Among medium-sized forms of spumellines predominant is the family *Liosphaeridae* including an abundant species *Cenosphaera* cf. *micropora* Rüst with thick-walled test, and the family *Astrosphaeridae,* including the genus *Conosphaera* — *Conosphaera sphaeroconus* Rüst, *C. haeckeli* Aliev. Other forms of the family *Liosphaeridae* — *Ethmosphaera inaequalis* Rüst, *Liosphaera* sp., and the families *Astrosphaeridae* — *Heliosphaera* sp., are comparatively smaller, and less abundant.

The family *Staurosphaeridae* is represented by the species *Staurosphaera sedecimporata* Rüst, *Staurolonche grandipora* n. sp., the family *Triposphaeridae* — by infrequent *Triposphaera* sp., all being medium — to small in size.

The family *Ellipsidiidae* is represented by inabundant species *Ellipsidium microporum Rüst,* the family *Druppulidae* — by *Protoxiphotractus* (?) *fisheri* Pessagno. Among the family *Sponguridae* frequent is the genus *Spongoprunum,* from the family *Phacodiscidae* — representatives of the genus *Triactis* — the species *Triactis* cf. *ilsedensis* Rüst, *Triactis* sp.

Very frequent are representatives of the family *Euchitoniidae* — including the forms *Rhopalastrum henlei* Rüst, *R. rectangulum* Rüst, *Hagiastrum egregium* Rüst, *H. squama* Kozlova, *Dictyastrum* sp., *Histiastrum* sp., *Flustrella* sp., less frequent is the family *Spongodiscidae* — ? *Paronaella* cf. *ewingi* Pessagno.

Among nasselines frequent are larger forms of the family *Theopiliidae-Heitzeria spinosa* n. sp., isolated *Podocyrtis* sp., *Triacartidae-Spinosicapsa ceblienica* n. sp. and *Theocorythidae* — *Tricolocapsa* cf. *elongata* Pantanelli.

Most frequent among nasselines are small tests of the family *Stichocorythidae* — *Dictyomitra montana* Neviani, *D. multicostata* Zittel, *D. pinna* n. sp., *Lithocampe haeckeli* (Pantanelli), *L. ruesti* n. sp., *L. rectilineum* (Rüst), *Lithostrobus brevicostatus* n. sp. Isolated are occurrences of *Anthocorys* sp. from the family *Artophormididae.*

The association discussed represents and assemblage of forms characteristic of the Upper Jurassic — Lower Cretaceous.

Since a detailed stratigraphic research of the Triassic and Jurassic radiolarians is not so complete as that of the Tertiary associations, the associations under study cannot be exactly stratigraphically ranged. The research of the Mesozoic radiolarians was considerably extended by A. I. Žamojda (1972) by examination of thin sections. Photographs made by the scannig electron microscope show such details of structural elements, that in most be identified with the thin sections.

The systematic part

The systematic classification of the taxons, applied was the system of A. SH. Campbell (1954).

Genus *Cenosphaera* Ehrenberg, 1854
Cenosphaera cf. *micropora* Rüst, 1889
Plate XCIX, Fig. 1, 1a

1889 *Cenosphaera micropora* n. sp. — D. Rüst: Neue Beiträge zur Kenntniss der fossilen Radiolarien etc., p. 5, tab. 1, fig. 1.

Description: The spherical shell is large, with numerous small pores of hexagonal shape, aligned in regular lines. The number of pores in an equatorial line on one hemisphere is 20—25.

Dimensions: Diameter of the shell 0,22—0,28 mm; diameter of pores 0,007 mm; width of sutural lines 0,005 mm; thickness of the wall 0,040 mm.

Remarks: In contrast to the holotype, whose pores are irregular round, our forms have hexagonal pores, and the shell is also smaller (in the holotype 0,326—0,378 mm).

Stratigraphical range: The holotype decribed is recorded from the Neocomian in the Italian Alps. The same author quoted it also from the Upper Jurassic.

Genus *Ethmosphaera* Haeckel, 1862
Ethmosphaera inaequalis Rüst, 1899
Plate XCIX, Fig. 3

1899 *Ethmosphaera inaequalis* n. sp. — D. Rüst: Neue Beiträge zur Kenntniss der fossilen Radiolarien etc., p. 5, tab. 1, fig. 2.

Description: A round shell of medium size. On its surface are dense tubules representing ascending pores above the surface of the shell. The termination of tubules is slightly conical.

Dimensions: The shell diameter 0,20—0,24 mm: the length of tubules about 0,02 mm; the width of the opening 0,009 mm.

Remarks: Our forms differ from the holotype in somewhat greater shell diameter (holotype 0,158 mm).

Stratigraphical range: The holotype described is recorded from the Upper Liassic to Lower Doggerian coprolites from Ilsede (near Hannover).

Genus *Staurolonche* Haeckel, 1882
Staurolonche grandipora n. sp.
Plate C, Fig. 1

Holotype: Nr. 2797, pl. C, fig. 1. Deposited in the Department of geology and paleontology, Faculty of Natural History, Comenius Univ., Bratislava. The film is deposited at Dionýz Štúr Institute of geology, Bratislava.
Type locality: The hill Keblie near Púchov.
Type level: Kelloway — Argovian, radiolarites of the Kysuca Series in the Klippen Belt.
Denomination: After the large pores of the outer shell.
Material: 20 forms

Diagnosis: Two concentric lattice shells, cubiform, with four main radial spines, and with large pores on the outer shell.

Description: The form consists of two concentric lattice shells, cubiform, with markedly concave lateral walls and slightly convex bases. On each of the four lateral edges a thick spine projects. The spines are arranged in a cross. The outer shell pores are large, of varied size. In corners and in the middle of the base is always a large, oval pore. Two smaller oval pores are at each edge of the base. Another two smaller pores are in the middle of the base, in a direction perpendicular to the elongation of the large central pore. The inner shell pores are small, dense. Spines consist of three longitudinally placed ridges separated by grooves. The spines are rounded on their ends. The lenght of two adjacent spines is always the same.

Dimensions:	Holotype (mm)	Paratypes (mm)
Width of shell	0,13	0,11—0,14
Width of shell in narrowed part	0,12	0,10—0,13
Length of spines	3,13	0,12—0,14
	0,10	0,09—0,11
Diameter of outer shell large pores	0,034	
Diameter of outer shell smaller pores	0,011	
Diameter of inner shell pores	0,005	

Remarks: By the form of its shell, and partially by the outer shell pores the species described resembles Staurosphaera sedecimporata Rüst from which it differs in possessing the inner shell, in differently arranged pores in the middle part of the outer shell base, and in the form and length of spines.

Genus *Conosphaera* Haeckel, 1882
Conosphaera haeckeli Aliev, 1965
Plate XCIX, Fig. 2

1965 *Conosphaera haeckeli* n. sp. — Ch. Š. Aliev: Radioljarii nižnemelovych otloženij etc., p. 23, tab. 2, fig. 1.

1972 *Conosphaera* aff. *haeckeli* Kh. Aliev — A. I. Žamojda: Biostratigrafija mezozojskich kremnistych tolšč etc., p. 109, tab. 11, fig. 6; tab. 13, fig. 6, 7.

Description: A spherical shell of medium size, with conic protuberances penetrated with small, scarce circular pores. The number of protuberances is 28—30 per hemisphere.

Dimensions: Shell diameter 0,20—0,24 mm; height of protuberances 0,014 mm; width of protuberances 0,04 mm; pore diameter 0,006 mm.

Stratigraphical range: The holotype comes from the Upper Albian in Azerbaidjan. In the east of the U.S.S.R. it was found in the Upper Jurassic — Lower Cretaceous.

Genus *Triactis* Haeckel, 1882
Triactis cf. ilsedensis Rüst, 1888
Plate C, Fig. 2

1888 *Triactis Ilsedensis* Rüst — D. Rüst: Beiträge zur Kenntniss der fossilen Radiolarien etc., p. 197.

Description: Single lenticular latticed cortical shell and simple medullary shell of medium size. The cortical shell pores are round arranged concentrically. The lattice of the cortical shell connects with prominent sharp nodes in a regular hexagonal meshwork. Three thick spines are of equal length. In cross section they are quadrangular, with four longitudinal ridges and deep grooves among them.

Dimensions: The shell diameter 0,14—0,16 mm; the length of spines 0,12—0,14 mm; the pore diameter 0,007 mm.

Remarks: Our forms differ from the holotype in thick spines with ridges. Their shape is not mentioned in the diagnosis of the holotype. On the surface of the holotype shell are short thorns which may be identic with sharp nodes of the latticed cortical shell in our forms. The differences are most likely due to incomplete examination under optical microscope.

Stratigraphical range: The holotype was described from the Upper Liassic — Lower Doggerian of coprolites from Ilsede (near Hannover).

Genus *Paronaella* Pessagno, 1971
? *Paronaella* cf. *ewingi* Pessagno, 1971
Plate C, Fig. 3

1971 ? *Paronaella ewingi* n. sp. — E. A. Pessagno: Jurassic and Cretaceous *Hagiastridae* etc, p. 47, tab. 19, fig. 2—5.

Description: The shell consists of a small central area and of three elongated, thin rays, with expanded ovate tips. At the end of each ray, one central spine runs out, and 4—6 smaller lateral spines. The meshwork on the rays is formed of square to rectangular frames arranged in two markedly longitudinal rows. Pore frames forming bars

connect to prominent nodes. Expanded tips of rays possess a spongy polygonal meshwork. Rays are quadrangular in cross section.

Dimensions: Length of rays 0,22—0,29 mm; 0,20—0,26 mm; 0,20 to 0,26 mm; interradial angles about 120°.

Remarks: The form described is closely related to the species *Chitonastrum tricuspidatum* Rüst and ? *Paronaella ewingi* Pessagno. From both it differs in less long rays, and from the first one also in more spines.

Stratigraphical range: The species is only recorded from the type locality of the Tithonian in California.

Genus *Heitzeria* nov. gen.
Type species *Heitzeria spinosa* n. sp.

Denomination: After I. Heitzer, who was the first to study radiolarians from the locality.

Diagnosis: The shell consists of three chambers. The first chamber--cephalis is small, conical, with an apical horn, the second chamber--thorax is broad, oval, with three radially arranged apophyses. The third chamber-abdomen is slender, closed by a terminal spine.

Remarks: *Heitzeria* nov. gen. differs from formally similar genera — *Urocyrtis Pantanelli* and *Pterocorys* Haeckel closed at the end by the third chamber — and by the terminal spine. From the first genus it differs also in possessing three radially arranged apophyses on the second chamber.

Heitzeria spinosa n. sp.
Plate CI, Fig. 2

Holotype: Nr. 2819, pl CI, fig. 2a. Deposited at the department of geology and paleontology, Faculty of Natural History, Comenius Univ., Bratislava. The film is deposited at Dionýz Štúr Institute of geology, Bratislava.
Type locality: The hill Keblie near Púchov
Type level: Kelloway — Argovian; radiolarites of the Kysuca Series in the Klippen Belt.
Denomination: according to spines
Material: 15 forms

Diagnosis: The shell is divided into three chambers. The first chamber-cephalis is conical; the second chamber-thorax is broad, and the third chamber-abdomen is tubular. The first and the third chambers terminate with a thorn with 3—4 short spines on their ends. On the second chamber are three radially arranged apophyses with the same spinal termination.

Description: The first chamber — of the latticed shell is short, conical, terminated with a thick apical horn ending with 3—4 short spines. The second chamber is broad, oval, slightly depressed in longitudinal sense, downwards passing into the narrow, long, conical third chamber. This one ends with a terminal spine, splitted into 3—4 short

spines at its end. In the middle of the second chamber — 3 thick non-perforated apophyses run out radially. They are of equal length and of quadrangular section. At their ends they split into 3—4 short spines. On the first chamber are pores of a half-diameter of those on the other two. The pores are irregularly hexagonal. On the second and third chambers are large, regularly hexagonal pores. The bars of the hexagonal meshwork are connected with the prominent sharp nodes.

Dimensions:	Holotype (mm)	Paratypes (mm)
Shell height	0,52	0,48—0,60
Second chamber width	0,23	0,22—0,27
Height of the first chamber with apical horn	0,16	0,14—0,16
Height of the third chamber with terminal spine	0,27	0,25—0,27
Length of radial apophyses	0,09	0,09—0,12
Pore diameter on the second and third chambers	0,011	0,011—0,016

Genus *Podocyrtis* Ehrenberg, 1847
Podocyrtis sp.
Plate CIII, Fig. 3, 4

Description: The shell consists of three chambers. The first chamber-cephalis is damaged, the second — and the third chambers — thorax and abdomen have a broadly conical shape, with large hexagonal pores. Basal shell mouth is open, broadly oval. On the base of the third chamber, around the shell mouth, are three thick divergent abdominal feet.

Stratigraphical range: The genus is recorded from the Cretaceous. With respect to its isolated, though, occurrences in radiolarites of this locality, presumed may be its presence in older sediments as well.

Genus *Tricolocapsa* Haeckel, 1887
Tricolocapsa cf. *elongata* Pantanelli, 1880
Plate CIII, Fig. 2

1880 *Tricolocapsa elongata* — D. Pantanelli: I diaspri della Toscana etc.; non vidi.

1972 *Tricolocapsa elongata* Pantanelli — A. I. Žamojda: Biostratigrafia mezozojskich kremnistych tolšč etc., p. 117, tab. 1, fig. 7—9.

Description: The shell consists of three chambers. The first chamber-cephalis is circular, smooth. The second chamber-thorax together with the first form a conus with a rounded apex. The third chamber--abdomen is broadly oval. On the second and the third chambers are large hexagonal pores. The bars of the hexagonal meshwork are con-

nected with prominent sharp nodes. Pores of the second chamber are by 1/3 smaller than of the third one.

Dimensions: Shell height 0,17—0,20 mm; first chamber width 0,02—0,04 mm; second chamber width 0,07—0,08 mm; third chamber width 0,135—0,140 mm; pore diameter on the third chamber is 0,01 mm.

Remarks: Our forms differ in greater pore diameter from the species *Tricolocapsa elongata* Pantanelli.

Stratigraphical range: The species is recorded from the Upper-Triassic and Jurassic sediments of Eastern U.S.S.R.

Genus *Spinosicapsa* nov. gen.
Type species: *Spinosicapsa ceblienica* n. sp.

Denomination: Lat. spinosus — spinose; capsa — shell

Diagnosis: The shell consists of four chambers. The first and the second chambers-cephalis and thorax form a short cone with an apical horn; the third chamber-abdomen is broad, oval, with three radially arranged spines; the fourth chamber-postabdominal segment is narrow, conically constricted, ended with a terminal spine.

Remarks: By its shape it reminds of the genus *Eusyringium* Haeckel and it differs from the latter in a closed the fourth chamber, in the terminal spine, and in possessing three radially arranged spines on the third chamber.

Spinosicapsa ceblienica n. sp.
Plate CI, Fig. 1

Holotype: Nr. 2818, pl. CI, fig. 1. Deposited in the Department of geology and paleontology, Faculty of Natural History, Comenius University, Bratislava. The film is deposited at Dionýz Štúr Institute of Geology, Bratislava.
Type locality: The hill Keblie near Púchov
Type level: Kelloway — Argovian; radiolarites of the Kysuca Series in the Klippen Belt.
Denomination: After the hill Keblie near Púchov.
Material: 20 forms

Diagnosis: The shell consists of four chambers. The first two — cephalis and thorax form a short cone with an apical horn, the third one — abdomen is broadly oval; the fourth — postabdominal segment is conically narrowed, ending with a terminal spine. In the middle of the third chamber are three radially arranged spines.

Description: The latticed shell is composed of 4 chambers. The first two chambers form a short cone terminated with an apical horn of oval section. The third chamber is broad, oval; the fourth chambers is narrow, conically constricted, ended with a terminal spine of oval section. The end of the terminal spine is slightly rounded, in some cases pointed, spiculous. In the middle of the third chamber are three radially arranged spines. They consist of four longitudinal ridges separated by

deep grooves. Pores of the latticed shell are hexagonal. On the first two chambers their diameter is about a half of that on the other two. The bars of the hexagonal meshwork are connected with the prominent sharp nodes.

Dimensions:	Holotype (mm)	Paratypes (mm)
Shell height	0,40	0,30—0,48
Width of the third chamber	0,17	0,17—0,20
Height of the first and the second chambers including apical horn	0,11	0,10—0,14
Height of the last chamber including the terminal spine	0,12 (termination broken)	0,13—0,19
Length of radial spines	0,10	0,06—0,10
Pore diameter on the 3rd and 4th chambers	0,013	0,009—0,013

Genus *Dictyomitra* Zittel, 1876
Dictyomitra pinna n. sp.
Plate CII, Fig. 2

Holotype: Nr. 2810, pl. CII, fig. 2. Deposited in the Department of geology and paleontology, Faculty of Natural History Comenius University, Bratislava. The film is deposited at Dionýz Štúr Institute of Geology, Bratislava.
Type locality: The hill Keblie near Púchov.
Type level: Kelloway — Argovian; radiolarites of the Kysuca Series in the Klippen Belt.
Denomination: according to the shape of chambers; Lat. pinna — battlements.
Material: 20 forms

Diagnosis: The shell is conical, and consists of 11 chambers. The first chamber-cephalis is small, circular; the other ones — thorax, abdomen, and post-abdominal segments — are mutually isolated to about 1/4 of their width. Chamber walls are slightly convex. Their top periphery is regular jagged.

Description: The shell is shaped to a high cone, with apical angle of 25—35°. It sonsists of 11 chambers. The first chamber is small, circular, the other ones regularly grow wider towards the basal shell mouth. Their height increases only slightly. The individual chambers are isolated to about 1/4 of their width and represent separate joints severed by a narrow carving. They are connected with the central pillar. Chamber walls are slightly convex, smooth, with a line of regular jags on the top periphery. The number of jags increases ith broadening shell (there are 9—19 jags on a half of the shell). Basal shell mouth is open.

Dimensions:	Holotype (mm)	Paratypes (mm)
Shell height	0,24	0,20—0,24
Shell width	0,095	0,07—0,10
Jags height	0,002	0,001—0,002
Basal shell mouth diameter	0,035	0,030—0,035

Dictyomitra multicostata Zittel, 1876
Plate CII, Fig. 4

1876 *Dictyomitra multicostata* n. sp. — K. A. Zittel: Über einige fossile Radiolarien etc., p. 81, tab. 2, fig. 2—4 (non vidi).
1892 *Dictyomitra multicostata,* Zittel — D. Rüst: Contributions to Canadian Micro-Palaentology, p. 109, tab. 16, fig. 3.
1963 *Dictyomitra (Dictyomitra) multicostata* Zittel — E. A. Pessagno: Upper Cretaceous Radiolaria etc., p. 206, tab. 1, fig. 9—10: tab. 4, fig. 1, 3; tab. 5, fig. 3, 7.

Description: A conical shell, with the apical angle 35—40°. The shell consists of 9—10 chambers. The first one — cephalis is oval, the other ones — thorax, abdomen, and postabdominal segments show a trapezium-like shape in longitudinal section. The shell surface is covered with 24—26 narrow, longitudinal convergent ribs. Among the ribs are vertical tiers of circular pores. On each chamber are 3 pores to a tier. Sutures among chambers are depressed. Basal shell mouth is open, broad.

Dimensions: The shell height 0,22—0,28 mm; shell width 0,095 to 0,160 mm; second chamber height 0,001—0,002 mm; last chamber height 0,04—0,05 mm.

Stratigraphical range: The species was recorded from Upper-Jurassic to Upper-Cretaceous sediments.

Genus *Lithocampe* Ehrenberg, 1838
Lithocampe haeckeli (Pantanelli, 1880)
Plate CII, Fig. 3

1880 *Polystichia Haeckelii* — D. Pantanelli: I Diaspri della Toscana ect., p. 21, fig. 37, 38.
1885 *Lithocampe Haeckelii* Pantanelli — D. Rüst: Beiträge zur Kenntniss der fossilen Radiolarien etc., p. 46, tab. 40/15, fig. 6
1971 *Eucyrtidium haeckeli* (Pantanelli) — G. E. Kozlova: O nachodke radioljarij v nižnekimeridžskich otloženijach etc., p. 1175, fig. 1/17.

Description: A conical shell, slightly constricted in the bottom part, consists of 12 chambers. The first chamber-cephalis is circular. The next two chambers-thorax and abdomen are indistinctly separated. On their surface are pores of uncertain number and shape. The other chambers-postabdominal segments are separated from one another by prominent sutures. Toward the basal shell mouth they get wider, only the last two chambers get somewhat constricted. Chamber height increases only slightly. Walls are penetrated by large hexagonal pores arranged in three, transversal rows in a regular hexagonal meshwork. In places where chambers are connected with one another the bars of the hexagonal meshwork are connected with prominent sharp nodes, and they cause an undulated appearance of the sutures surfaces. The basal shell mouth is open, broad.

Dimensions: Shell height 0,19—0,25 mm; width 0,10—0,14 mm; basal shell mouth diameter 0,09—0,11 mm; pore diameter 0,007 mm.

Remarks: The pore shape in the species Lithocampe haeckeli (Pantanelli) is round, while in our forms pores are hexagonal with rounded apexes. The difference is most likely due to insufficient detailed examina-

tion under optical microscope. A distinct apical horn depicted by G. E. Kozlova (1971) is missing in our forms.

Stratigraphical range: The species is recorded from jaspers of Toscany (D. Pantanelli 1880) and from the Tithonian of Switzerland (D. Rüst 1885), and it is also quoted in the last works concerning the Lower—Kimmeridgian sequences in the Timano—Uralian area of the U.S.S.R. (G. E. Kozlova 1971).

Lithocampe ruesti n. sp.
Plate CIII, Fig. 1

Holotype: Nr. 2795, pl. CIII, fig. 1. Deposited in the Department of geology and paleontology, Faculty of Natural History Comenius University, Bratislava. The film is deposited at Dionýz Štúr Institute of Geology, Bratislava.

Type locality: The hill Keblie near Púchov.

Type level: Kelloway — Argovian; radiolarites of the Kysuca Series in the Klippen Belt.

Denomination: After D. Rüst, who dealt in detail mostly with Mesozoic radiolarians.

Material: 20 forms

Diagnosis: The shell is conical, composed of 12 chambers. Beginning with the last two chambers, it is slightly constricted. The first chamber — cephalis is oval, the other chambers — thorax, abdomen, and postabdominal segments show a trapezium-like shape in cross section. The chambers are mutually isolated to about 1/4 of their width by a narrow carving. On the surface of the postabdominal segments are distinct knolls arranged in diagonal lines, with 2—3 knolls to a line.

Description: The conical shell consists of 12 chambers. Beginning with the last two, towards the basal shell mouth it gets slightly constricted. The first chamber is oval, elongated upwards. Its connection with the second chamber is constricted. The other chambers show a trapezium-like form in longitudinal section. Their width is regularly increasing to the last two which are slightly constricted. Height increases only slightly. In the place of the connection of chambers, approximately at 1/4 of their width is a narrow carving, and the chambers represent isolated joints, connected with a central pillar. On the first three chambers is no sculpture. The walls of other chambers are covered with distinct oval knolls aligned in diagonal lines, with an angle of about 60°, with 2—3 knolls in each line. The basal shell mouth is open.

Dimensions:	Holotype (mm)	Paratypes (mm)
Shell height	0,29	0,24—0,29
Shell width	0,093	0,09—0,11
Basal shell mouth diameter	0,040	0,04—0,08
Knoll diameter	0,003—0,006	

Remarks: By its shape the species reminds of Lithocampe terniseriata Rüst. On representation of holotype by the optical microscope the sculpture of chambers is inconspicuous, and the author described 3 transversal lines of pores, in diagnosis. The species also possesses less chambers — 8.

Genus *Lithostrobus* Bütshli, 1882
Lithostrobus brevicostatus n. sp.
Plate CII, Fig. 1

Holotype: Nr. 2805, pl. CII, fig. 1. Deposited in the Department of geology and paleontology, Faculty of Natural History, Comenius University, Bratislava. The film is deposited at Dionýz Štúr Institute of Geology, Bratislava.
Type locality: The hill Keblie near Púchov.
Type level: Kelloway — Argovian; radiolarites of the Kysuca Series in the Klippen Belt.
Denomination: According to its short ribs. Lat. brevis — short; costa — rib.
Material: 20 forms

Diagnosis: The shell is conical, composed of 11 chambers, regularly broadening toward the basal shell mouth. The first chamber-cephalis is oval, provided with an apical horn; the next two-thorax and abdomen show indistinct sculpture. The walls of the other chambers-postabdominal segments are distinctly convex, with short longitudinal ribs, separated by two longitudinal lines of pores, with 3 pores in each line.

Description: The shell is shaped to a high cone consisting of 11 chambers. The chambers regularly broaden towards the basal shell mouth. The first chamber is circular, with a short apical horn. The next two show indistinct sculpture. The other chambers have markedly convex walls, with short longitudinal ridges. Among the ridges, in a depression, are two longitudinal lines of pores. The number and length of ridges in the individual chambers increase toward the basal shell mouth (8—11 ridges in a half of the shell). Sutures among chambers are depressed. The walls are irregularly convex. Towards the basal shell mouth, approx. to 2/3 of the chamber height, convexity slowly increases, and in the last third sudden constriction appears. In the first 2/3 of the chamber height are 2 pores in each longitudinal line, and in the last third is 1 pore in each line. The basal shell mouth is open, broad.

Dimensions:	Holotype (mm)	Paratypes (mm)
Shell height	0,27	0,27—0,30
Shell width	0,13	0,11—0,13
Apical horn height	0,012	
Ridge length	0,006—0,016	

Explanations to plates XCIX—CIII

Plate XCIX

Fig. 1 *Cenosphaera* cf. *micropora* Rüst. Nr. 2825; magn. 200×
Fig. 1a *Cenosphaera* cf. *micropora* Rüst. Nr. 2826; a part of shell of the form Nr. 2825, magn. 450×
Fig. 2 *Conosphaera haeckeli* Aliev. Nr. 2822; magn. 175×
Fig. 3 *Ethmosphaera inaequalis* Rüst. Nr. 2809; 175×

Plate C

Fig. 1 *Staurolonche grandipora* n. sp. Nr. 2797 — holotype; magn. 260×
Fig. 2 *Triactis* cf. *ilsedensis* Rüst. Nr. 2798; magn. 150×
Fig. 3 ?*Paronaella* cf. *ewingi* Pessagno. Nr. 2811; magn. 90×

Plate CI

Fig. 1 *Spinosicapsa ceblienica* n. sp. Nr. 2812 — holotype with broken end of terminal spine; magn. 260×
Fig. 2 *Heitzeria spinosa* n. sp. Nr. 2819:
a — holotype without apical horn
b — paratype with apical horn without the 3rd chamber with a terminal spine

Plate CII

Fig. 1 *Lithostrobus brevicostatus* n. sp. Nr. 2805 — holotype; magn. 300×
Fig. 2 *Dictyomitra pinna* n. sp. Nr. 2810 — holotype; magn. 350×
Fig. 3 *Lithocampe haeckeli* (Pantanelli) Nr. 2794; magn. 175×
Fig. 4 *Dictyomitra multicostata* Zittel. Nr. 2796; magn. 200×

Plate CIII

Fig. 1 *Lithocampe ruesti* n. sp. Nr. 2795 — holotype; magn. 300×
Fig. 2 *Tricolocapsa* cf. *elongata* Pantanelli. Nr. 2808; magn. 300×
Fig. 3 *Podocyrtis* sp. Nr. 2800; magn. 350×
Fig. 4 *Podocyrtis* sp. Nr. 2799, basal shell mouth of the form Nr. 2800 magn. 350×

Translated by E. Jassingerová
Reviewed by O. Samuel

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Ladislava Ožvoldová

Vrchnojurské radiolárie z kysuckej série bradlového pásma

Resumé anglického textu

Tab. XCIX—CIII

Článok prináša výsledky štúdia radiolárií z radiolaritov kysuckej série bradlového pásma, z vrchu »Keblie« pri Púchove. Radiolarity ležia v dogger-malmskom súvrství a na základe analógie s radiolaritmi v Podhradskej doline (s. od Pruského) usudzuje sa ich vek na kelloway — argov (A. Began 1959).

Opísané formy boli z radiolaritov vypreparované rozpúšťaním v HF a snímané pomocou scanningového elektrónového mikroskopu v GÚDŠ v Bratislave.

V radioláriovej asociácii slabo prevládajú spumellina nad nassellinami. Zo spumellín sa nachádzajú druhy — *Cenosphaera* cf. *micropora* Rüst, *Ethmosphaera inaequalis* Rüst, *Conosphaera haeckeli* Aliev, *Triactis* cf. *ilsedensis* Rüst, *?Paronaella* cf. *ewingi* Pessagno a novoopísaný druh *Staurolonche grandipora* n. sp. Tento je charakteristický vonkajšou a vnútornou mriežkovitou schránkou, kubického tvaru, 4 ostňami v tvare kríža a hrubopórovitou mriežkou vonkajšej schránky.

Z nassellín boli opísané 2 nové rody — rod *Heitzeria nov. gen.*, charakteristický kónickou počiatočnou komôrkou s apikálnym tŕňom, širokou druhou komôrkou s troma radiálnymi apofýzami a rúrkovitou treťou komôrkou, uzavretou terminálnym tŕňom, a rod *Spinosicapsa nov. gen.*, ktorý má, na rozdiel od tvarove podobného predchádzajúceho rodu, 4 komôrky. Z každého rodu bol opísaný nový druh — *Heitzeria spinosa* n. sp., *Spinosicapsa ceblienica* n. sp.

Ďalej boli opísané 3 nové druhy:

Dictyomitra pinna n. sp. — kónická schránka s 11 komôrkami, čiastočne od seba izolovanými, so zúbkovaním na hornom okraji.

Lithocampe ruesti n. sp. — kónická schránka s 12 komôrkami, s miernym zúžením pri posledných dvoch. Komôrky sú čiastočne izolované úzkym výrezom. Na povrchu väčšiny komôrok sú pravidelné hrbolčeky.

Lithostrobus brevicostatus n. sp. — kónická schránka s apikálnym tŕňom má 11 komôrok. Väčšina z nich má vypuklé steny s krátkymi pozdĺžnymi rebrami, oddelenými dvoma pozdĺžnymi radmi pórov.

Okrem týchto sa nachádzajú druhy — *Tricolocapsa* cf. *elongata* Pantanelli, *Dictyomitra multicostata* Zittel, *Lithocampe haeckeli* (Pantanelli), *Podocyrtis* sp.

Študovaná asociácia predstavuje spoločenstvo foriem, charakteristických pre vrchnú juru — spodnú kriedu.

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Viera Kantorová

Vsevolodia, a new foraminiferal genus from the Oncophora beds of southern Slovakia

4 plates (LV—LVIII), Slovak summary

Abstract. The new foraminiferal genus Vsevolodia, represented by a species and a subspecies V. czechoviczi n. sp. and V. czechoviczi plicata n. ssp., is described from the Oncophora sands of the lower Miocene in the Ipeľská kotlina depression (southern Slovakia).

Introduction

In the Oncophora beds of the Lower Miocene* in southern Slovakia a peculiar foraminiferal microfauna had been found some years ago, indicating the marine origin of these beds (V. Kantorová — A. Ondrejíčková — D. Vass 1968). A new foraminiferal genus from these thanatocoenoses belonging to the superfamily Bulimininacea has been established and described in the present paper on the basis of several hundreds individuals amog which 42 were examined under Scanning electron microscope (SEM).

Systematic descriptions

Order: Foraminiferida

Suborder: Rotaliina

Superfamily: *Buliminacea* Jones, 1875

Family: so far uncertain — as explained in the genus description — (comparison)

Genus: *Vsevolodia* n. gen.

Denomination: After Vsevolod Čechovič, a well-known stratigrapher and discoverer of Oncophora beds in the Ipeľská kotlina depression.

Type species: *Vsevolodia czechoviczi* n. sp.

RNDr. V. Kantorová, Geologický ústav Dionýza Štúra, Mlynská dolina 1, Bratislava.

* According to the authoress' recent studies of the foraminiferal plankton from these beds, they are correlable with the Globigerina woodi connecta zone of New Zealand (D. G. Jenkins 1971).

Presumable affinities of the new foraminiferal genus Vsevolodia

Table 1

1	Genus and its stratigraphic distribution	Test elongate: early portion	Test elongate: later portion	Aperture	Tooth plate	Chambers	Surface
C 565	*Uvigerina* Orbigny 1826 Eoc. — Rec.	triserial in section		terminal rounded nonperforate with neck ± phialine lip	with distinct wing at one side	inflated perforate	smooth hispid or costate
C 567	*Hopkinsina* Howe and Wallace 1932 Eoc. — Rec.	tri-	bi- serial	terminal with lip or neck	not described in type-species	perforate	smooth or longitudinally striate or costate
C 572	*Uvigerinella* Cushman 1926 Eoc. — Rec.	triserial		up face of final chamber ± rim or collar	not described in type-species	perforate	smooth
C 572	*Virgulinopsis* Hofker 1956 Rec.	tri-	bi- serial	elongate nearly terminal (loop-shaped)	flaring	finely perforate	striate costate
C 561	*Virgulopsis* Finlay 1939 M. Mioc.	tri-	bi- serial	loop-shaped up face	unknown	finely perforate	plicate pustulose
C 561	*Stainforthia* Hofker 1956 Eoc. — Rec.	tri-	bi- serial twisted	loop-shaped in face + lip	partially closing opening	finely perforate	smooth or costate apical spine
C 556	*Eovigerina* Cushman 1926 (syn. *Zeauvigerina* Finlay 1939) L. Cret (Alb) — U. Eoc.)	biserial		terminal with neck phialine lip with crenulated margin	columellar	finely perforate	smooth carinate hispid
	Vsevolodia n. gen. so far known from Oncophora beds of southern Slovakia	tri-	bi- serial ± twisted	terminal or nearly terminal crater-like rounded lip	partially closing opening	with tiny perforation which is visible from the inside only	pustulose or with rich plicature

1 = Page in the work of A. R. Loeblich and H. Tappan (1964) where is the genus description to find.

Diagnosis: Test elongate, triserial in the early stage, in the later portion biserial, plait-like, somewhat ± twisted. The biserial part consists of 3—4 pairs of chambers. The last chamber is extended following the longitudinal axis forming a short, wide crater-like neck or collar around the aperture in terminal or partially up face position. Aperture with apertural tooth or filled up by a modified tooth. Surface finely granulated and longitudinally pustulated or the surface-ornamentation is richer, arranged in grainy plicature. The ornamentation is commonly more dense towards the apertural region. Wall calcareous, partially bilamellar on the periphery, the interior constructions monolamellar, more compact. The external lamella with tiny perforation, which is visible under the SEM at magnification 1.750 X at least, from the inside only. The external lamella shows radiate structure.

Comparison: As the new genus shows similar characters of the test to several foraminiferal genera belonging to different families of the superfamily Buliminacea and as it is impossible to decide which of them are leading characters of close taxonomical value (see tab. 1) the author put it provisionally in the superfamily *Buliminacea* (sensu A. R. Loeblich jr. — H. Tappan, 1964) without ranging it in any distinct foraminiferal family.

Regarding the general shape of the test the new genus is very similar to the genus *Virgulopsis* Finlay 1939 differing from it in having a crater-like neck or collar around the aperture, whilst Virgulopsis has a loop-shaped aperture in an up face position. — The present genus is close to the genus *Eouvigerina* Cushman 1926 (syn. *Zeauvigerina* Finlay 1939) regarding its biserial stage and final chamber nearly central in position, as well as its aperture. The new genus differs from the last one in having triserial early stage, a lesser number of chambers in the biserial stage, which are more extended and wedged in each other along the central suture (not throughout as in *Hopkinsina* Howe and Wallace 1932); the surface ornamentation is different too, including the perforation, which we couldn't notice on the surface of the test under the SEM not even at the 5000 X magnification.

When even the exterior test morphology and its tiny dimensions suggest the idea, Vsevolodia could be a juvenile stage of some Uvigerinids, the internal construction and ultrastructure of the wall — observed under the SEM — do not convince us of such consideration.

Distribution: The representatives of this relationship here established occur in the thanatocoenoses of Oncophora beds in the Ipeľská kotlina (Ipeľ river depression), which are of lower Miocene age. They are more frequent in mica richer lamina of the Oncophora sands, but it is very difficult to wash and pick them clean, as the mica flakes adhere to the peculiar elongate bodies.

As they never have been found before in other stratigraphic units they seem to be of stratigraphic importance.

Vsevolodia czechoviczi n. sp.
Pl. LV, Fig. 1—4; Pl. LVI, Fig. 1—2; Pl. LVII, Fig. 1—2; Pl. LVIII, Fig. 1—2

Denomination: After Vsevolod Čechovič.

Diagnosis: Test elongate, early stage triserial, later development biserial, ± twisted. The biserial part consists of 3 pairs of chambers.

The final chamber is extended following the longitudinal axis forming a crater-like neck in which is placed the aperture usually in a nearly terminal position. Aperture with an apertural tooth or filled up by a modified tooth. Surface finely granulated, with longitudinally arranged pustules in irregularly interrupted lines in most cases more dense in apertural region.

Diameter of about 210 μ.
Type locality: Stredné Plachtince in Ipeľská kotlina, borehole S-174, 252—253 m.
Type level: Oncophora beds of lower Miocene.
Depository of holotype: Geologický ústav Dionýza Štúra, Bratislava, Mlynská dolina 1, Paleontological collection. Registered no. VK-1.
Paratypes: 60 uncoated paratypes are deposited in the paleontological collection of the Geologický ústav Dionýza Štúra, Bratislava, Mlynská dolina 1. Registered no. VK-I.
Type figure: Scanning electron micrograph no. 4207/1972, deposited at Geologický ústav Dionýza Štúra, Bratislava, Mlynská dolina 1, representing a gold-palladium coated paratype conformable to the holotype. Used as illustration of the present paper.

Vsevolodia czechoviczi plicata n. ssp.
Pl. LVI, Fig. 3, 4

Denomination: In accordance with the plicate surface of the test.
Diagnosis: Test elongate, narrow, plait-like, triserial in the early stage; the later biserial part consists of 4 pairs of chambers. The final chamber with aperture sitting in a collar which is somewhat turned aside up face. The aperture is filled up by a modified tooth. The surface of the test with very dense grainy ornamentation arranged in plicature.

Diameter of about 210 μ.
Type locality: Suché Brezovo in Ipeľská kotlina, borehole M-88, 302—303 m.
Type level: Oncophora beds of lower Miocene (not so abundant as the preceding species).
Depository of holotype: Geologický ústav Dionýza Štúra, Bratislava, Mlynská dolina 1, Paleontological collection. Registered VK-2.
Paratypes: 20 uncoated paratypes are deposited in the paleontological collection of Geologický ústav Dionýza Štúra, Bratislava, Mlynská dolina 1. Registered VK-II.
Type figure: Scanning electron micrograph no. 5570/1972, deposited at Geologický ústav Dionýza Štúra, Bratislava, Mlynská dolina 1, representing a gold-palladium coated paratype conformable to the holotype. Used as illustration of the present paper.

Aknowledgment
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Translated by author
Reviewed by O. Samuel

Explanations of plates LV—LVIII

Plate LV

Fig. 1, 2 *Vsevolodia czechoviczi* n. sp. Coated paratype comformable to the holotype with distinct apertural tooth and twisted test. — 1 General view 360×, Nr. 4207/1972* — 2 Surface pustules of the same specimen 3000×, Nr. 4208/1972

Fig. 3, 4 *Vsevolodia czechoviczi* n. sp. Another specimen with removed wall, showing the inside chambre construction. — 3 General view 360×, Nr. 4198/1972 — 4 Central portion more enlarged 1000×, Nr. 4199/1972 — Locality: Stredné Plachtince, borehole S-174, 252—253 m. Photographed by SEM

Fig. 1, 2 *Vsevolodia czechoviczi* n. sp. Paratype with modified tooth and more dense wall ornamentation in the apertural region. — 1 General view 450×, Nr. 5466/1972 — 2 Crater-like aperture 1600×, Nr. 5468/1972 — Locality: Suché Brezovo, borehole M-88, 302—303 m

Fig. 3, 4 *Vsevolodia czechoviczi plicata* n. ssp. Coated paratype comformable to the holotype. — 3 General view 400×, Nr. 5570/1972 — 4 Plicature near apertural region 1400×, Nr. 5572/1972 — Locality: Suché Brezovo, borehole M-88, 302—303 m. Photographed by SEM

Plate LVII

Fig. 1, 2 *Vsevolodia czechoviczi* n. sp. Specimen with removed side-wall. — 1 General view showing the inner construction 500×, Nr. 4103/1973 — 2 Enlarged open part showing the radiate wall structure and tiny pores at the inner side 1750×, Nr. 4104/1973 — Locality: Malý Krtíš, sand pit. Photographed by SEM

Plate LVIII

Fig. 1, 2 *Vsevolodia czechoviczi* n. sp. — 1 Broken specimen with visible tooth-plate 000×, Nr. 4102/1973 — Locality: Malý Krtíš, sand pit — 2 Surface view of the triserial portion of another specimen with small break showing the wall--structure (of bilamellar appearance) 2000×, Nr. 4544/1972 — Locality: Pôtor, borehole MHY 3, 141,4—141,6 m. Photographed by SEM

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* Depository number of scanning electron micrograph.

Plate LVI

Viera Kantorová

Vsevolodia, nový foraminiferový rod z onkofórových vrstiev južného Slovenska

Resumé anglického textu

Tab. LV—LVIII

V onkofórových vrstvách Ipeľskej kotliny, ktoré sú podľa planktonických foraminifer spodnomiocénneho veku (korelovateľné so zónou *Globigerina woodi connecta* — D. G. Jenkinsa, 1971), autorka našla nový foraminiferový rod *Vsevolodia*, zatiaľ s jedným druhom a jedným poddruhom, *V. czechoviczi* n. sp. a *V. czechoviczi plicata* n. ssp. Títo príslušníci nového rodu majú veľmi malé schránky s výraznou ornamentáciou, ktorú však, ako i ostatné diagnostické znaky, nie je možné pozorovať inak než pomocou elektrónového riadkovacieho mikroskopu (SEM), pod ktorým autorka preskúmala 42 jedincov tohoto nového taxónu, pochádzajúcich jednak z pieskovne pri Malom Krtíši, jednak z vrtných vzoriek, ako je to uvedené vo vysvetlivkách k obrazovým prílohám.

Systematické zaradenie nového rodu, druhová a poddruhová diagnóza sú obsiahnuté v anglickom texte. Nový rod sa vyznačuje týmito diagnostickými znakmi:

Schránka podlhovastá, spočiatku triseriálna, ďalej biseriálna, niekedy trochu stočená okolo pozdĺžnej osi. Posledná komôrka pretiahnutá do širokého kráterovitého hrdla alebo goliera, v ktorom je apertúra so zubom alebo modifikovaným zubom. Vo vnútri schránky sú sukcesívne apertúry spojené dentálnou platničkou. Povrch jemne granulovaný, zdobený pozdĺžne zoradenými pľuzgiermi, alebo dosť rovnomerne pokrytý hustou zrnitou plikatúrou. Schránka vápnitá, vonkajšie steny s výrazne radiálnou stavbou. Vonkajšia stienka je hrubšia, s veľmi jemnými pórami viditeľnými len z vnútornej strany pri silnom zväčšení; vnútorná stienka je tenšia, kompaktná. V mieste, kde novšia komôrka nasedá na staršiu (v okolí švov), pozorujeme zdánlivú bilamelárnosť steny.

Autorka sa doteraz nestretla ani v literatúre, ani vo svojom materiáli, pokiaľ bol vekove odlišný od typických vrstiev pre nový rod, s foraminiferou zodpovedajúcou horeuvedenému opisu. Domnieva sa preto, že nový rod má význam pre stratigrafiu.

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M. G. Barakat – A. S. El-Dawoody

Microbiostratigraphy of some middle Eocene rocks in Egypt (with special reference to Abou Treifiya, Samalut and Areg sections)

6 plates (LIX—LIXV), 3 text-figs, Slovak summary

Abstract. This paper deals with the biostratigraphy of some Middle Eocene sections in Lower Egypt. It describes the different biozones reported by foraminiferal associations and the microfacies characteristics of the indurated rock samples. Ten various types of microfacies matched with five biozones are illustrated, described and their paleoecological environments are interpreted.

Introduction

The Miocene Middle sequence of Lower Egypt is mainly composed of calcareous facies with minor lateral lithological variations. The sections which form the scope of this study lie along a profile extending from east to west. It begins with Abou Treifiya outcrop in the east, includes Samalut wells and El-Fashn surface section in the Nile Valley and ends with Areg exposure further in the west (see location map, fig. 1). This profile is represented by sediments belonging to Lower Middle Eocene (Lower Lutetian), Upper Middle Eocene (Upper Lutetian) and the lowermost horizons of the Upper Eocene (Bartonian). The Upper Middle Eocene however, builds up the major part of the sections investigated.

The palentology of the Middle Eocene rocks has been the subject of enormous literature since the early days of geological investigations in Egypt. Among the recent workers, Cuvillier (1933, 1935, 1937) must be singled out for his notable contributions to the macropaleontology of the Egyptian Eocene. His studies resulted in dating the different Eocene rock units, and proposing biozones still valid to this day.

Little work, however, was undertaken on the smaller foraminifera of the Egyptian Middle Eocene. This is mainly attributed to the nature of the hard calcareous facies characteristic for this age. Large foraminifera (Nummulitidae and Alveolinidae), however, draw the attention of many workers; De la Harpe (1883), Schwager (1883), Schaub (1951), Hottinger (1960) and many others. This stock of large foraminifera represent the main stratigraphic tool upon which biozonation of the Eoce-

* M. G. Barakat—A. S. El.-Dawoody, Geology Dept., Faculty o Science, Cairo University, Giza/Egypt.

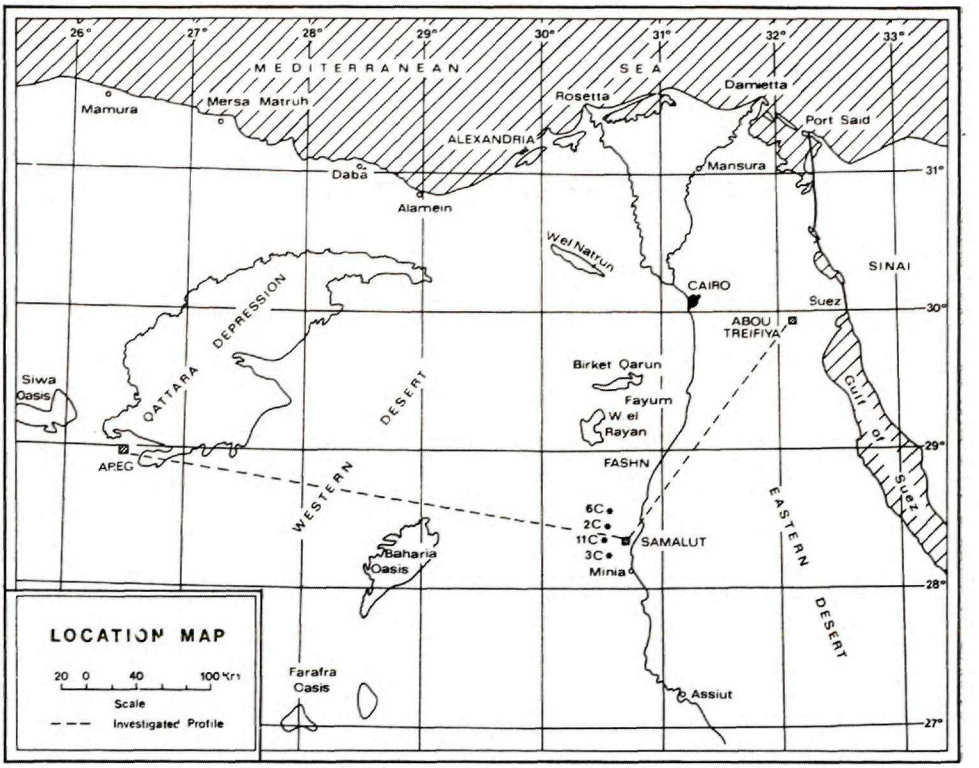

Fig. 1

ne was accomplished. Said (1963) recognized that the splitting of *Nummulites gizehensis* (Forksal) into its different taxonomic units would make possible the use of this species in biostratigraphy.

Lithostratigraphic Review

The rock units treated in this study start chronologically with the Minia Formation followed by the Mokattam Formation. These units are easily recognizable in the field, briefly introduced and arranged from base to top as follows:

Minia Formation

This formational name was first introduced by Said (1960, 1962) to match with the »Alveolinen Kalk« or »Oberlibysche Stufe« of Zittel (1883). This formation corresponds to the reefal facies of the Lower Middle Eocene (Lower Lutetian) represented by snow white Alveolinid limestone. Sometimes, it is partially dolomitized and packed full with elongate Alveolina species of the *Alveolina frumentiformis* group. It is overlain by the white weathering grey *Nummulites gizehensis* limestones of the Mokattam Formation, and underlain by the Thebes Formation. In the type locality, Zawiet Saada opposite Minia, it attains a thickness of about 35 meters. This unit is best developed in the Nile Valley between

Assiut and Minia, and a more complete section +150 meters in thickness is known near Assiut. El-Naggar (1970) suggested the term »Drunka Limestone« as a substitute for this more recent term »Minia Formation« of Said (1962) and of Awad-Said (1966).

At Gebel Abou Treifiya, Cairo-Suez district, this unit represents the lowermost +21 mts. of the Middle Eocene section, samples A/Tr, B/Tr & C/Tr (Fig. 2). It is made up of chalky to snow white limestone, locally dolomitized and exposed in restricted area at the southeastern corner of Abou Treifiya block. This unit is highly fossiliferous with *Alveolina frumentiformis* Schwager, *Nummulites praecursor* De la Harpe and other micro & macrofossils. It is the lowest unit exposed in the studied profile. It may be correlated with the nearest similar formation exposed in Gebel El-Galala El-Bahariya.

Mokattam Formation

The term »Mokattam Stufe« was first introduced by Zittei (1883) to cover the whole section overlying the Minia Formation and represented by massive limestone including the top brownish beds of Gebel Mokattam. At its type locality, Gebel Mokattam east of Cairo, the base is unexposed and the section attains a thickness of about 133 mts. To the south at Minia, the yellowish massive limestones and marls of the Mokattam Formation rests conformably over the snow white limestones of the Minia Formation. The Minia and Mokattam limestone formations are dated as Lower and Upper Middle Eocene respectively, although the upper part of the Mokattam limestone may be of Upper Eocene age (Cuvillier 1930, Said 1960). Local names for the Middle Eocene sections of Helwan (Farag—Ismail 1959) and Fayum (Beadnell 1905) have also been suggested. The Mokattam Formation or its equivalents is extensively developed and cover large tracts of the Nile Valley, Western and Eastern Deserts, the Gulf of Suez and Sinai. It forms most of the limestone plateaus in the middle latitudes of Egypt.

The Mokattam Formation, as used in the present work, includes only the Lower Mokattam of Zittel (1883). The classic Upper Middle Eocene section in Egypt is that of Gebel Mokattam. This section which forms the scope of enormous literature has been subdivided by Said—Martin (1964) into the following rock units:

d — Giushi	member
c — Upper Building Stone	member
b — Upper Gizehensis	member
a — Lower Building Stone	member

(with a concentration of *N. gizehensis* at base)

The lower two units of the Mokattam succession can be followed for long distances in the field. The Upper Building Stone member, on the other hand, shows wide lateral variation being represented in the Samalut-Fayum reach by a shale section. This section has been equated by Said (1962) with the Gehannam Formation of the classical Fayum cection.

CAIRO * (after Said & Martin, 1964)	FAYUM * (after Beadnell, 1905; Said, 1962)	MINIA * (after Said 1962)	ABOU TREIFIYA	SAMALUT SM. 6C.	SAMALUT SM. 2C.	SAMALUT SM. 11C.	SAMALUT SM. 3C.	FASHN	AREG
Maadi Formation	Qasr El-Sagha Formation								
Giushi Member	Birket Qarun Formation								N Contortus - Striatus Limestones with N. lyelli
Upper Building Stone	Gehannam Shales with N. lyelli							Gehannam Shales with N. lyelli	
N gizehensis (MOKATTAM FORMATION)	N. gizehensis (bed 3, Said 1962, p. 102) (WADI RAYAN FORMATION)	MOKATTAM FORMATION	N gizehensis					N gizehensis Bank	N gizehensis Bank
Lower Building Stone	Shales (bed 2, Said 1962, p. 102)							Shales	Shales
N gizehensis ** (Base unexposed)	N gizehensis (bed 1, Said 1962, p. 102)		N gizehensis	Globigerina Biomicrite	Globigerina Biomicrite **	N gizehensis **	N gizehensis **		
				N zitteli	N zitteli	N zitteli			
		MINIA FORMATION	A frumentiformis / N praecursor						

* Type localities for the Eocene Rock Units of Egypt

** with intercalated N. champollioni & N. mariettei

Fig. 2

The studied Mokattam limestone formation represents the upper 129 meters of the Middle Eocene section (Upper Lutetian part), samples D/Tr—N/Tr, at Gebel Abou Treifiya which is underlain conformably by the Minia Formation (Fig. 2). To the west in Samalut area along the Nile Valley, this formation attains a thickness ranging from 30—100 meters as recorded in the four wells investigated. At El-Fashn surface section, it attains about 50 meters in thickness, while in Areg Oasis further west in the Western Desert it reaches to +106.2 mts. thick. The topmost bed in Areg belongs to the basal part of the Upper Eocene. The material upon which this study is based was described in detail by El-Dawoody (1970).

The occurrences of both Minia and Mokattam formations together with their thicknesses in meters are shown by the following table:

Locality / Rock unit	Abou Treifiya	Samalut Wells				Fashn	Areg
		SM.6C	SM.2C	SM.11C	SM.3C		
2. Mokattam Fm.	129	100	41.4	89.5	29.6	50	+106.2
1. Minia Fm.	+21						

Biostratigraphy

The Minia and Mokattam limestones of the Middle Eocene sequence in the studied sections yielded a great deal of Foraminifera. In the carbonate members of this succession, representatives of the families *Alveolinidae* and *Nummulitidae* are abundant and form in fact the bulk of the rock itself. Because most of the rocks are hard and indurated, they are thin sectioned and their lithology and foraminiferal content are described. These microfacies studies have proved to be valuable in stratigraphic zonation. The different biozones encountered are arranged from base to top as follows:

Alveolina frumentiformis/Nummulites praecursor zone

This represents the lowest recognized larger foraminiferal zone in the succession studied. It coincides with the Minia limestone formation known in the southeastern corner of Gebel Abou Treifiya.

This zone is characterized by the flood of *Alveolina frumentiformis* Schwager, *Nummulites praecursor* De la Harpe and other *Nummulites spp.* It belongs to the Lower Middle Eocene (Lower Lutetian) of the Cairo-Suez district.

Nummulites zitteli zone

This is the lowermost zone in Samalut section, reaching about 81.2 mts. thick in well SM.6C, attains a thickness of about 33.8 mts. in well SM.2C and in well SM.11C it acquires about 69.5 meters in thickness. This zone

is represented in the Samalut wells by a lithologically uniform unit of chalky micrites which is equated with the lower part of the Mokattam limestone formation (Lower Building Stone member).

These micrites are packed full with both forms of *Nummulites zitteli* De la Harpe. Few specimens of *Nummulites champollioni?* De la Harpe are recorded.

In general, Samalut biomicrites contain few species of Nummulites but very abundant. The chief fossil in the biomicrites of wells SM.6C, SM.2C, SM.11C is *Nummulites zitteli* De la Harpe, a species related to *Nummulites gizehensis* (Forskal), but it differs from the type form by its smaller size (≠16 mm diameter), having rounded and straight edge, possessing less undulating meandrine septal filaments and a laxer spire. Said (1951) showed the distinctiveness of this chief fossil and separated it into a taxonomic unit of specific level. In 1963, the same author was the first to point out the value of this species in Upper Middle Eocene zonation of various sections in Egypt. He stated that it is only present in the lower parts of this unit and it is replaced in the upper approaches of the Middle Eocene by *Nummulites gizehensis* (Forskal). The sections studied here support this view and show that *Nummulites zitteli* De la Harpe occupies a level in the Middle Eocene prior to the *Nummulites gizehensis* zone.

Nummulites champollioni-gizehensis zone

This zone coincides with the Mokattam limestone formation known in Gebel Abou Treifiya, and overlies the lower *Alveolina frumentiformis/ Nummulites praecursor* zone of the same locality. It belongs to the Upper Middle Eocene (Upper Lutetian) of the Cairo-Suez district. In Samalut well SM.11C, this zone overlies the *Nummulites zitteli* zone where it attains a thickness of about 20 mts., where as it coincides with the 29.6 meters subsurface section in well SM.3C. In the two other Samalut wells; SM.6C, SM.2C, the *Nummulites zitteli* zone is followed by *Globigerina* and *Shelly* biomicrites, with shales fossiliferous with planktonic foraminifera building up the *Truncorotaloides rohri* zone recently recorded in the Samalut area (El-Dawoody, 1966, 1971). Whether these latter units are followed upward by the gizehensis zone or not is uncertain. These units represent the uppermost parts of the Middle Eocene sections of these wells, and are directly followed by Recent or subrecent Nile alluvium.

In Samalut well SM.11C, the lower part of the *Nummulites gizehensis zone* carries *Nummulites champollioni* De la Harpe in large numbers while the upper parts are made greatly of *Nummulites gizehensis* (Forskal). *Nummulites champollioni* De la Harpe appears in the form of a thin band of about 0.50 meter thick in well SM.2C interfingering the Globigerina biomicrite — shale section. In well SM.30, the whole subsurface section is made up of *Nummulites gizehensis* (Forskal) with thin bands of smaller Nummulites that probably belong to *Nummulites mariettei* De la Harpe.

In the Fashn Middle Eocene exposure, the basal 5 meters rock unit is made up of a bank of *Nummulites gizehensis* (Forskal) and it seems from field relations that this bed overlies the subsurface sections in Samalut. In Areg Oasis, the basal shalemarl unit is overlain by 41 me-

ters marly limestone unit packed full with *Nummulites gizehensis* (Forskal).

Nummulites lyelli zone

This follows the upper *Nummulites gizehensis* zone at Fashn and Areg surface sections. It is represented by 45 meters shale section (Gehannam Formation) in Fashn and 31.2 meters carbonate section (Upper Building Stone member) in Areg.

The Fashn shale section is made up of variegated fossile gypsiferous shales poor in microfossils, but carries the large *Nummulites lyelli* d'Archiac. In Fayum, this section includes a fauna which has been assigned by Ansary (1955) to the Upper Eocene. In Areg, the correlatable section is made up of a unit of chalky micrites packed full with *Nummulites lyelli* d'Archiac, *Nummulites spp.* as well as *Operculina spp.*

Nummulites contortus-striatus zone

This represents the uppermost recognized larger foraminiferal zone in the succession studied. It characterizes the topmost bed of the Areg section immediately above the Gisortia bed (Said 1963). This zone is defined by flood of *Nummulites contortus* Deshayes, *Nummulites striatus* Bruguière and other *Nummulites spp.* It marks the base of the Upper Eocene (Bartonian) in Siwa area.

The occurrences of these biozones together with their thicknesses in meters are shown by the following table:

Locality	Abou Treifiya	SAMALUT		WELLS		Fashn	Areg
Biozone		SM.6C	SM.2C	SM.11C	SM.3C		
5. *Nummulites contortus-striatus*							9
4. *Nummulites lyelli*						45	31.2
3. *Nummulites champollionigizehensis*	129			20	29.6	5	41
(Truncorotaloid rohri)	—	18.8	7.6	—	—		—
2. *Nummulites zitteli*	—	81.2	33.8	69.5			
1. *Alveolina frumentiformis* *Nummulites praecursor*	+21						

From discussions previously mentioned in the chapters of litho and biostratigraphy, it seems possible to construct a correlation chart of the sections studied (Fig. 2).

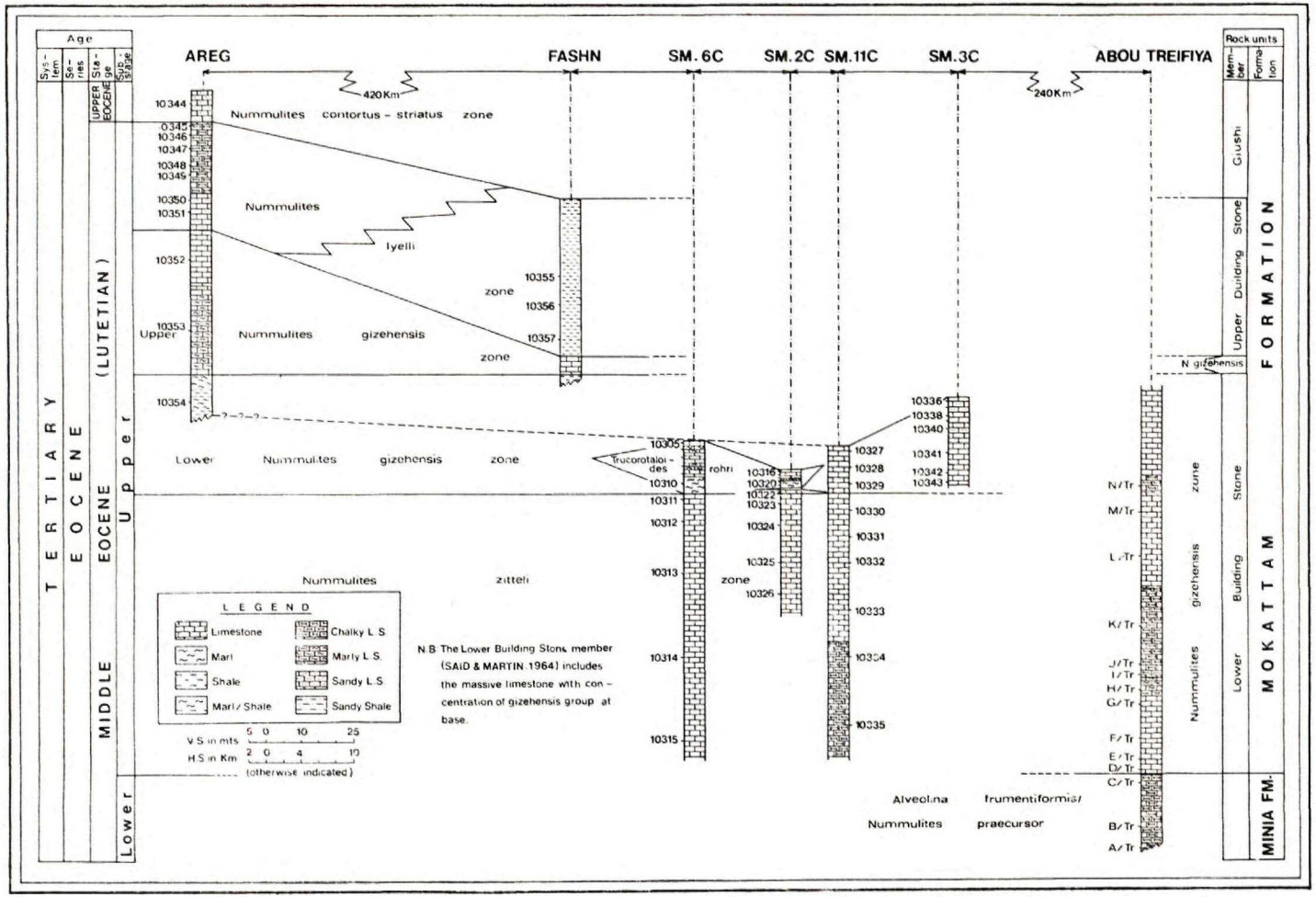
Age
System
Series
Stage
Sub-stage
Rock units
Member
Formation
TERTIARY
EOCENE
UPPER EOCENE
(LUTETIAN)
MIDDLE EOCENE
Upper
Lower
AREG
FASHN
SM. 6C
SM. 2C
SM. 11C
SM. 3C
ABOU TREIFIYA
420Km
240Km
Nummulites contortus - striatus zone
Nummulites
Iyelli
zone
Upper
Nummulites gizehensis
zone
Lower Nummulites gizehensis zone
Nummulites zitteli
Trucorotaloides rohri
zone
Alveolina frumentiformis/
Nummulites praecursor
N. gizehensis
Nummulites gizehensis zone
Giushi
Upper Building Stone
Lower Building Stone
FORMATION
MOKATTAM
MINIA FM.
LEGEND
Limestone
Marl
Shale
Marl / Shale
Chalky L.S.
Marly L.S.
Sandy L.S.
Sandy Shale
V.S. in mts 5 0 10 25
H.S. in Km 2 0 4 10
(otherwise indicated)
N.B. The Lower Building Stone member (SAID & MARTIN, 1964) includes the massive limestone with concentration of gizehensis group at base.

Fig. 3

The lowest *Alveolina frumentiformis/Nummulites praecursor* zone is encountered at the base of the succession. It corresponds to the basal limestone at Gebel Abou Treifiya, Cairo-Suez district which is equated with the Minia Formation.

The *Nummulites zitteli* zone is correlatable over the three Samalut wells SM.6C, SM.2C, SM.11C. This zone is followed by the *Nummulites champollioni-gizehensis* zone which in places is intercalated with *Globigerina*-bearing rocks with distinctive Upper Middle Eocene fossils. This is followed by another *Nummulites gizehensis* zone followed by a shale section (Gehannam Formation in Fayum and Fashm) and carbonate sections (Upper Building Stone member in Cairo area as well as in Areg Oasis). The Fashn shale together with the Areg limestone sections carry the large *Nummulites lyelli* De la Harpe. On this rests a unit of white weathering brown limestone with *Nummulites contortus-striatus* and some *Operculina* spp., which is lithologically difficult to distinguish from the underlying beds.

Formations correlated with this unit are the Qurn Formation of the desert to the east of Helwan (Farag—Ismail 1959) as well as the Giushi member of the Mokattam limestone formation southeast of Cairo. It is correlated also with the Birket Qarun Formation of the Fayum Desert. To the east in the Cairo-Suez district, the section becomes reefal and carries many fossils among which *Dendracis conferta, Dictyoconus aegyptiensis, Gisortia gigantea, Macrosolen uniradiatus, Natica longa* ... etc. are famous. The rock units of the numerous Eocene sections of Egypt are summarized in a table (Fig. 3) to show their correlations.

Microfacies and Paleoecology

This recent method of study is now gaining importance in the field of local and inter-regional stratigraphical correlations. It is widely used to reveal the organic structures and sedimentary textures where diagnostic micro-organisms could not be separated by normal washing techniques. It is also emphasized and applied for the interpretation of the paleoecology and the paleogeographic reconstruction of sedimentary basins.

Cuvillier—Sacal (1951) were the pioneers to inspire the study of microfacies. This was followed by a series of monographs dealing with the microfacies in many parts of the world. (Fairbridge 1954, Hagn 1955, Rey—Nouet 1958, Hanzawa 1961, Ford & Houbolt 1963, Cita 1965, Papp—Turnovský 1970, ... ect). Mišík (1966) published a work on the microfacies of the Mesozoic and Tertiary limestones of the West Carpathians. He proved that microfacies based upon index micro-organisms may have the value of stratigraphical zones.

In Egypt, Ghorab—Ismail (1957) were the first investigators who critically analyzed the microfacies of the Eocene and Pliocene sediments to the east of Helwan. This work motivated microfacies studies in other parts of Egypt (Ismail — El-Dakkak 1967, Ismail — Selim 1967, Barakat — Fahmy 1968, Ghorab — Ismail 1969, Barakat — Aboul Ela 1970) which are more related to the present study.

In this study, the indurated interbeds which build up the bulk of Middle

Eocene sections and a part of the early Upper Eocene succession were thin sectioned and microscopically examined. The vast majority of these beds are composed of either microcrystalline or sparry allochemical rocks. The terminology proposed by Folk (1959) in describing the different carbonate types is followed. The following is a description of the microfacies encountered and their paleoenvironmental conditions.

Microfacies

Lower Middle Eocene (L. Lutetian):

Alveolina Biomicrite

Pl. LIX, Fig. 1

The rock is composed of chalky white foraminiferal biomicrite, wholly composed of large foraminifera especially *Alveolina frumentiformis* Schwager, *Nummulites praecursor* De la Harpe and other *Nummulites* spp. in less abundance, together with some small unidentifiable foraminifera embedded in a fine grained micrite. Quartz grains are distributed in the ground mass but less frequent in the lower levels of this rock unit. These grains are rounded to subrounded, slightly turbid and irregularly scattered throughout the rock which is fairly well sorted and dolomitized in part. This facies is reported in the southeastern corner of Gebel Abou Treifiya, samples A/Tr—C/Tr. It belongs to the Lower Lutetian (Barakat—Abou Khadrah 1969) recently recorded in the Cairo-Suez district.

The nature of this association reflects deposition in a fairly warm, well aeriated and shallow to reefal environment. This is justified by the abundance of large foraminifera as well as the occurrence of well sorted quartz grains which are derived from a nearby landmass.

Upper Middle Eocene (U. Lutetian):

Nummulites zitteli Biomicrite

Pl. LIX, Fig. 2; Pl. LX, Fig. 1

The rock is creamish to yellowish white, sometimes chalky, coarse grained and highly fossiliferous. Large foraminifera are abundant, being represented by *Nummulites zitteli* De la Harpe which forms the bulk of the sample, both forms are encountered. Bryozoa and lamellibranch fragments together with few undifferentiated organic remains are also present. Allochems and fauna have no preferred orientation. Typical *Nummulites zitteli* biomicrites are found in Samulat wells (SM. 60, sample no. 10311, SM. 11C, samples 10330, 10335). In the first sample, a few specimens of *Nummulites champollioni?* De la Harpe are recorded, but with absence of bryozoa and lamellibranch fragments. These biomicrites are also found in Samalut wells (SM. 6C, samples 10312—10315, SM. 8C, samples 10324, 10326, SM. 11C, samples 10331—10334).

This association reflects deposition in a relatively shallow to reefal environment that have been affected by high level of energy caused by waves.

Nummulites zitteli Biosparite

Pl. LX, Fig. 2

The rock is yellowish white, ranging in grain size from medium calcarinite to fine calcirudite. Large foraminifera are the most abundant, being represented by *Nummulites zitteli* De la Harpe. Corals, bryozoa and lamellibranch fragments are noticeable. Allochems and fauna exhibit no preferable orientation. This biosparite is known in Samalut well SM. 2C, sample no. 10325 interbedded with *Nummulites zitteli* biomicrite of the same well.

This association reflects deposition in a relatively shallow to reefal environment that have been affected by high level of energy caused by waves.

Nummulites champollioni Biomicrite

Pl. LXI, Fig. 1

The rock is greyish white, hard and coarse grained, highly fossiliferous, with *Nummulites champollioni* De la Harpe and *Nummulites gizehensis* (Forskal). Few undifferentiated organic remains are also noticeable. Allochems and fauna exhibit a preferable orientation. This biomicrite is known in Samalut wells (SM. 2C, sample no. 10321, SM. 11C, samples 10328, 10329). In the first well, this microfacies association interfingers the lower levels of the *Globigerina* biomicrites. In the second well, the *Nummulites champollioni* biomicrite overlies directly the *Nummulites zitteli* zone and underlies the *Nummulites gizehensis* zone.

Such a type of association reflects predominance of reefal environment where great water agitation, good illumination and abundance of food and oxygen are the most characteristic. These interbedded planktonic fauna have been probably washed ashore.

Molluscan Biomicrite

Pl. LXI, Fig. 2

The rock is yellowish whitish grey, very fine grained, with a clear argillaceous matter in which lamellibranch fragments together with few gastropod and cephalopod remains are embedded. The fragments are sometimes iron stained. Small foraminifera and Nummulites are rare, being represented by few *Nummulites* spp. The biomicrite is characterized by the presence of clear and noticeable organic remains. Such an association is recorded from Samalut well SM. 2C, sample no. 10323 above the *Nummulites zitteli* zone and below the *Globigerina biomicrite*.

This association reflects a littoral environment in the area between high and low tides and undertow on a beach. This is justified by the organisms which are indigenous to the littoral zone.

Globigerina Biomicrite
Pl. LXII, Fig. 1

The rock is white to greyish white, hard and fine grained, slightly sandy, highly fossiliferous. Planktonic foraminifera are abundant together with some representatives of the families Buliminidae, Miliolidae and Textulariidae. Molluscan fragments, ostracods together with minute undifferentiated organic remains are common. Fossils are loosely packed in a carbonate mud matrix. Allochems have no prefered orientation. Typical *Globigerina biomicrites* are found in Samalut well SM. 6C, samples 10305, 10307, 10309. In the latter two samples, the microcrystalline ooze matrix is volumetrically larger and shows evidence of recrystallization at few jointed places. This biomicrite is also known in Samalut well SM. 2C, samples 10316, 10317.

This association reflects a marine environment of the neritic zone where the vagrant benthos are well represented. Later ascending hydrothermal solutions along joints may have participated in secondary recrystallization.

Nummulites gizehensis Biomicrite
Pl. LXII, Fig. 2; Pl. LXIII, Fig. 1

The rock is grey to yellowish grey, sometimes greyish white, very hard and coarse grained, highly dolomitized and fossiliferous. It is packed with *Nummulites gizehensis* (Forskal), *Nummulites mariettei* De la Harpe and other species. Small foraminifera are also common in the matrix. Lamellibranch fragments, ostracods together with minute undifferentiated organic remains are met with. Allochems and fauna exhibit no proper orientation. Typical *Nummulites gizehensis* biomicrites are recorded in Samalut wells (SM. 11C, sample no. 10327, SM. 3C, samples 10336, 10338, 10339, 10341—10343) as well as in Areg surface section in samples 10352 & 10353. These biomicrites occur above the *Nummulites champollioni* zone in Samalut well SM. 11C, in the whole section of Samalut well SM. 3C as well as over the basal shale of Areg section.

Such a type of faunal association reflects a reefal environment which have been strongly affected by water agitation caused by waves.

Nummulites lyelli Biomicrite
Pl. LXIII, Fig. 2

The rock is yellowish white, moderately hard and fine grained, slightly sandy, and fossiliferous. It possesses abundant voids filled with secondary calcite grains. Canalicular skeleton, chambers and the proloculum of many nummulitic species are filled with calcite crystals. Nummulites are represented by *Nummulites lyelli* d'Archiac, *Nummulites* spp. as well as *Operculina* spp. Small foraminifera and ostracods are rare. Few echinoid plates and bryozoa are dissiminated throughout the matrix. This biomicrite is known only in Areg surface section above the *Nummulites gizehensis* zone (samples 10350, 10351).

This association reflects marine environment of shallow neritic zone with well ventilated warm sea floor of normal salinity.

Nummulites lyelli Biosparite
Pl. LXIV, Fig. 1

The rock is chalky white, moderately hard and coarse grained, Clusters of *Nummulites lyelli* d'Archiac, *Nummulites* spp. and *Operculina* spp. predominate. Small foraminifera are rare. Echinoid remains together with bryozoa and ostracods are also encountered. Allochems and fauna show no preferable orientation. This biosparite is known only in Areg surface section below the *Nummulites contortus-striatus* zone (samples 10345—10349).

This association reflects marine environment of shallow neritic zone with well ventilated warm sea floor of normal salinity. Secondary crystallization is probably attributed to ascending hydrothermal solutions.

Upper Eocene:

Sandy Nummulitic Biomicrite
Pl. LXIV, Fig. 2

The rock is pink, hard and fine grained, highly sandy and fossiliferous. Large foraminifera are represented by flood of *Nummulites contortus* Deshayes, *Nummulites striatus* Bruguière and *Nummulites* sp. Shell fragments are common, but bryozoa and worm tracks are rare. Quartz grains are commonly medium sized, secondary calcite fills some voids. Allochems and fauna are non-oriented. This microfacies association is quite distinct. It characterizes the top bed of the Areg section (sample no. 10344) immediately above the Gisortia bed of Said 1963. This association belongs to the Upper Eocene and similar types have been reported in the area east of Helwan by Ghorab—Ismail, 1957.

Such a facies reflects marine environment of shallow neritic zone not far from the nearby landmass. Secondary calcite filling is attributed to carbonate rich ascending hydrothermal solutions.

Paleoecology

The paleoecological analyses elucidate the conditions under which sedimentation took place. Fossil organisms and the sediments in which they are embedded are good indicators for the evaluation and adaptation to the conditions that dominated during their life (Hecker 1965). Since this paleoecologic study is based on wide spaced stratigraphic sections from different localities, it is preferred to deal with each section separately and concisely. The paleoecologic conditions were interpreted for a certain stratigraphic time as represented by the investigated section and were continued in another section for the next stratigraphic interval, till the whole investigated sequence was elucidated.

The Abou Treifiya section is mainly concerned with the Lower Lutetian stage while both Samalut and Areg sections are concerned with the Upper Lutetian and the early Upper Eocene stages.

The Lower Lutetian of Abou Treifiya area (Cairo-Suez district) is characterized by reefal to inner neritic facies. This reflects gradual shallo-

wing of the sea where large Forams, Miliolids and Bryozoa have been flourished. This thanatocoenosis includes the fore-reef association existing between the Lower Eocene fore-reef shoal of the Lower Eocene (Barakat—Fahmy, 1968) and the upper back-reef of shallower condition in the belt of photic, warm and turbulent water.

During the Upper Lutetian in Abou Treifiya & west in Samalut along the Nile Valley and in Areg further west in the Western Desert, more shallowing took place and the occurrence of reefal facies is detected. This environment has been affected by a moderately energetic medium where good illumination, better food and oxygen are the most diagnostics. Intermittent short lived inundations and retreat resulted in alternation of thin bedded micrites and biomicrites with remarkable percent of clastics. The micrites and biomicrites enclose minute admixture of calcareous matter with planktonic elements reflecting deep conditions. By retreat, shallowing is repeated again and ill-bedded bioherms with non-oriented molluscan shell fragments and few large Forams have been accumulated under aerated warm sea of normal salinity.

The Upper Eocene is also characterized by shallow marine facies, being of fine grained detrital material with Nummulites, Bryozoa and worm tracks. Such a type of facies represent the dawn of continuous retreat that persisted during the whole Upper Eocene and resulted in the estuarine to continental facies of the Oligocene.

Conclusions

Detailed investigations of surface and subsurface Middle and early Upper Eocene sections in Lower Egypt lead to the recognition of ten different types of microfacies, equated with five foraminiferal biozones. These zones are arranged from base to top as:

1. *Alveolina frumentiformis/Nummulites praecursor* zone (L. Middle Eocene)
2. *Nummulites zitteli* zone (early U. Middle Eocene)
3. *Nummulites champollioni-gizehensis* zone (U. Middle Eocene)
4. *Nummulites lyelli* zone (late U. Middle Eocene)
5. *Nummulites contortus-striatus* zone (early U. Eocene)

The paleoecology of the sections studied revealed that the Lower Middle Eocene, Upper Middle Eocene and early Upper Eocene sediments were accumulated in a retreating sea. Accordingly, fore-reef transitional zone, followed by reefal environment with short lived invasions are well demonstrated. Further shallowing persisted and participated in the formation of estuarine to continental facies of the Oligocene.

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Reviewed by O. Samuel
(Described in English by author)

Explanation of plates LIX—LXIV

Plate LIX

Fig. 1 *Alveolinal Biomicrite* (7 X)
Fine grained, highly fossiliferous, wholly composed of large foraminifera especially *Alveolina frumentiformis* Schwager, together with some small unidentifiable organic remains.
Age: Lower Lutetian
Locality: Abou Treifiya, sample B/Tr
Environment: Reefal to inner neritic.

Fig. 2 *Nummulites zitteli Biomicrite* (5.5 X)
Coarse grained, highly fossiliferous, with abundance of large foraminifera especially *Nummulites zitteli* De la Harpe. Bryozoa and lamellibranch fragments with few undifferentiated organic remains common.
Age: Upper Lutetian
Locality: Samalut SM.11C, core sample 10335
Environment: Relatively shallow to reefal, affected by high level of energy caused by waves.

Plate LX

Fig. 1 *Nummulites zitteli Biomicrite* (5.5 X)
Coarse grained, highly fossiliferous, mainly with *Nummulites zitteli* De la Harpe, both micro and megalospheric forms known. Other *Nummulites* spp. common, together with some bryozoa and lamellibranch fragments.
Age: Upper Lutetian
Locality: Samalut SM.11C, core sample 10335
Environment: Relatively shallow to reefal.

Fig. 2 *Nummulites zitteli Biosparite (5.5 X)*
Medium grained, nummulitic, with abundant *Nummulites zitteli* De la Harpe, together with bryozoa and lamellibranch fragments embedded in a sparry calcite matrix.
Age: Upper Lutetian
Locality: Samalut SM.2C, core sample 10325
Environment: Relatively shallow to reefal, affected by high level of energy caused by waves.

Plate XI

Fig. 1 *Nummulites champollioni Biomicrite* (7 X)
Coarse grained, highly nummulitic, with *Nummulites champollioni* De la Harpe, and *Nummulites gizehensis* (Forskal).
Age: Upper Lutetian
Locality: Samalut SM.11C, core sample 10329
Environment: Reefal, affected by water agitation.

Fig. 2 *Molluscan Biomicrite* (5.5 X)
Fine grained, fossiliferous, mainly formed of lamellibranch fragments together with few gastropod and cephalopod remains. Small foraminifera and Nummulites rare.
Age: Upper Lutetian
Locality: Samalut SM.2C, core sample 10323
Environment: Littoral, subjected to wave action.

Plate LXII

Fig. 1 *Globigerina Biomicrite* (30 X)
Fine grained, slightly sandy, highly fossiliferous, with abundant planktonic foraminifera, together with some representatives of the families Buliminidae and Discorbidae. Molluscan fragments common, loosely packed in a carbonate matrix.
Age: Upper Lutetian
Locality: Samalut SM.6C, core sample 10307
Environment: Neritic, open marine facies.

Fig. 2 *Nummulites gizehensis Biomicrite* (5.5 X)
Coarse grained, highly fossiliferous, with abundant *Nummulites gizehensis* (Forskal), *Nummulites mariettei* De la Harpe, together with other *Nummulites* spp. Small foraminifera common in the matrix, but lamellibranch fragments rare.
Age: Upper Lutetian
Locality: Samalut SM.3C, core sample 10341
Environment: Reefal, affected by water agitation caused by waves.

Plate LXIII

Fig. 1 *Nummulites gizehensis Biomicrite* (5.5 X)
Medium grained, highly nummulitic, with abundant *Nummulites gizehensis* (Forskal). Small foraminifera and lamellibranch fragments rare.
Age: Upper Lutetian
Locality: Areg, sample 10352
Environment: Reefal, affected by water agitation caused by waves.

Fig. 2 *Nummulites lyelli Biomicrite* (5.5 X)
Fine grained, slightly sandy, highly nummulitic, with *Nummulites lyelli* d'Archiac, *Nummulites* spp, together with *Operculina* spp. Small foraminifera, ostracods, echinoid plates and bryozoa rare.
Age: Upper Lutetian
Locality: Areg, sample 10351
Environment: Shallow neritic, with well aerated warm sea of normal salinity.

Plate LXIV

Fig. 1 *Nummulites lyelli Biosparite* (5.5 X)
Medium grained, nummulitic, with *Nummulites lyelli* d'Archiac, *Nummulites* spp. together with *Operculina* spp. Echinoid plates and bryozoa common, small foraminifera and ostracods rare.
Age: Upper Lutetian
Locality: Areg, sample 10348
Environment: Shallow neritic, with well aerated warm sea of normal salinity.

Fig. 2 *Sandy Nummulitic Biomicrite* (5.5 X)
Fine grained, sandy, highly fossiliferous, with abundant *Nummulites contortus* Deshayes, *Nummulites striatus* Bruguiere, and *Nummulites* sp. Shell fragments common.
Age: Upper Eocene
Locality: Areg, sample 10344
Environment: Shallow neritic, not far from the nearby landmass.

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M. G. Barakat—A. S. El-Dawoody

Mikrobiostratigrafia niektorých strednoeocénnych hornín v Egypte

Resumé anglického textu

Tab. LIX—LXIV

Autori v práci podávajú litologicko-biostratigrafický opis niektorých stratigraficky významných profilov lutétu. Väčšinou ide o klasické profily, ktoré tvoria »oporné body« pre interregionálnu stratigrafickú koreláciu mediteránnej oblasti. V práci sú opísané a vyobrazené najvýznamnejšie lutétske formy veľkých i malých foraminifér, pričom hlavný dôraz sa kladie na ich vertikálne rozšírenie.

Z hľadiska stratigrafickej korelácie so Západnými Karpatmi majú význam planktonické foraminifery. Na ich základe môžeme konštatovať, že stratigrafické ponímanie stredného eocénu — lutétu — sa chápe v podstate jednotne.

Západné Karpaty • séria paleontológia (1) • P. 111—176 • GÚDŠ • Bratislava • 1975

Ondrej Samuel

Foraminifera of Upper Priabonian from Ľubietová (Slovakia)

(34 plates [XV—XCVIII], 3 text-figs, Slovak summary)

Abstract. The author describes the microfauna from a marly — claystone lithofacies near Ľubietová. The results of a detailed microstratigraphic analysis of foraminifers show that the association studied indicates the Upper Priabonian age of the beds under study. In accordance with the standard zonation of the Mediterranean zone, the populations of planktonic foraminifers may be best correlated with W. H. Blow's (1969) zone P-17.

Introduction

Relicts of the Central-Carpathian Paleogene sedimentation cycle (Upper Lutetian — Lower Oligocene) were known long ago from the Horehronie intramontaneous depression. They were mentioned for the first time by D. Štúr cf. 1866, 1868; fide 1960, pp. 264—265. Further brief information followed after a century, mostly in connection with the research of the Neogene and later formations (cf. J. Koutek et D. Andrusov 1937; D. Andrusov 1954; J. Seneš 1961; J. Lozert et M. Náprstek 1957; I. Cicha 1960; D. Andrusov et E. Köhler 1963; L. Horák et B. Pacltová 1963).

A complete idea of the lithological-stratigraphical and paleogeographical history of the Central-Carpathian Paleogene from the Horehronie region was presented for the first time by A. Matějka (in M. Maheľ et al. 1964) in the Explanations to the General map 1 : 200 000 (sheet Banská Bystrica), and later on by D. Andrusov (1965) and F. Chmelík (1967) basing on the results of the preceding authors.

Since 1960 M. Pulec and a team of specialists have carried out the geological-stratigraphical research of Cenozoic sediments in the intramontaneous depression of the Horehronie. The research resulted in valuable data about spatial distribution, tectonics, lithological-facial characteristics, stratigraphy and paleogeographic history of the Central-Carpathian Paleogene sedimentation cycle. Detailed analyses of small and larger foraminifers (M. Vaňová 1972), pollen and spores (E. Planderová 1973), and of nannoplankton (H. Bystrická — manuscript) facilitated exact stratigraphic ranging of isolated lithofacies, the preliminary data on the entire Cenozoic filling having been published as

RNDr. O. Samuel, DrSc., Geologický ústav Dionýza Štúra, Mlynská dolina 1, Bratislava.

early as 1963 by E. Planderová — M. Pulec — O. Samuel — M Vaňová. These authors distinguished the following facies within the Central-Carpathian sedimentation cycle:

1. pre-Lutetian continental facies (Upper Cretaceous — Lower Luthetian);
2a. basal transgressive lithofacies (Upper Lutetian—Lower Priabonian);
2b. sandstone-claystone lithofacies — nontypical flysch (Upper Priabonian);
2c. marly-claystone lithofacies (Upper Priabonian — ? Lower Oligocene);
2d. brackish and freshwater sediments (Lower Oligocene). Later paleontological data facilitated more exact stratigraphical ranging of these facies.

Microbiostratigraphical description

The author only deals with the stratigraphical significance of foraminifers mostly recovered from the boreholes P-4 and P-8 (Illustration 1) in a marly-claystone lithofacies near Ľubietová. The lithofacies in the boreholes is represented by grey and light-grey marls and calcareous claystones, while sandy claystones and conglomerates in the pelitic component form only several cm thick irregular intercalations without marked gradation and rhythmicity. In these characteristics it differs from the sandy — claystone lithofacies (non-typical flysch). The two lithofacies are connected by a gradual transition.

When researching the inner depressions, we did not record marine Lower Miocene sediments mentioned by D. Štúr (1868) and almost a century later by I. Cicha (1960), L. Horák et B. Pacltová (1963), J. Jaroš et al. (1966). Besides the Paleogene (Central-Carpathian) marine sedimentation cycle (Upper Lutetian-Priabonian) they also distinguished a later Chattian-Aquitanian cycle. In their paleogeographical conclusions the authors relied upon stratigraphical data by B. Pacltová (1966) treating palynologically the samples from the northern surroundings of Banská Bystrica, and upon I. Cicha's results (1960). He examined foraminifers from a sample taken by N. Náprstek from grey and blue-grey, fine-sandy non-bedded calcareous clays from Ľubietová. I. Cicha (l. c.) regards the sediments as Aquitanian in age. A detailed geological research and lithological-facial correlations showed that these sediments are identic with our marly — claystone bed sequence. It is also evidenced by the borehole P-8 situated near an exposure at Ľubietová.

In the boreholes P-4 and P-8 the marly-claystone lithofacies contains quite rich and well preserved foraminiferal associations in contrast to the flysch formation in the northern sedimentation zone of the Central-Carpathian Paleogene. Interestingly, the nature of the associations is repeatedly changing in the course of the profiles in both boreholes. In the lower parts of the boreholes are comparatively poor benthonic calcareous associations with accasional agglutinated elements. Higher-up appears an association rich in calcareous benthos. The planktonic component is rather smaller. Such associations are repeatedly alternating with planktonic in which the ratio of the calcareous benthos and plank-

ton is reversed — the association consists almost of pure planktonic forms.

The changes in the substance of different biotopes reflect oscillations of the coastal line at the southern Spish-Gemer cordillera which separated the Central-Carpathian sea from the Budín epicontinental marine facies.

Among planktonic forms identified were the following species:

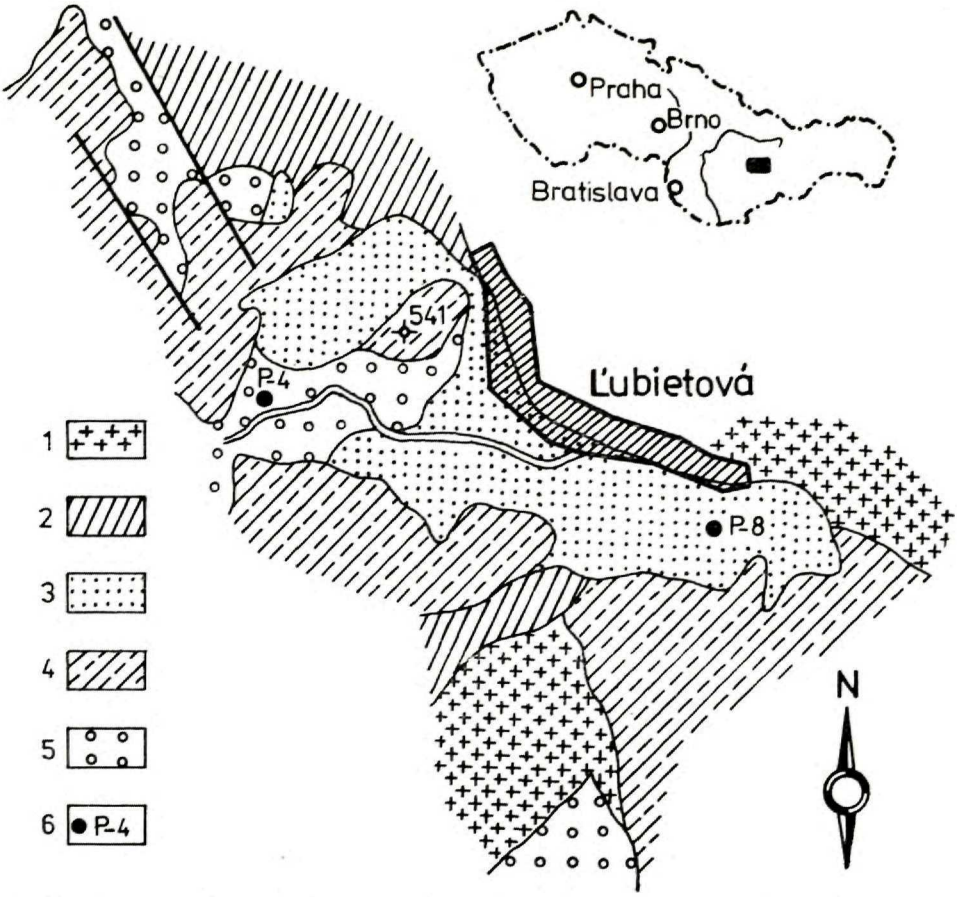


Fig. 1 A geological sketch of the vicinity of Ľubietová (after M. Pulec in E. Planderová — M. Pulec — O. Samuel — M. Vaňová 1963). Explanations: 1 — crystalline; 2 — Mesozoic; 3 — marly — claystone lithofacies; 4 — agglomerates; 5 — gravels, Pliocene; 6 — boreholes P-4 and P-8.

Quantitatively most abundant are the species *Globigerina* ex gr. *preabulloides* and *G. gnaucki* Blow et Banner. In some flood-plains (e.g. in the borehole P-4: 29—30 m, 32—33 m, 59,5 m) their ocurrence is up to 90 %. Other species are usually infrequent. Only the species *G. angiporoides* Hornibrook surpasses the value occasionally.

In vertical sense the amount of planktonic species remains practically unchanged. A slight change may be observed in the borehole P-4 above

Species	Borehole P-4: 31—40 m	51—60 m
Chiloguembelina gracillima (Andreae)	+	—
Globanomalina micra (Cole)	+	+
Turborotalia (T.) *centralis* (Cushman et Bermúdez)	—	+
Turborotalia (T.) ex *gr. cerroazulensis* (Cole)	+	+
Turborotalia (T.) cf. *increbescens* (Bandy)	+	+
Globigerina ampliapertura Bolli	+	+
Globigerina angiporoides Hornibrook	+	+
Globigerina angustiumbilicata Bolli	+	—
Globigerina corpulenta Subbotina	—	+
Globigerina danvillensis Howe et Wallace	+	+
Globigerina dissimilis Cushman et Bermúdez	+	+
Globigerina eocaena compacta Subbotina	—	+
Globigerina galavisi Bermúdez	+	+
Globigerina gnaucki Blow et Banner	+	+
Globigerina gortanii (Borsetti)	+	+
Globigerina linaperta linaperta Finlay	+	+
Globigerina transdanubica Samuel	+	+
Globigerina liverovskae (Bykova)	+	—
Globigerina officinalis Subbotina	+	+
Globigerina opima nana Bolli	+	+
Globigerina ouachitaensis Howe et Wallace	+	+
Globigerina praebulloides praebulloides Blow	+	+
Globigerina praebulloides leroyi Blow et Banner	+	+
Globigerina praebulloides occlusa Blow et Banner	+	+
Globigerina prasaepis Blow	+	+
Globigerina postcretacea (Mjatliuk)	+	—
Globigerina pseudoampliapertura Blow et Banner	+	+
Globigerina pseudovenezuelana Blow et Banner	+	+
Globigerina senilis Bandy	+	+
Globigerina aff. tapuriensis Blow et Banner	+	+
Globigerina tripartita Koch	+	+
Globigerina turcmenica Chalilov	—	+
Globigerina variabiliformis Chalilov	—	+
Globorotaloides suteri Bolli	+	+

40 m, where on the one hand we are lacking some species encountered in lower levels *(T. (T.) centralis, G. corpulenta, G. eocaena compacta, G. turcmenica, G. variabiliformis)*, while on the other hand there are occasional occurrences of the species *Globigerina angustiumbilicata* Bolli, *G. liverovskae* (Bykova), *G. postcretaceae* Mjatliuk and slender forms of the species *Chiloguembelina gracillima.* Together with the species quoted there are sporadical occurrences of a higher evolutionary form representing the species *T. (T.) cerroazulensis* (Cole). It is ranged in separate subspecies *T. (T.) cerroazulensis cunialensis* by M. Toumarkine et H. M. Bolli (1970). According to their data it does not overpass the Upper Eocene (Priabonian). W. H. Blow et F. T. Banner's (1962) and W. H. Blow's (1969) results, and

our data from the West Carpathians show that all the species identified started appearing in the Middle, and mostly in the Upper Eocene (Priabonian). The first occurrences of the species *G. gnaucki* Blow et Banner, *G. prasaepis* Blow, *G. ampliapertura* Bolli, *G. angustiumbilicata* Bolli belong in his zone P-17 representing the uppermost successive zone of the Upper Eocene, according to most authors. In the beds under study no such species was found as to apear in the Upper Oligocene or Lower Miocene (»Chattian—Aquitanian«). Some forms (see Tab. XCV, Fig. 4—5) show a close relationship with the species *Globigerina tapuriensis* Blow et Banner. According to W. H. Blow's (1969) data it started appearing at the base of his zone P-18. The analysis of planktonic foraminifers shows that the sequence studied corresponds to the lowermost part of the zone *G. postcretacea.*

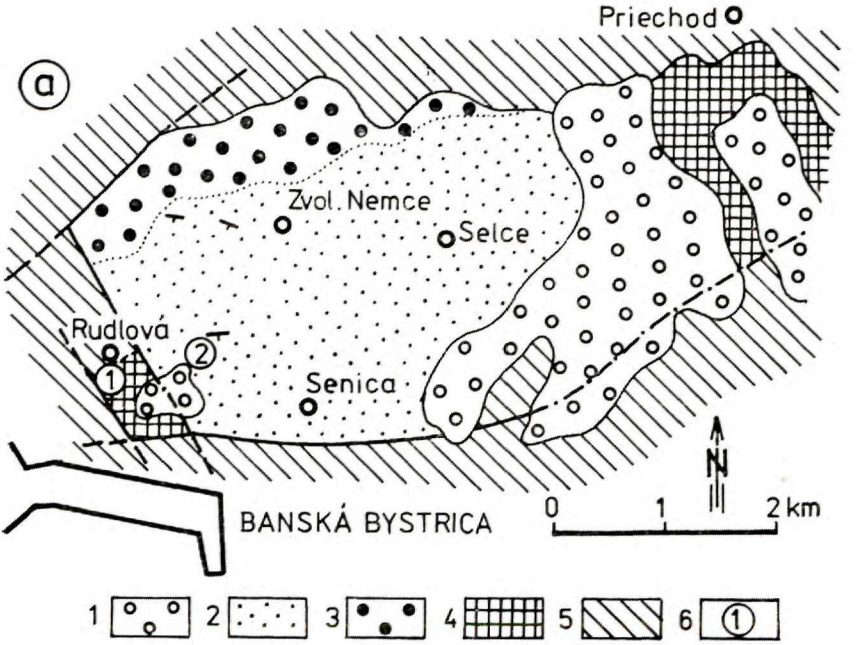
In accordance with the results of the research of planktonic foraminifers are larger foraminifers recorded from a depth of 142 m in the borehole P-4. M. Vaňová (1972) identified them as forms intermediate between *Nummulites fabianii* (Prever) and *N. fichteli fichteli* Michelotti.

Among stratigraphically important species of benthonic foraminifers, attention should be paid to the genus *Almaena* represented by an infrequent species *Almaena taurica* Somoilova and by *A.* cf. *crenata* (Marie), which — according to literary data started to appear as early as Upper Eocene. A form typical of the Upper Oligocene or Lower Miocene sediments, i.e. *A. osnabrugensis* (Roemer) as mentioned by I. Cicha (1960) has not been found in the material examined. The benthonic component exhibits many features in common with the microfauna recorded in the Paris basin by Y. Le Calvez (1970). Special attention should be paid to the genus *Glabratella* represented by the species *G. diadematoides* (Le Calvez), *G. excavata* (Terquem), *G. herouvalensis* (Le Calvez), *G. turbinata* (Terquem), *G. ubiqua* (Le Calvez), *G. hronica* nov. sp. In accordance with the existing literary data, any of these species does not surpass the Upper Eocene. On the other hand, there are species whose Oligocene holotypes were recently described. Such are e.g. *Bulimina kasselensis* Batjes 1961, *Buliminella rara* Pischvanova 1960, *Cibicides lopjanicus* Mjatliuk 1950, *»Eponides« octocameratus* Subbotina 1960, *»Eponides« binominatus* Subbotina 1960. The results of our examination show that their diapason is broader, and that the first appearances of the species quoted were in the Uppermost Priabonian.

The age diapason of the other benthonic forms identified is broader, and they are recorded from various areas: from the Paleogene, Oligocene, or Miocene, and this is why we do not treat them separately.

Conclusions

1. The results of the analysis of foraminifers from the boreholes P-4 and P-8 from the surroundings of Ľubietová show that the marly-claystone lithofacies in the Horehronská kotlina intramontaneous depression correspond to the upper part of the Carpathian zone of *Globigerina officinalis,* related to the uppermost Priabonian. The opinion is also supported by larger foraminifers representing intermediary forms among phylogenetically related forms *Nummulites fabianii* (Prever) — *N. fichteli*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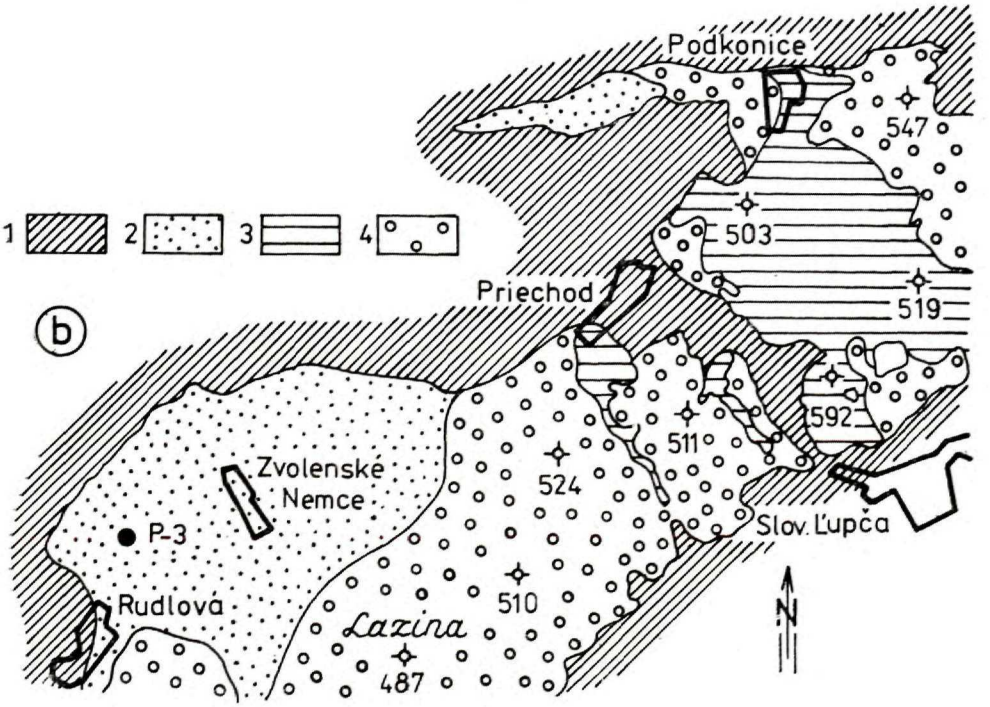
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Michelotti, the first of them being characteristic of the Priabonian, the second — of the Lower Oligocene.

2. The Lower Oligocene of the Horehronská kotlina intramontaneous depression includes the uppermost part of marine sediments encountered e.g. in the upper part of the borehole P-16 (Polomka) brackish sediments cropping out near the JRD (Cooperative farm) Polomka (containing *Ammonia propinqua)*, and freshwater sediments exposed in a quarry near the railroad in Brezno (see E. Planderová, 1973).

3. »Chattian — Aquitanian« sediments in Ľubietová, mentioned by I. Cicha (1960) have not been recorded in this region. No sediments of the same age have been found in the area of Banská Bystrica where the borehole P-3 has been situated (Illustration 2). The results of our investigations show that the marine »Chattian — Aquitanian« sedimentation cycle did not reached the Horehronská kotlina intramontaneous depression.

The borehole P-3 was situated in the sequence referred to Chatt—Aquitanian by Horák and B. Pacltová (1963; p. 125, Fig. 1). The borehole penetrated through the entire bed complex down to the substratum (cf. E. Planderová — M. Pulec — O. Samuel). In the lower part of the borehole, on the Mesozoic substratum (150,5—137 m) are arcosic and calcareous sandstones containing Upper Priabonian larger foraminifers [115 m: *N. striatus striatus* (Bruguiere), *N. striatus minor* Archiac et Haim, *N. striatus pannonicus* (Rozlozsnik), *N. incrassatus incrassatus* Harpe — fide N. Vaňová 1972]. Toward the overlier the pelitic component gradually increases and alternates rhythmically with sandstone beds. Owing to this the bed sequence acquires the nature of nontypical flysch, beginning from the middle part of the borehole (95 m). Consequently, as regards lithofacial aspect, the bed sequence possesses all the characters of the Central-Carpathian Paleogene developed mostly in the southern parts of the Inner West Carpathians.

4. The analysis of foraminifers did not show any traces of redeposition, nor earlier Upper Lutetian or Lower Priabonian forms which should be found if we admit that the associations are resedimented from the Central Carpathian Paleogene (Upper Lutetian — Lower Oligocene) into the so-called Chatt—Aquitanian marine sedimentation cycle.

5. Stratigraphical parallelization shows that the Carpathian zone of *Globigerina officinalis* has most characters in common with H. M. Bolli's (1957b) undefined zone of *Globorotalia cerroazulensis.* On the other hand, these zones are more-or-less identic with W. H. Blow's (1969) zones P-16—P-17. The results from the boreholes P-4 and P-8 show that the Blow's zone P-17 corresponds only to the upper part of our zone *Globigerina officinalis* and to the lowest part of the zone *Globigerina postcretacea* (Illustration 3). According to these criteria the boundary

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Fig. 2 A geological sketch of the area to the northeast of Banská Bystrica [after a) L. Horák in L. Horák et B. Pacltová 1963; b) M. Pulec in E. Planderová — M. Pulec — O. Samuel — M. Vaňová 1963]. Explanations: (a) 1 — Pliocene (?) — gravels; 2 — Chatt-Aquitanian, clays and sands; 3 — Chatt--Aquitanian, polymict gravels; 4 — Eocene; 5 — Mesozoic; 6 — points of palynological sampling. (b) 1 — Mesozoic; 2 — sandstone — pelitic lithofacies; 3 — variegated shales; 4 — dolomitic conglomerates and sandstones; 5 — Pliocene (gravels); 6 — borehole P-8.

between the Upper Eocene (Priabonian) and the Lower Oligocene in our region should be in the lowest part of the zone *G. postcretacea.* Still the relation of the planktonic zone to the international chronostratigraphic scale and the position of the Oligocene stratotypes described is not so clear as to prevent difficulties in interregional stratigraphical correlation.

<table>
<tr><td colspan="2"></td><td colspan="4">UPPER EOCENE
(PRIABONIAN)</td><td>LOWER OLIGOCENE</td></tr>
<tr><td rowspan="3">ZONES</td><td>H. M. Bolli 1957</td><td colspan="2">G. semiinvoluta</td><td colspan="2">Gr. cocoaensis</td><td></td></tr>
<tr><td>O. Samuel et J. Salaj 1968</td><td colspan="2">G. index</td><td colspan="2">G. officinalis</td><td>G. postcretacea</td></tr>
<tr><td>W. H. Blow 1969</td><td colspan="2">P-15</td><td colspan="2">P-16</td><td>P-17 | P-18</td></tr>
<tr><td rowspan="2">BOREHOLES</td><td>P - 4</td><td colspan="3"></td><td colspan="2"></td></tr>
<tr><td>P - 8</td><td colspan="3"></td><td colspan="2"></td></tr>
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Fig. 3 A stratigraphical correlation table.

Genus *Pyrgo* Defrance 1824
Pyrgo bulloides (Orbigny, 1826)
Pl. LXV, Fig. 1

1826 *Biloculina bulloides* d'Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Pyrgo bulloides* (d'Orbigny). Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 54, tab. 6, fig. 5 (cum syn.).

Remark: Our forms are identic with the original description of the species by Y. Le Calvez (1970) who described the forms from the Parisian Basin.

Stratigraphical range: Eocene-Oligocene (cf. Y. Le Calvez 1970, D. A. J. Batjes 1958). Our forms pictured were recorded from the zone *Globigerina officinalis.*

Pyrgo simplex (Orbigny, 1846)
Pl. LXV, Fig. 2a-b

1846 *Biloculina simplex* d'Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Pyrgo simplex* d'Orbigny Y. Le Calvez: Contribution a l'étude des Foraminifères etc., p. 55, tab. 8, fig. 7.

Stratigraphical range: After Y. Le Calvez (1970) the species occurs in the Middle Eocene of the Parisian Basin. Our forms pictured were recorded from the zone *Globigerina officinalis.*

Genus *Nodosaria* Lamarck 1812
Nodosaria acuminata Hantken, 1875
Pl. LXX, Fig. 3

1875 *Nod. acuminata* Hant. — M. Hantken: Die Fauna der Clavulina Szabói Schichten, p. 28, tab. 2, fig. 9, tab. 13, fig. 5.

Remark: In the material examined are fragments of tests with 3 or maximally 9 chambers. Throughout the periphery of the test are symmetrically distributed 6—7 ribs. It differs from *Nodosaria minor* Hantken in more elongated chambers and in pointed (pin-shaped) first third of the test.

Stratigraphical range: The holotype was recorded from the Oligocene beds of Hungary. In the area studied it has been only found in the Upper Eocene and Oligocene, so far.

Nodosaria adolphina (Orbigny, 1846)
Pl. LXX, Fig. 2a—b

1846 *Dentalina adolphina* d'Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1969 *Nodosaria adolphina* (dOrbigny) — E. Y. Krayeva et B. F. Zerneckiy: Foraminiferi paleogena Ukraini, p. 41—42, tab. 14, fig. 6 (cum syn.).

Remark: Some test fragments regarded as belonging to the species *Nodosaria adolphina* (Orbigny) show spherical form of chambers severed by a prominent neck. The middle parts of the chamber surfaces are covered with rare fine spines. The test wall is fine-perforated.

From the species *Nodosaria spinencens* (Reuss) it differs in more spherical chambers severed by a higher and prominent neck, by fine spines covering mostly the equatorial chambers.

Stratigraphical range: According to literary data the species is recorded in the Paleogene up to the Miocene. In the area studied it was found in the Upper Eocene and Oligocene.

Nodosaria coarctata Hantken, 1875
Pl. LXV, Fig. 5

1875 *Nod. coarctata* Hantk., n. sp. — M. Hantken: Die Fauna der Clavulina Szabói Schichten, p. 24, tab. 12, fig. 15.

Remark: Among the specimens studied are only a few singlechambered fragments. As for the number of ribs and the shape of chambers

they are identic with the form from Hungary described by M. Hantken (l. c.) as *N. coarctata.*

Stratigraphical range: Eocene-Oligocene. In the area studied the species was only found in the Upper Eocene.

Nodosaria consobrina (Orbigny, 1846)
Pl. LXIX, Fig. 7—9

1846 *Dentalina consobrina* d'Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1969 *Nodosaria consobrina* E. Y. Krayeva et B. F. Zerneckiy: Foraminifera paleogena Ukraini, p. 43, tab. 15, fig. 4 (cum syn.).

Remark: The Carpathian forms agree with the description and picture of the holotype.

Stratigraphical range: Paleogene — ? Recent. In the West Carpathians they are in the Paleogene and Miocene.

Nodosaria contorta (Hantken, 1875)
Pl. LXX, Fig. 4—5

1875 *Dent. contorta* Hantk. — M. Hantken: Die Fauna der Clavulina Szabói Schichten, p. 36, tab. 4, fig. 5.

Remark: In the material examined are rare fragments of tests consisting of 1—3 chambers. Their ornamentation is costate, identic with that of the holotype as quoted by M. Hantken from the adjacent area of Hungary. When describing the species he mentions a case with the smooth upper part of the test. We had the case, too, in the association studied (cf. Pl. 70, fig. 5).

Stratigraphical range: Eocene-Oligocene. In the West Carpathians the author found the form only in the Upper Eocene.

Nodosaria exilis Neugeboren, 1852
Pl. LXIX, Fig. 12a-b, 13—14

1852 *Nodosaria exilis* Neugeboren — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1953 *Siphonodosaria exilis* Subbotina — N. N. Subbotina: *Verkhneeocenoviye lyagenidi* etc., p. 186—188, tab. 6, fig. 7—10 (cum syn.).

Remark: Our forms agree with those described and pictured by the author and by N. N. Subbotina (l. c.) who described the species from the U.S.S.R.

Stratigraphical range: N. N. Subbotina (l. c.) recorded the forms in the Upper Eocene in the U.S.S.R. The holotype is from the Rumanian Miocene. In the Slovak West Carpathians it has been found in the Upper Eocene (mostly in the zone *Globigerina officinalis)* so far.

Nodosaria setosa (Hantken, 1875)
Pl. LXX, Fig. 1a-c

1875 *Dent. setosa* Hantk. n. sp. — M. Hantken: Die Fauna der *Clavulina Szabói* Schichten, p. 39, tab. 13, fig. 9.

Remark: The extremely rare specimens agree with those described and pictured by M. Hantken (l.c.). The test consists of 5 chambers, the penultimate of which is 1½ X smaller than the ultimate. The test surface is hispid; the test wall — fine-perforated, and pores are asymmetrically distributed among fine »nodes« visibly only at multiple magnification (Fig. 1b).

Stratigraphical range: In the Western Carpathians the species described is infrequent in the zone *Globigerina officinalis*. M. Hantken recorded it in the upper *Clavulina szaboi* beds ranged to the Oligocene (Rupelian) — Lower Miocene (Egerian) on the basis of the recent investigations.

Nodosaria spinescens (Reuss, 1851)
Pl. LXIX, Fig. 15a-b., 16a-b

1851 *Dentalina spinescens* Reuss — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1969 *Nodosaria spinescens* (Reuss, 1851) — E. Y. Krayeva et B. F. Zerneckiy: Foraminiferi paleogena Ukraini, p. 46, tab. 15, fig. 15 (cum. syn.).

Remark: In the material studied are some fragments of a test composed of 2—5 chambers. In the part of each chamber is jagged (to fine-hispid) ornamentation in one line, the test wall is fine-perforated (Fig. 15b). Our forms show most common features with the species *N. spinecens* (Reuss), to which they are ranged.

Stratigraphical range: *Nodosaria spinecens* was described by D. Reuss from the Oligocene of East Germany. From the same stratigraphical level it was recorded by D. A. J. Batjes (1958) from Belgium. From the U.S.S.R. it is quoted from the Upper Eocene (cf. E. Y. Krayeva et B. F. Zerneckiy, l.c.). In the area studied it has been found in the Upper Priabonian (= the Zone *Globigerina officinalis*) so far.

Nodosaria tutkowskii Kitchapov, 1939
Pl. LXX, Fig. 7

1939 *Nodosaria tutkowskii* Kitchapov: Foraminiferi iz otlozneniy kiyevskogo yarusa etc., p. 26, tab. 4, fig. 60 (non vidi; fide E. Y. Krayeva et B. F. Zerneckiy 1969, in lit.).
1969 *Nodosaria tutkowskii* Kitchapov — E. Y. Krayeva et B. F. Zerneckiy: Foraminiferi paleogena Ukraini, p. 47, tab. 16, fig. 4a-b.

Remark: In the Slovak West Carpathians the species is rather infrequent. Our specimen pictured differs from that described by E. Y.

Krayeva et B. F. Zerneckiy (l.c.) only in a broken horn in the proximal part of the test. Our specimen consists of two chambers with 7—8 ribs on their surface. The test is calcareous, and- as showed by stereoscan pictures — very fine-perforated.

Stratigraphical range: According to E. Y. Krayeva et B. F. Zernickiy (1969), *Nodosaria tutkowskii* Kitchapov occurs in the Upper Eocene in the U.S.S.R. In the West Carpathians it has been found in the same stratigraphical level, i.e. in the zone *Globigerina officinalis*.

Nodosaria sp. (cf. *N. ewaldi* Reuss, 1851)
Pl. LXIX, Fig. 10

cf. 1851 *Nodosaria ewaldi* Reuss — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1961 *Dentalina* sp. c. *D. ewaldi* (Reuss) — J. P. H. Kaasschieter: Foraminifera of the Eocene of Belgium, p. 175, tab. 7, fig. 15—16.

Remark: Among the forms studied found were some fragments resembling the species *D. ewaldi* (Reuss). Similar forms were pictured by J. P. H. Kaasschieter from the Upper Eocene of Belgium.

Genus *Dentalina* Orbigny, 1826
Dentalina aproximata Reuss, 1846
Pl. LXIX, Fig. 5—6

1865 *Dentalina aproximata* Reuss — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1969 *Dentalina aproximata* Reuss — E. Y. Krayeva et B. F. Zerneckiy: Foraminifera paleogena Ukraini, p. 62, tab. 22, fig. 4 (cum syn.).

Stratigraphical range: ? Upper Senonian — Miocene. In the West Carpathians it was recorded only in Eocene and Miocene.

Dentalina intermedia Hantken, 1975
Pl. LXIX, Fig. 1—3

1875 *Dent. intermedia Hantk.* n. sp. — M. Hantken: Die Fauna der Clavulina Szabói Schichten, p. 30, tab. 3, fig. 3, 8.

Remark: Among the specimens studied the species is only found in the form of fragments. They do, however, agree with the described and pictured holotype recorded from the Oligocene of the adjacent Hungarian area.

Stratigraphical range: The species is current in the Eocene and Oligocene sedimentation cycles of the Hungarian Median Mass and in the adjacent part of South Slovakia. It is very rarely found in the Upper Eocene — Lower Oligocene flysch sediments of the Central Carpathian Paleogene.

Dentalina megalopolitana Reuss, 1855
Pl. LXX, Fig. 8

1855 *Dentalina megalopolitana* Reuss — fide B. F. Ellis et A. I. Messina: Catalogue of Foraminifera.
1961 *Dentalina megalopolitana* Reuss — J. R. H. Kaasschieter: Foraminifera of the Eocene etc., p. 174—175, tab. 7, fig. 14 (cum syn.).

Remark: Our forms are similar to the forms described by Kaasschieter from the Eocene of Belgium. Among the specimens studied they are infrequent in the upper part of the Upper Eocene (= the Carpathian Zone of *Globigerina officinalis*).

Dentalina pauperata Hantken, 1847, non Orbigny, 1846
Pl. LXIX, Fig. 4

1875 *Dent. pauperata* d'Orbigny — M. Hantken: Die Fauna der Clavulina Szabói Schichten, p. 31, tab. 3, fig. 6.

Remark: The material examined comprises some fragments of test with 6—9 chambers, mostly resembling the species pictured by M. Hantken (1875) and denoted as *Dentalina pauperata* d'Orb.
Stratigraphical range: The author found the form only in the Upper Eocene and Lower Oligocene sediments of the Central Carpathian Paleogene in the Slovak West Carpathians.

Genus *Lagena* Walker et Jacob, 1798
Lagena asperoides Galloway et Morrey, 1929
Pl. LXVI, Fig. 1a-c, 2

1929 *Lagena asperoides* Galloway et Morrey — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1953 *Lagena asperoides* Galloway et Morrey — J. P. *Beckmann:* Foraminiferen der Oceanic Formations etc., p. 355—366, tab. 19, fig. 28.

Remark: The forms studied exhibit most features in common with the species *L. asperoides*. They differ from the holotype in subspherical to oval shape of the test.
Stratigraphical range: Eocene—Oligocene. Among the specimens studied from the entire boring profile it is very sparse.

Lagena amphora Reuss, 1858
Pl. LXVI, Fig. 5a-b

1858 *Lagena amphora* Reuss 1858 — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1969 *Lagena costata amphora* Reuss — E. Y. Krayeva et B. F. Zerneckiy: Foraminifery paleogena Ukraini, p. 48, tab. 16, fig. 7, (cum. syn.).

Remark: Forms ranged to the species described differ from *Lagena isabella* (Orbigny 1839) mostly in more slender chambers and in less ribs (8—10 in contrast to 12—14).

Stratigraphical range: In the Ukrainian S.S.R. the species was recorded from the Upper Eocene. In an analogous stratigraphic level it is found in the Slovak Central Carpathian Paleogene. Some authors quote it from the Paleogene — the Recent.

Lagena gracilis Williamson, 1848
Pl. LXVI, Fig. 4a-b

1848 *Lagena gracilis* Williamson — fide B. F. Ellis et R. A. Messina: Catalogue of Foraminifera.
1966 *Lagena gracilis* Williamson — J. Hofker: Maastrichtian, Danian etc., p. 89, tab. 15, fig. 24, p. 253, tab. 57, fig. 123—125.
1969 *Lagena gracilis* Williamson — E. Y. Krayeva et B. F. Zerneckiy: Foraminifery paleogena Ukraiiny, p. 48, tab. 16, fig. 10 (cum syn.).

Remark: Among the specimens studied are some forms with pointed ends of chambers. These forms show variableness in length and width of the test and in number of ribs. They show most features in common with the species *L. gracilis.*

Stratigraphical range: According to literature the species is present from the Cretaceous up to the Recent. In the West Carpathians, the author has found the species only in the Upper Eocene and Oligocene, so far.

Lagena hexagona (Williamson, 1848)
Pl. LXV, Fig. 4a-d

1848 *Entosolenia squamosa* Montagu var. *hexagona* Williamson — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1958 *Lagena squamosa* (Montagu) var. *hexagona* (Williamson) — D. A. J. Batjes: Foraminifera of the Oligocene of Belgium, tab. 3, fig. 9.
1969 *Lagena hexagona* (Williamson) — E. Y. Krayeva et B. F. Zerneckiy: Foraminifery paleogena Ukraiiny, p. 48—49, tab. 16, fig. 11 (cuc. syn.).
1970 *Oolina hexagona (Williamson)* — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 101—102, tab. 16, fig. 2—3 (cum syn.).

Remark: Our specimens agree with the original description and show practically no variability. Interesting is wall perforation: it is not symmetrical all over the surfaces but in certain geometrical shapes.

Stratigraphical range: According to literature the species occurs between the Upper Cretaceous and the Recent. In the Slovak West Carpathians it is present in the Paleogene and Neogene sediments.

Lagena isabella (Orbigny, 1839)
Pl. LXVI, Fig. 6

1839 *Oolina isabella* d'Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1961 *Lagena isabella* (d'Orbigny) — J. P. H. Kaasschieter: Foraminifera of the Eocene of Belgium, p. 178, tab. 7, fig. 25 (cum syn.).
1969 *Lagena isabella* Orbigny — E. Y. Krayeva et B. F. Zerneckiy: Foraminifery paleogena Ukraini, p. 49—50, tab. 16, fig. 14, (cum syn.).

Remark: Among the forms studied the species is quite frequent. Width of the test and number of ribs (10—14) are partly varied.
Stratigraphical range: According to literature the age diapason of the species is Cretaceous — Recent. In the Slovak West Carpathians it was found in the Paleogene and Miocene.

Lagena scalariformis (Williamson, 1848)
Pl. LXV, Fig. 3a-c

1848 *Entosolenia squamosa* (Montagu) var. B. *scalariformis* Williamson fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera etc.

Remark: Among the forms studied are — with the species *Oolina hexagona* (Williamson, 1848) — some forms with 8—9 ridges transversally connected by fine lamelles and form tetragonal ornamentation on the entire surface of the test. The aperture is terminal, circular. The wall — finely perforated. The Carpathian forms show almost all diagnostic features of the species *O. scalariformis,* to which they are ranged.
Stratigraphical range: The holotype was described from the Recent. In the area studied it was only found in the Upper Priabonian.

Lagena striata (Orbigny)
Pl. LXVI, Fig. 7—8

1839 *Oolina striata* d'Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1969 *Lagena striata* (Orbigny)—E. Y. Krayeva et B. F. Zerneckiy: Foraminifera paleogena Ukraini, p. 51, tab. 16, fig. 2 (cum syn.).

Remark: The forms studied ranged to the species have a very fine-perforated wall and its surface is not smooth as seen by multiple magnification.
Stratigraphical range: ? Jurassic — Recent. In the West Carpathians it has been found in the Senonian, Paleogene and Miocene, so far.

Lagena tenuis ornata Reuss, 1863
Pl. LXVI, Fig. 3a—b

1855 *Ovulina tenuis* var. *ornata* Reus — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1958 *Lagena tenuis* (Bornemann)—D. A. J. Batjes: Foraminifera of the Oligocene of Belgium, p. 119—120, tab. 3, fig. 23 (cum syn.).

1961 *Lagena tenuis* (Bornemann)—E. Y. Krayeva et B. F. Zerneckiy: Foraminiferi paleogena Ukraini, p. 51, tab. 16, fig. 21 (cum syn.).

Remark: In contrast to the original description, our forms are symmetrically narrowed from 1/5 of the test towards its proximal part. Fine ribs developed between the basal part and 1/5—2/5 of the test.

Stratigraphical range: Upper Eocene — Pliocene. In the West Carpathians it was only found in the Upper Eocene.

Genus *Marginulina* Orbigny, 1826

Marginulina behmi (Reuss, 1866)

Pl. LXX, Fig. 11

1866 *Cristelaria behmi* Reuss — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1969 *Marginulina behmi* (Reuss 1866)—E. Y. Krayeva et B. F. Zerneckiy: Foraminifery paleogena Ukraini, p. 60, tab. 21, fig. 5a, b, 6a, b (cum syn.).

Remark: Our specimens agree with the description and picture of the holotype. In the associations studied are macrospherical and microspherical forms. The last form mentioned exhibits all features typical of the genus *Amphicoryne* (cf. Pl. LXX, fig. 11).

Stratigraphical range: In most literature the form is recorded from the Upper Eocene — Oligocene. In the Slovak West Carpathians it was found in sediments of various tectonic units within the Upper Eocene — Oligocene.

Marginulina infracompressa Krayeva et Zerneckiy 1969, non Thalmann, 1937

Pl. LXX, Fig. 12

1969 *Marginulina infracompressa* Thalmann — E. Y. Krayeva et B. F. Zerneckiy: Foraminiferi paleogena Ukraini, p. 60—61, tab. 21, fig. 8.

Remark: The Carpathian forms studied are identic with the Ukrainian forms.

Stratigraphical range: E. Y. Krayeva et B. F. Zerneckiy recorded the species from the Upper Eocene. The author found the species in the Carpathians in the same stratigraphical position as quoted by the above authors.

Marginulina subbullata Hantken, 1875

Pl. LXX, Fig. 13a—b

1875 *Marg. subbullata* Hantk. n. sp.—M. Hantken: Die Fauna der Clavulina Szabói Schichten, p. 46, tab. 4, fig. 9—10; tab. 5, fig. 9.

1969 *Marginulina subbullata* Hantken 1875—E. Y. Krayeva et B. F. Zerneckiy: Foraminiferi paleogena Ukraini, p. 61, tab. 22, fig. 1 (cum syn.).

Remark: The Carpathian forms agree with the description and picture of the holotype.

Stratigraphical range: So far the form has been recorded from the Upper Eocene and Oligocene of the U.S.S.R., Central Europe und U.S.A. In the West Carpathians it is present in the same stratigraphical levels in different lithofacial units.

Genus *Bolivinella* Cushman, 1927
Bolivinella rugosa Howe, 1930
Pl. LXXIV, Fig. 7a—b, 8

1930 *Bolivinella rugosa* Howe — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

Remark: Our specimens exhibit most features in common with the species *B. rugosa*. They differ from the holotype only in a more conspicuous ornamentation.

Stratigraphical range: The holotype was described from the Oligocene of the U.S.A. (Red Bluff clay.) The associations studied are sparse in the upper part of the Upper Eocene.

Genus *Globulina* Orbigny, 1839
Globulina gibba gibba (Orbigny, 1826)
Pl. LXXI, Fig. 4a—c, 5a—d

1826 *Globulina gibba* d'Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Globulina gibba* d'Orbigny — Y. Le Calvez: Contribution a l'étude des Foraminifères etc., p. 84—85, tab. 17, fig. 3—4 (cum syn.).

Remark: The forms studied differ from the typical forms only in simpler (less radiate) aperture.

Stratigraphical range: Y. Le Calvez (l.c.) quoted the species from the Paleocene, Eocene—Oligocene of the Parisian Basin, while D. A. J. Batjas recorded it from the Miocene. In the West Carpathians it is in the same stratigraphical level.

Globulina gibba punctata Orbigny, 1846
Pl. LXXI, Fig. 1

1846 *Globulina punctata* d'Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Globulina gibba punctata d'Orbigny* — Y. Le Calvez: Contribution à l'étude des Foraminifères tec., p. 86—87, tab. 18, fig. 1—4 (cum syn.).

Remark: The forms referred to the subspecies described exhibit the test surface with irregurlarly arranged spines. The shape of the test is spherical to subspherical.

Stratigraphical range: Paleogene — Neogene. It is infrequent in the associations studied.

Genus *Guttulina* Orbigny, 1839
Guttulina problema Orbigny, 1826
Pl. LXXI, Fig. 2—3

1826 *Guttulina problema* d'Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1969 *Guttulina problema* Orbigny — E. Y. Krayeva et B. F. Zerneckiy: Foraminiferi paleogena Ukraini, p. 66, tab. 24, fig. 2a—b (cum syn.).

Stratigraphical range: Cretaceous — Recent. In the West Carpathians the form was recorded from the Paleogene and Miocene.

Genus *Glandulina* Orbigny, 1839
Glandulina aequalis Reuss, 1863
Pl. LXXI, Fig. 7

1863 *Glandulina aequalis* Reuss — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1969 *Glandulina aequalis* Reuss — D. A. J. Batjes: Foraminifera of the Oligocene of Belgium, p. 123, tab. 4, fig. 5—6.

Stratigraphical range: Paleogene — Recent. In the area studied of the West Carpathians the author found it in the Middle and Upper Eocene and Oligocene.

Glandulina radicula (Linné, 1758)
Pl. LXXI, Fig. 6

1758 *Nautilus radicula* Linneus — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1961 *Glandulina radicula* (Linnaeus) — H. Bystrická: Mikrofauna pestrých vrstiev etc., p. 143—144, tab. 20, fig. 11—13.

Remark: The test consists of 2—4 chambers, it is uniserial, rectolinear; sutures are horizontal, aperture terminal, radial. H. Bystrická recorded from the variegated beds of the Lutetian of the Hričov—Žilina facies (the West Carpathians) forms consisting of 2 or even 6 chambers, the latter being most frequent according to the authoress.
Stratigraphical range: In the West Carpathians the form was recorded from the Middle Eocene (Lutetian) beds. Among the specimens studied it is rare throughout the profile.

Genus *Fissurina* Reuss, 1850
Fissurina aperta Seguenza, 1862
Pl. LXVIII, Fig. 4a—b, 5

1862 *Fissurina (Fissurine) aperta* Seguenza — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

Remark: Our specimens differ from the original description in smaller tests and in subangular test periphery.

Stratigraphical range: Paleogene — Recent. They are very rare in the associations studied. So far they have only been found in the Upper Eocene and Lower Oligocene.

Fissurina carpathica nov. sp.

Pl. LXVIII, Fig. 1a—c

Holotypus: the specimen figured in Pl. LXVIII, fig. 1a—c; in the depository at Dionýz Štúr Institute of Geology, Bratislava (ČSSR).

Locus typicus: the borehole Ľubietová P-8, 64—65 m.

Stratum typicum: Upper Priabonian, the zone *Globigerina officinalis*.

Derivato nominis: After the Carpathians mountains.

Material: 20 specimens from the boreholes P-8 and P-4 (Ľubietová).

Diagnosis: A lenticular oval thest with subspherical periphery, terminal aperture, a long narrow slit, smooth surface.

Description: The test is small, lenticular, elliptic in cross section, oval in longitudinal section. In the basal part of the test the periphery is subspherical, in the top part — subangular. The aperture is terminal, a long narrow slit extends to 1/3 or 1/2 of the test. Smooth surface.

Remark: The species discussed differs from morphologically resembling species *Fissurina crassicarinata* Bandy 1949 in a more elongated — oval shape of the test, in undeveloped keel and a larger aperture. In similar features (undeveloped keel and a larger aperture) it also differs from *Fissurina modesta* (Mathes 1939).

Stratigraphical range: Among the specimens studied it is in the course of both boreholes (P-8, P-4) corresponding to the Upper Priabonian (= the Carpathian zone *Globigerina officinalis*). In the typical sample containing planktonic foraminifers are infrequent *Globigerina officinalis* Subbotina, *G.* ex gr. *praebulloides* Blow, *G. pseudovenezuelana* Blow et Banner, *Turborotalia* (T.) *cerroazulensis* (Cole), and *Globanomalina micra* (Cole).

Fissurina laevigata Reuss, 1850

Pl. LXVIII, Fig. 2a—b, 3

1850 *Fissurina laevigata* Reuss — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1953 *Lagena laevigata* (Reuss)—J. P. Beckmann: Die Foraminifera der Oceanic Formation etc., p. 357—358, tab. 20, fig. 1.

1958 *Lagena (Fissurina) laevigata* (Reuss)—D. J. A. Batjes: Foraminifera of the Oligocene of Belgium, p. 118, tab. 3, fig. 25.

Remark: The forms included in the species show some variability as regards thickness of the test and form of the keel which is either angular or subangular.

Stratigraphical range: Paleogene — ? Recent. The author found the species in the Upper Eocene and Oligocene of the West Carpathians.

Fissurina latistoma Seguenza, 1862
Pl. LXVIII, Fig. 6a—b

1862 *Fissurina (Fissurine) latistoma* Seguenza — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

Remark: Our forms agree with the original description and picture of the species described. Varied are only size, and chamber periphery — being angular to subangular.

Stratigraphical range: In the West Carpathians they were only recorded in the Upper Eocene material studied.

Fissurina marginata (Walker et Boys, 1784)
Pl. LXVII, Fig. 3

1784 *Serpula (Lagena) marginata* Walker et Boys — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Fissurina marginata* (Walker et Boys)—Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 104, tab. 24, fig. 5—6.

Remark: Our forms are identic with that pictured by Y. Le Calvez (l.c.).

Stratigraphical range: Paleogene — Recent. So far it has been found in the Eocene and Oligocene sediments of the West Carpathians.

Fissurina marginatoperforata (Seguenza, 1880)
Pl. LXVII, Fig. 7—8

1880 *Lagena marginato-perforata* Seguenza — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1946 *Entosolenia marginato-perforata* (Seguenza)—J. A. Cushman et R. Todd: A Foraminiferal fauna from the Byram marl etc., p. 92, tab. 15, fig. 27.

Remark: The forms examined agree with the description of the holotype. Slight differences between the holotype and our forms (smaller size, absent neck) are insignificant.

Stratigraphical range: The holotype was recorded from the the Pliocene of Italy, J. A. Cushman et R. Todd (l. c.) quoted it from the Byramian marls (Oligocene). Among the forms studied it is rare throughout the zone *Globigerina officinalis*.

Fissurina orbignyana orbignyana Seguenza, 1862
Pl. LXVII, Fig. 1a—b, 2

1862 *Fissurina (Fissurine) orbignyana* Seguenza — fide B. F. Ellis et Messina: Catalogue of Foraminifera.

Remark: In the material studied are rare forms with the main diagnostic features of the species *Fissurina orbignyana.* Besides the form pictured in this work Fig. 1a—b1 there are also typical individuals as pictured in Fig. 2.

Stratigraphical range: ? Cretaceous — Recent. In the West Carpathians it is present in the Paleogene and Miocene sediments.

Fissurina orbignyana tricarinata Terquem, 1882 emend Le Calvez, 1950

Pl. LXVII, Fig. 4—5

1882 *Fissurina tricarinata* Terquem — B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1970 *Fissurina orbignyana* Seguenza var. *tricarinata* Terquem — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 105, text.-fig. 36—37 (cum syn.).

Remark: In most literature the form is not denoted as an independent subspecies, but it is included in the species *Fissurina orbignyana Seguenza* 1862. Y. Le Calvez (l. c.) — in accordance with O. Terquem — distinguishes within *Fissurina orbignyana* another two subspecies: *F. orbignyana bicarinata* Terquem 1882 and *F. orbignyana tricarinata* Terquem 1882. Carpathian forms are identic with the latter pictured by Y. Le Calvez (1970) from the French Basin.

Stratigraphical range: Paleogene — Recent. In the area studied it is very rare in some Upper Eocene and Lower Oligocene beds.

Fissurina praeclara Cushman et Renz, 1946

Pl. LXVII, Fig. 9, 10a—b

1946 *Entosolenia orbignyana* var. *praeclara* Cushman et Renz — fide B. F. Elis et A. R. Messina: Catalogue of Foraminifera.

1969 *Entosolenia praeclara* Cushman et Renz — L. Montanari: Sulla sezione terziaria etc., tab. 24, fig. 16.

Remark: Some Carpathian forms differ from the holotype only in subcircular shape of the test in longitudinal section. Varied is also the number of longitudinal ridges (6—9).

Stratigraphical range: Upper Senonian — Miocene. In the West Carpathians it was recorded only in the Upper Eocene profiles of the borehole studied.

Genus *Buliminella,* Cushman, 1911
Buliminella bullina Le Calvez, 1950

Pl. LXXII, Fig. 5

1950 *Buliminella bullina* n. sp. — Y. Le Calvez: Revision des Foraminiferes etc., III. Polymorphinidae etc., p. 34, tab. 2, fig. 19—20.

1970 *Buliminella bullina* Le Calvez — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 107—108, tab. 21, fig. 7.

Remark: In the association studied were 3—4 forms corresponding well with the original description of the species.

Stratigraphical range: Y. Le Calvez (l. c.) recorded the species from the Middle and Upper Eocene in the Parisian Basin. In the West Carpathians the author found the species only in the Upper Priabonian of the area studied.

Buliminella elegantissima (Orbigny, 1839)
Pl. LXXII, Fig. 3

1839 *Bulimina elegantissima* d'Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

Remark: Our forms are identic with the original description of the species.

Stratigraphical range: According to literary data it is present in the Oligocene through the Recent (U. S. S. R. U. S. A.). In the area studied it was found in the Upper Priabonian zone *Globigerina officinalis.*

Buliminella rara Pischvanova, 1960
Pl. LXXII, Fig. 7a—c, 8

1960 *Buliminella rara* Pischvanova sp. n., in N. N. Subbotina, L. S. Pischvanova, L. V. Ivanova: Stratigrafiya oligocenovikh etc., p. 76—77, tab. 5, fig. 8a—b.

Remark: The species *Buliminella rara* was recorded in the sediments of the Fore-Carpathian area of the U. S. S. R. The species is characteristic in very small size of the test (0.1—0.18 mm), in 3 whorls, with 8—11 chambers in the last whorl occupying 4/5 of the test diameter. The aperture is loop shaped, the wall is fine-perforated.

The species *Buliminella elegantissima* (Orbigny 1839) differs from the species described in a more elongated — cylindrical shape and less chambers, while in contrast to *Buliminella pulchra* (Terquem 1882) and *Buliminella madagascariensis spicata* Cushman et Parker 1942 it is of considerably smaller size; it has obtuse-conical basal part of the test and more chambers.

Stratigraphical range: According to the authoress of the species it is most frequent in the Oligocene and rare in the Middle Miocene (? Helvetian sensu N. N. Subbotina et al. 1960) of the Fore-Carpathian region. In the area studied it has only been found in the zone *Globigerina officinalis* so far.

Genus *Bolivina* Orbigny 1839
Bolivina beyrichi Reuss, 1851
Pl. LXXIII, Fig. 4—5

1851 *Bolivina beyrichi* Reuss — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1958 *Bolivina beyrichi* Reuss — D. A. J. Batjes: Foraminifera of the Oligocene of Belgium, p. 131, tab. 5, fig. 11a—b (cu syn.).

Remark: The specimens studied comprise forms differing from the typical representative of the species only in less elongated tests.

Stratigraphical range: Upper Eocene — Miocene. In the West Carpathians its first appearances were recorded in the Upper Eocene, and from the Oligocene and Miocene.

Bolivina budensis (Hantken)
Pl. LXXIII, Fig. 3a—b, 6a—c

1875 *Textilaria budensis* Hantk. n. sp. — M. Hantken: Die Fauna der Clavulina Szabói Schichten, p. 67, tab. 15, fig. 1.
1937 *Bolivina budensis* (Hantken) — J. A. Cushman: A monograph of the subfamily Virgulininae etc., p. 47, 50, tab. 6, fig. 21—23 (cum syn.).
1969 *Bolivina budensis* (Hantken) — E. Y. Krayeva et B. F. Zerneckiy: Foraminiferi paleogena Ukraini, p. 162, tab. 74, fig. 1a, b (cum syn.).

Remark: Two forms are in the material examined: one of them is identic with the holotype of the species *B. budensis,* the second is slimmer and represents a microspherical form. It exhibits many features in common with the form described by M. *Hantken* (1875) as *Textilaria elongata.* Most likely *B. budensis* and *B. elongata* represent the micro- and macrospheric forms of one taxon.

Stratigraphical range: Eocene — Oligocene. J. A. Cushman (1937) and the Soviet specialists recorded the species from the Eocene (mostly the Upper Eocene). In the West Carpathians it has been found in the Upper Eocene and Lower Oligocene, so far.

Bolivina cookei Cushman, 1922
Pl. LXXIV, Fig. 3

1922 *Bolivina cookei* Cushman — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1961 *Bolivina cookei* Cushman — J. P. H. Kaasschieter: Foraminifera of the Eocene of Belgium, p. 195, tab. 8, fig. 25—26.

Remark: Among the specimens examined are 3—4 forms exhibiting most features in common with the species *B. cookei* described by Cushman.

Stratigraphical range: Upper Eocene — Oligocene. The holotype described comes from the Oligocene of the U. S. A. In the West Carpathians it is in the upper part of the Upper Eocene.

Bolivina crenulata Cushman, 1936
Pl. LXXIII, Fig. 1, 2a—c

1936 *Bolivina crenulata* Cushman n. sp.: New genera and species etc., p. 50, tab. 7, fig. 13a—b.
1970 *Bolivina crenulata* Cushman — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 113, tab. 22, fig. 8 (cum syn.).

Remark: The Carpathian forms correspond well to the forms from Hungary. The holotype described is Hungarian, too.
Stratigraphical range: Eocene — Oligocene. In the Parisian Basin it is within the Eocene — Oligocene. Its stratigraphical position is the same in the Slovak West Carpathians.

Bolivina nobilis Hantken
Pl. LXXIV, Fig. 4, 5a—c, 6

1875 *Bol. nobilis* Hantk. n. sp. — M. Hantken: Die Fauna der Clavulina Szabói Schichten, p. 65, tab. 15, fig. 4a—b.

Remark: Our specimens agree well with the original Hatken's description of a form from Hungary.
Stratigraphical range: Eocene — Oligocene. The species is quite common in the West Carpathians, particularly in the Upper Eocene and Lower Oligocene.

Bolivina reticulata Hantken, 1875
Pl. LXXIII, Fig. 7, 8a—b

1875 *Bol. reticulata* Hantk. n. sp. — M. Hantken: Die Fauna der Clavulina Szabói Schichten, p. 65—66, tab. 15, fig. 6a—b.
1969 *Bolivinoides reticulatus* (Hantken) — E. Y. Krayeva et B. F. Zernickiy: Foraminiferi paleogena Ukraini, p. 160, tab. 74, fig. 1 (cum syn.).
1973 *Bolivina reticulata* Hantken — Nagyné-Gellai Á: Oligocén foraminiferák etc., p. 470, tab. 5, fig. 15.

Remark: The Eocene forms studied differ from younger Miocene in a simpler ornamentation.
Stratigraphical range: Upper Eocene — Miocene. The holotype was described from the Eocene of Hungary. In the West Carpathians it is in the Upper Eocene, Oligocene and Miocene (?) sediments.

Genus *Bulimina* Orbigny
Bulimina aksuatica Morozova, 1939
Pl. LXXV, Fig. 6a—c, 7—9

1939 *Bulimina truncana* Gümbel var. *aksuatica* Morozova — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1953b *Bulimina aksuatica* Morozova — N. N. Subbotina: Verkhneeocenoviye lyagenidy etc., p. 207—210, tab. 9, fig. 3—11.

Remark: In associations from investigation bore holes two types of »costate« bulimines occur. Those of the first type are mostly 1 mm in size or larger, and they evidently belong to the species *Bulimina truncena Gümbel* 1868; the bulimines of the second type are 0.2 mm or rarely 0.35 mm in size. The test surface is covered with 10—13 ribs mutually connected by fine perforated lamines (fig. 7) in the first third of the test. The test wall is calcareous, fine-perforated. The forms resemble the species *Bulimina aksuatica* Morozova described in detail by N. N. Subbotina (1953). The wall perforation of the species *Bulimina truncana* Gümbel is practically the same as in the species described. Consequently, they may be regarded as phylogenetically related species.

Stratigraphical range: N. N. Subbotina (l. c.) recorded the species in the Upper Eocene, while V. G. Morozova and N. K. Bikova (in N. N. Subbotina, l. c.) found it rare throughout the Eocene. In the West Carpathians it has only been found in the Upper Eocene of the Central Carpathian Paleogene so far.

Bulimina kasselensis Batjes, 1958

Pl. LXXII, Fig. 1; Pl. LXXV, Fig. 4—5

1958 *Bulimina kasselensis* nov. sp. — D. A. J. Batjes: Foraminifera of the Oligocene of Belgium, p. 127—128, tab. 5, fig. 4—6.

Remark: Carpathian forms are identic with the holotype. As for morphology, they resemble *Turrilina maeta* Maslakova 1955. According to the authoress it only differs in smooth, coarse-perforated test wall.

Stratigraphical range: The holotype was described from the Late Oligocene — »Chattian« in the West Carpathians it was found in the zone *Globigerina officinalis*.

Bulimina ovata Orbigny, 1846

Pl. LXXV, Fig. 3

1846 *Bulimina ovata* d'Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1953b *Bulimina ovata* Orbigny — N. N. Subbotina: Verkhneeocenoviye lyagenidi etc., p. 210—212, tab. 9, fig. 16 (cum syn.).

1961 *Bulimina ovata* d'Orbigny — J. P. H. Kaasschieter: Foraminifera of the Eocene of Belgium, p. 191, tab. 9, fig. 6.

Remark: Forms from the area studied are identic with the species *Bulimina ovata* described by d'Orbigny from the Miocene of the Vienna Basin. I may agree with N. N. Subbotina in stating that also in the forms studied the last 3 chambers occupy 3/5—4/5 of the test diameter. The test wall is fine-perforated, without ornamentation.

Stratigraphical range: According to literature it is present throughout the Tertiary to the Recent. In the West Carpathians it is present in the Paleogene and Miocene.

Bulimina parisiensis Kaasschieter, 1961
Pl. LXXII, Fig. 4

1961 *Bulimina parisiensis* nov. nom. — J. P. H. Kaasschieter: Foraminifera of the Eocene of Belgium, p. 190, tab. 8, fig. 19; tab. 8, fig. 3—4.
1970 *Bulimina parisiensis* Kaasschieter — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 118, tab. 21, fig. 4.

Remark: Among the specimens studied are some forms identic with those originally described by Y. Le Calvez (l. c.) from the Parisian Basin.

Stratigraphical range: The holotype comes from the Eocene sediments of Belgium. Y. Le Calvez (l. c.) recorded it from the same stratigraphic level in the Parisian Basin. In the West Carpathian area studied it was found in the Middle and Upper Eocene.

Bulimina punctatocostata Cushman et Stone, 1949
Pl. LXXV, Fig. 1, 2a—b

1949 *Bulimina punctato-costata* Cushman et Stone, n. sp.: Foraminifera from the Eocene etc., p. 52, tab. 9, fig. 12—13.

Remark: In the material examined, in addition to forms with identic morphological features as the holotype, there are also forms with broad test, inconspicuous spiral and intracameral sutures (Fig. 1). The structure of these forms is very similar to the species *Bulimina ovata* Orbigny 1846. Their wall structure is the same as with the species *Bulimina punctatoscata.*

Stratigraphical range: The holotype was described from the Middle Eocene of the Formation chacra. In the area studied it is in the zone *Globigerina officinalis.*

Genus *Uvigerina* Orbigny, 1826
Uvigerina costellata Morozova 1939
Pl. LXXVI, Fig. 3a—c

1939 *Uvigerina costellata* Morozova (non vidi).
1953b *Uvigerina costellata* Morozova — N. N. Subbotina: Verkhneeocenoviye lyagenidi etc., p. 237—238, tab. 11, fig. 14—15.

Remark: Our forms differ only in less ribs from the species described by N. N. Subbotina (1953).

Stratigraphical range: Upper Eocene. After N. N. Subbotina (1953) the species is in the Upper Eocene in various areas of the U. S. S. R. In the Slovak West Carpathians it has only been found in the area studied, so far.

Uvigerina hispida Schwager, 1866
Pl. LXXVI, Fig. 4a, 4b, 5

1866 *Uvigerina hispida* Schwager fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1953b Uvigerina hispida Schwager — N. N. Subbotina: Verkhneeocenoviye lyagenidi etc., 235—237, tab. 11, fig. 11—13 (cum syn.).

Remark: Our forms agree with those described by N. N. Subbotina (1953) from Crimea as *Uvigerina hispida*. They differ from the original description only in a smaller test (0.25—0.4 mm).

Stratigraphical range: Upper Eocene —? Miocene. In the U. S. S. R. it was only recorded from the Upper Eocene. In the area studied it was found in the same stratigraphical level.

Uvigerina pygmea Orbigny

Pl. LXXVI, Fig. 1a—c, 2a—c

1846 *Uvigerina pygmea* Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1953b *Uvigerina pygmea* Orbigny — N. N. Subbotina: Verkhneeocenoviye lyagenidi etc., p. 239—241, tab. 12, fig. 1a—b, 2—6 (cum syn.).

Stratigraphical range: Eocene-Recent. In the West Carpathians, the species *Uvigerina pigmea* was recorded from the Middle and Upper Eocene, and from the Oligocene and Miocene.

Genus *Angulogerina* Cushman, 1927

Angulogerina angulosa (Williamson, 1958)

Pl. LXXVII. Fig. 7a—b

1858 *Uvigerina angulosa* Willamson — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1953b *Ungulogerina angulosa* (Williamson) — N. N. Subbotina: Verkhneeocenoviye lyagenidi etc., p. 245—247, tab. 13, fig. 4a—b, 5, 6a—b, 7 (cum syn.).

Stratigraphical range: Eocene-Recent. In the West Carpathians the species is common in the Middle Eocene-Miocene.

Angulogerina gracilis oligocaenica (Andreae, 1894)

Pl. LXXVII, Fig. 3

1894 *Uvigerina oligocaenica* Andreae — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1958 *Uvigerina gracilis* (Reuss) var. *oligocaenica* (Andreae) — D. A. J. Batjes: Foraminifera of the Oligocene of Belgium, p. 135—136, tab. 6, fig. 3 (cum syn.).

Remark: Some infrequent forms included in our associations, exhibit most features in common with Batjes's forms recorded from the Oligocene sediments of Belgium. In the West Carpathians in Slovakia, the author found the forms only in the Upper Priabonian and Lower Oligocene sediments.

Angulogerina gracilis germanica Cushman et Edwards, 1938
Pl. LXXVII, Fig. 4a—b

1838 *Angulogerina germanica* Cushman et Edwards — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Angulogerina gracilis* (Reuss) var. *germanica* Cushman et Edwards — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 123, tab. 23, fig. 2 (cum syn.).

Remark: Our specimens are identic with the original description or with the description and depiction of forms recorded from the Oligocene sediments of Belgium by D. A. J. Batjes, and with the forms recorded by Y. Le Calvez (1970) from the Parisian Basin.
Stratigraphical range: The above authors quote the species from the Oligocene. In the area studied its first occurrences were in the Uppermost Priabonian.

Angulogerina muralis (Terquem, 1882)
Pl. LXXVII, Fig. 5—6

1882 *Uvigerina muralis* Terquem — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Angulogerina muralis* (Terquem) — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 124, tab. 23, fig. 1 (cum syn.).

Remark: The forms examined agree well with the forms from the Parisian Basin (cf. Y. Le Calvez, l. c.). Their occurrences are common in the Eocene sediments of the area under study.

Genus *Sagrina* Orbigny, 1839
Sagrina aspera (Terquem, 1882)
Pl. LXXIV. Fig. 10

1882 *Textilaria aspera* Terquem — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Sagrina aspera* (Terquem) — Y. Le Calvez: Contribution a l'étude des Foraminifères etc., p. 125—126 (cum syn.).

Remark: In the associations studied are some forms displaying most basical morphological signs in common with the species *S. aspera*.
Stratigraphical range: In the Slovak West Carpathians the author found it only in the Upper Priabonian. It was found in the same stratigraphical level in the Parisian Basin (cf. Y. Le Calvez, l. c.).

Genus *Siphogenerina* Schlumberger, 1882
Siphogenerina elegans (Hantken, 1875)
Pl. LXXVII, Fig. 8a—b

1875 *Dimorph. elegans* Hantk. n. sp. — M. Hantken: Die Fauna der Clavulina Szabói Schichten, p. 63, tab. 7, fig. 9.

Remark: Our specimens differ from the original description only in smaller tests.

Stratigraphical range: The holotype was recorded from the Oligocene sediments of Hungary. In the Upper Priabonian material studied the form is very infrequent.

Genus *Trifarina* Cushman, 1923
Trifarina wilcoxensis (Cushman et Ponton, 1932)
Pl. LXXVII, Fig. 1a—b, 2

1932 *Pseudouvigerina wilcoxensis* Cushman et Ponton — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Trifarina wilcoxensis* Cushman et Ponton — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 127—128, tab. 23, fig. 5 (cum syn.).

Stratigraphical range: Eocene-Recent. Y. Le Calvez (l. c.) described the species from the Middle and Upper Eocene of the Parisian Basin. In the West Carpathians its occurrences are sporadical in the Middle Eocene — Miocene.

Genus *Virgulina* Orbigny, 1826
Virgulina schreibersiana Czjzek, 1848
Pl. LXXIV, Fig. 9

1848 *Virgulina schreibersiana* Czjzek — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1953b *Virgulina schreibersiana* Czjzek — N. N. Subbotina: Verkhneeocenoviye lyagenidi etc., p. 218—220, tab. 10, fig. 3a—b.

Stratigraphical range: Eocene-Recent. In the West Carpathians it is present in the Eocene-Miocene.

Genus *Caucasina* Chalilov, 1951
Caucasina coprolithoides (Andreae, 1884)
Pl. LXXX, Fig. 6—10

1884 *Bulimina coprolithoides* Andreae — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Caucasina coprolithoides* (Andreae) — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 130—131, tab. 25, fig. 4 (cum syn.).

Remark: Most forms from the locality studied differ from the original description in smaller tests. Only some (3—4) forms have the maximum diameter 0.35—0.45 mm. These forms (Fig.) are identic with the description of *Caucasina oligocenica* Khalilov, regarded as a synonym of the species *Caucasina coprolithoides* (Andreae 1884) by Y. Le Calvez (1970). The described species differs from *Caucasina tenebricosa* Pishvanova 1960 (syn. *Caucasina alpina* Sigal 1961) in the number of whorls and in more slender (cylindrical) test.

Stratigraphical range: After Y. Le Calvez (1970) the species occurs in the Oligocene of the Paris basin. Our forms pictured were recorded from the zone *Globigerina officinalis.*

Caucasina tenebricosa Pischvanova, 1960
Pl. LXXX, Fig. 11a—b

1960 *Caucasina tenebricosa* Pischvanova sp. n. — in N. N. Subbotina, L. S. Pischvanova, L. V. Ivanova: Stratigrafiya oligocenovikh etc., p. 90—91, tab. 6, fig. 2a, b, v.

1960 *Caucasina tenebricosa* Pischvanova — N. N. Subbotina: Mikrofauna oligocenovikh etc., p. 212—213, tab. 4, fig. 2a, b, v — 4a, b, v.

1961 *Caucasina alpina* Espitalié et Sigal n. sp.: Microstratigraphie des »marnes bleues« etc., 204, tab. 1, fig. 9a—d, 10, 11.

Remark: Among the specimens studied the form is rather infrequent. From the original description our forms differ only in smaller test. Such forms are also quoted by N. N. Subbotina (l. c.) from the Poljanica formation (= Lower Oligocene) of the Fore-Carpathian region.

The species *Caucasina alpina* (Espitalie et Sigal 1961) is a younger synonym to the species described. According to the authors mentioned, *C. alpina* possesses 5—5 1/2 chambers in average in one rotaloid whorl, and its rotaloid stage represents 1 1/2 whorl. In contrast to this, L. S. Pishvanova found 2—2 1/2 whorls in the rotaloid part of the test of the species *Caucasina tenebricosa* with 4—5 chambers to a whorl. The forms pictured by N. N. Subbotina (1960) from the Polyanica formation have 1 1/2—2 rotaloid whorls.

Stratigraphical range: Holotype of the species was recorded from the Nižnaja Vorotyzha (Oligocene) formation After N. N. Subbotina et col. (1960) and N. N. Subbotina (1960) the species is present throughout the Oligocene (the Polyanica and the Nižnaja Vorotyzha formations) and in the Middle Miocene (Stebnik formation). In France the species *C. alpina* Espitallé et Sigal was recorded in the Upper Eocene. In the West Carpathians they have only been found in the Upper Priabonian and Lower Oligocene sediments so far.

Genus *Discorbis* Lamarck, 1804
Discorbis discoides (Orbigny, 1826)
Pl. LXXXII, Fig. 1a—b

1826 *Rotalia discoides* d'Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1970 *Discorbis discoides* (d'Orbigny) — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 133, tab. 28, fig. 2, 5.

Remark: Our forms are identic with those described recently by Y. Le Calvez from the Oligocene of the Parisian Basin.

Stratigraphical range: In the West Carpathians, the author found the species when investigating the Upper Eocene and Oligocene sediments.

Genus *Rosalina* Orbigny, 1826
Rosalina douvillei (Cushman, 1928)
Pl. LXXXII, Fig. 3a—b

1928 *Discorbis douvillei* Cushman — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1958 *Discorbis globularis* (d'Orbigny) — D. A. J. Batjes: Foraminifera of the Oligocene of Belgium, p. 145, tab. 8, fig. 2a—c (cum syn.).
1970 *Rosalina douvillei* (Cushman) Y. Le Calvez: Contribution a l'étude des Foraminifères etc., p. 140—141, tab. 29, fig. 3—5.

Remark: The forms studied are conspecific with the forms described by D. A. J. Batjes (l. c.) from Belgium.
Stratigraphical range: Upper Eocene-Miocene. It is present in an analogous stratigraphical level in the West Carpathians as well.

Rosalina quadrata Terquem, 1882
Pl. LXXXII, Fig. 2a—c

1882 *Rosalina quadrata* Terquem 1882 — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Rosalina quadrata* Terquem — Y. Le Calvez: Contribution à l'étude des Foraminifères tec., p. 143—144, tab. 29, fig. 8 (cum syn.).

Remark: Our specimens agree with the original description and with Y. Le Calvez's (l. c.) description of the forms from the Parisian Basin.
Stratigraphical range: The above mentioned author recorded the species from the entire Eocene. In the area studied it was very rare in the Upper Eocene.

Genus *Baggina* Cushman, 1926
Baggina parisiensis (Orbigny, 1826)
Pl. LXXXII, Fig. 5a—b

1826 *Globigerina parisiensis* Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Baggina parisiensis* (d'Orbigny) — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 144—145, tab. 38, fig. 1, 3, 5 (cum syn.).

Stratigraphical range: In the Parisian Basin the species occurs in the Middle Eocene-Oligocene. In the Slovak West Carpathians it has only been found in the associations studied.

Genus *Cancris* Montfort, 1882
Cancris subconicus (Terquem, 1882)
Pl. LXXXII, Fig. 4a—b

1882 *Rotalina subconica* Terquem — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1970 *Cancris subconicus* (Terquem) — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 145—146, tab. 43, fig. 6 (cum syn.).

Stratigraphical range: Y. Le Calvez (l. c.) quotes the species from the Parisian Basin — from the entire Eocene. In the area studied of the West Carpathians it was found in the Upper Eocene.

Genus *Glabratella* Dorreen, 1948
Glabratella diadematoides (Le Calvez, 1959)
Pl. LXXXIV, Fig. 2—4

1959 *Pseudoruttenia diadematoides* n. sp. — Y. Le Calvez: Étude de quelques Foraminifères etc., p. 92—94, tab. 1, fig. 17—19.
1970 *Glabratella diadematoides* (Le Calvez) — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 147—148, tab. 30, fig. 1—3.

Remark: The Carpathian forms agree well with the original description by Y. Le Calvez (l. c.).
Stratigraphical range: The above mentioned author recorded the species from the entire Eocene. In the West Carpathians it has only been found in the Upper Priabonian material so far.

Glabratella excavata (Terquem 1882) emend Le Calvez, 1949
Pl. LXXXIV, Fig. 1a—c

1882 *Rosalina excavata* Terquem — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Glabratella excavata* (Terquem) — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 148, text-fig. 55—57.

Remark: In the material examined, the species was quite infrequent. It differs from the holotype only in less chambers (6—7).
Stratigraphical range: In the Parisian Basin the species is in the Lower and Middle Eocene. In the West Carpathians it has been evidenced in the Upper Priabonian of the area studied.

Glabratella herouvalensis (Le Calvez, 1953)
Pl. LXXXV, Fig. 1a—c

1953 *Discorbis herouvalensis* Le Calvez — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Glabratella herouvalensis* (Le Calvez) — Y. Le Calvez: Contribution a l'étude des Foraminifères etc., p. 148—149, tab. 30, fig. 6

Remark: In the material examined are very infrequent forms with most features in common with the forms from the Parisian Basin, described by Y. Le Calvez (1970) from the Lower Eocene. In the West Carpathians the species of the genus *Glabratella* were only described from the Upper Priabonian sediments studied.

Glabratella hronica nov. sp.
Pl. LXXXV, Fig. 3a—c, 4

Holotypus: The specimen figured in Pl. LXXXV, fig. 3a—c, in the depository at Dionýz Štúr Institute of Geology, Bratislava (ČSSR).

Locus typicus: The borehole Ľubietová P-8, 26,8 m.

Stratum typicum: Uppermost Priabonian the zone *Globigerina officinalis*.

Derivatio nominis: After the river Hron flowing through the Horehronská kotlina intramontane depression.

Material: About 20 specimens from the boreholes P-8 and P-4 (Ľubietová).

Diagnosis: A small, calcareous, trochospiral test, with six subconical chambers in the last whorl. The aperture is umbilical-extraumbilical at the base of the last chamber.

Description: The test consists of 2½—3 trochospiral whorls. The first whorl is indistinct. The last whorl consists of 6—7 chambers, subconical on the dorsal side. The chambers on the ventral side are trapezoid-shaped. The equatorial section of the test is star-shaped. The intercameral sutures on the dorsal and ventral sides are radial. The umbilicus is large, deep, usually open. The wall is calcareous, fine-perforated on the dorsal side; with fine-rugose surface; with radial rugose ornamentation on the ventral side. Toward the periphery the ornamentation gets finer. The aperture is small, semi-arcuate, umbilical-extraumbilical, at the base of the last chamber.

Dimensions: The test diameter — 0,28 mm, height 0,26 mm.

Remark: It differs from the morphologically related species *Glabratella diadematoides* (Le Calvez) described from the Cuisian of the Paris basin, in more chambers in the last whorl, in star-shaped equatorial section, in its stratigraphical position (the Uppermost Priabonian), and in different ornamentation on the ventral side — as showed by electronmicrographic photographs.

Stratigraphic range: In the boreholes studied (P-4, P-8) the form is in associations corresponding to the Carpathian zone *Globigerina officinalis* (Upper Priabonian). Among the most significant planktonic forms found were *Globigerina* ex gr. *praebulloides* Blow, *G. officinalis* Subbotina, *G. gnaucki* Blow et Banner, *G. angiporoides* Hornibrook, *G. pseudoampliapertura* Blow et Banner, *Turborotalia (T.)* ex gr. *cerroazulensis* (Cole) etc.

Glabratella turbinata (Terquem, 1882)
Pl. LXXXIV, Fig. 5, 6a—b, 7a—b

1882 *Rotalina turbinata* Terquem — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1970 *Glabratella turbinata* (Terquem) — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 149, tab. 30, fig. 4—5.

Remark: Individuals of the species belong to the most current forms among the species of the genus *Glabratella*. Our forms differ from the holotype only in smaller size.

Stratigraphical range: Middle Eocene-Lower Oligocene. Y. Le Calvez (1970) recorded and described the species from the Middle Eocene of the Parisian Basin. In the area studied it is in the Upper Eocene.

Glabratella ubiqua (Le Calvez, 1949)
Pl. LXXXV, Fig. 2a—d

1949 *Discorbis ubiqua* Le Calvez — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Glabratella ubiqua* (Le Calvez) — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 149, tab. 35, fig. 7.

Remark: Our specimens are identic with the holotype in description and figure. They consist of 2.5—3 whorls with 4—5 chambers in the last of them. Chambers on the dorsal side are coarsely perforated, on the ventral side they exhibit a very tiny granulose, radially arranged ornamentation. The periphery of subcircular forms consisting of four chambers, is subquadrate.

Stratigraphical range: According to Y. Le Calvez's (l. c.) data it is present throughout the Eocene in the Parisian Basin. In the West Carpathians it was only found in the Upper Priabonian samples.

Genus *Siphonina* Reuss, 1850
Siphonina reticulata (Czjzek, 1848)
Pl. LXXXIII, Fig. 5, 6

1848 *Rotalina reticulata* Czjek — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Siphonina reticulata* (Czjzek) — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 150 (cum syn.).

Remark: The forms included in the material studied show most features in common with the species *S. reticulata*.

Stratigraphical range: In the West Carpathians the species is in the Middle Eocene up to the end of the Miocene. From the Middle Eocene beds of the Parisian basin it is recorded by Y. Le Calvez (l. c.).

Genus *Cassidulina* Orbigny, 1826
Cassidulina subglobosa Brady, 1884
Pl. LXXVIII, Fig. 1, 2a—b

1884 *Cassidulina subglobosa* Brady — fide B. F. Ellis et A. R. Messina: Catalogue of Forminifera.
1969 *Cassidulina subglobosa* Brady — E. Y. Krayeva et B. F. Zerneckiy: Foraminiferi paleogena Ukraini (cum syn.).

Remark: The forms discussed agree with the holotype described and pictured.

Stratigraphical range: Paleogene-Recent. In the West Carpathians they are in the Paleogene and Miocene.

Genus *Pullenia* Parker et Jones, 1862
Pullenia bulloides (Orbigny, 1826)
Pl. LXXVIII, Fig. 5a—b

1826 *Nonionina bulloides* d'Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Forminifera.
1952 *Pullenia bulloides* (Orbigny) — N. A. Voloshinova et L. G. Dain: Nonionidy etc., p. 132—133, tab. 3, fig. 5a—7b.

Remark: Our forms are identic with the original description and picture.

Stratigraphical range: Eocene-Miocene.

Pullenia quinqueloba (Reuss, 1851)
Pl. LXXVIII, Fig. 6a—b, 7

1851 *Nonionina quinqueloba* Reuss — N. A. Voloshinova et L. G. Dain: Nonionidi etc., p. 135—136, tab. 4, fig. 4a—b, 5; 6a—b, 7 (cum syn.).

Remark: In the material studied, the size of the forms varies within 0.25—0.7 mm, and the number of chambers (4—6).

Stratigraphical range: Eocene-Oligocene. In the West Carpathians it was also found in the Eocene and Oligocene sediments.

Genus *Sphaeroidina* Orbigny, 1826
Sphaeroidina austriaca Orbigny, 1846
Pl. LXXVIII, Fig. 3a—b

1846 *Sphaeroidina austriaca* d'Orbigny — fide E. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1952 *Sphaeroidina austriaca* Orbigny — N. A. Voloshinova et L. G. Dain: Nonionidi etc., p. 139, tab. 4, fig. 1a—13b (cum syn.).

Remark: The forms ranged to the species have a jag in the aperture and in this they differ from the species Sphaeroidina bulloides Orbigny.

Stratigraphical range: Upper Eocene-Miocene. In the West Carpathians it is in the Upper Eocene-Miocene.

Sphaeroidina bulloides Orbigny, 1826
Pl. LXXVIII, Fig. 4a—b, 5a—b

1826 *Sphaeroidina bulloides* d'Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1952 *Sphaeroidina variabilis* Reuss — N. A. Voloshinova et A. R. Dain: Nonionidy etc., p. 137—138, tab. 4, fig. 8a—b, 9 (cum syn.).

1962 *Sphaeroidina bulloides* Orbigny — N. A. Voloshinova et A. R. Dain: Nonionidy etc., p. 138—139, tab. 4, fig. 10—11 (cum syn.).

Remark: Some authors regard the species *Sphaeroidina bulloides* Orbigny 1826 and *S. variabiliformis* Reuss 1851 as two independent taxonomic units. Differences between them are insignificant and are only due to natural variability within a taxon.

Stratigraphical range: Eocene-Recent. In the West Carpathians it has been recorded from the Middle and Upper Eocene, Oligocene and Miocene.

Genus *Epistomina* Terquem, 1883
Epistomina cf. elegans (Orbigny, 1826)
Pl. LXXXI, Fig. 5a—b

cf 1826 *Rotalia elegans* d'Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

Remark: In the material examined are some forms showing most features in common with the species *E. elegans* (Orbigny).

Stratigraphical range: In the West Carpathians the form was only found among the specimens studied. Typical forms of *E. elegans* (Orbigny) are recorded from the Miocene.

Genus *Elphidium* Montfort, 1808
Elphidium cf. *inflatum* (Reuss, 1861)
Pl. LXXX, Fig. 1—3

1861 *Polystomella inflata* Reuss — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1958 *Elphidium inflatum* (Reuss) — D. A. J. Batjes: Foraminifera of the Oligocene of Belgium (cum syn.).

Remark: Our forms are morphologically close to the species *E. inflatum*. They only differ in less developed intraseptal lamelles.

Stratigraphical range: In the associations studied the form is present throughout the Upper Priabonian.

Elphidium subcarinatum (Egger, 1857)
Pl. LXXIX, Fig. 5, 6a—b

1875 *Polystomella subcarinata Egger* — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1966 *Elphidium subcarinatum* (Egger) — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 411, tab. 3, fig. 1—2.

Stratigraphical range: According to Y. Le Calvez's (1970) data, the species described is present in the Oligocene of the Parisian Basin. In the West Carpathians it was found only in the area studied, i. e. in the top part of the Carpathian zone *Globigerina officinalis*.

Genus *Eponides* Montfort, 1808
Eponides polygonus Le Calvez, 1949
Pl. LXXXII, Fig. 6a—b

1949 *Eponides polygonus* Le Calvez — Y. Le Calvez: Révision des Foraminifères lutétiens etc., p. 28, tab. 5, fig. 90—92.
1970 *Eponides polygonus* Le Calvez — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 176, tab. 37, fig. 1, 9.

Stratigraphical range: Eocene-Oligocene. Geographically it ranges from the entire Eocene of the Parisian Basin. In the West Carpathians it was only found in the Upper Eocene sediments.

Eponides pygmeus (Hantken, 1875)
Pl. LXXXIII, Fig. 1a—b, 2a—b, 3a—b, 4

1875 *Pulv. pygmea* Hantk. — M. Hantken: Die Fauna der Clavulina Szaboi Schichten etc., p. 78, tab. 10, fig. 8.
1961 *Cibicides pygmeus* (Hantken) — J. P. H. Kaasschieter: Foraminifera of the Eocene of Belgium, p. 219, tab. 14, fig. 1 (cum syn.).
1969 *Cibicides pygmeus* (Hantken) — E. Y. Krayeva et B. F. Zerneckyi: Foraminiferi paleogena Ukraini, p. 96—97, tab. 38, fig. 7a, b, v (cum syn.).

Remark: The aperture of the specimens studied is typical of the genus Eponides. In few forms the aperture extends to the periphery, due to which some authors refer the species to the genus *Cibicides*.

Stratigraphical range: Eocene-Oligocene. Geographically it is a very frequent species (Asia, Europe, America). In the West Carpathians it is in the Eocene-Miocene.

Genus *Planulina* Orbigny, 1826
Planulina ambiqua (Franzenau, 1888)
Pl. LXXXVII, Fig. 4a—c

1888 *Rotalia ambiqua* n. sp. — A. Franzenau: Beitrag zur Kenntniss etc., p. 174, tab. 2, fig. 9—11.
1956 *Discorbis* (?) sp. — H. Hagn: Geologische und Paläontologische Untersuchungen etc., tab. 14, fig. 15a—b.
1961 *Planulina burlingtonensis* (Jennings) var. *neelyi* (Jennings) — J. P. H. Kaasschieter: Foraminifera of the eocene of Belgium, p. 224, tab. 14, fig. 11a—c.

Remark: Our forms are in a good accordance with the original description of the holotype. The forms studied exhibit variable inflatedness of chambers and evoluteness of tests.

The species *Cibicides neelyi* described by Jennings (1936) is a synonym to the species examined.

Stratigraphical range: Eocene-Oligocene. In the U. S. S. R. it was recorded from the Upper Eocene, in Belgium and the Netherlands — from the Eocene.

Planulina ungeriana (Orbigny, 1846)
Pl. LXXXVII, Fig. 1, 2a—b, 3

1846 *Rotalina ungeriana* Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1954 *Cibicides ungerianus* (Orbigny) — V. P. Vasilenko: Anomalinidi, p. 172, tab. 29, fig. 6a, b, v; 7a, b, v, tab. 30, fig. 1a, b, v.
1969 Cibicides ungerianus (Orbigny) — E Y. Krayeva et B. F. Zerneckiy: Foraminiferi paleogena Ukraini, p. 98—99, tab. 39, fig. 4a, b, v (cum syn.).

Remark: Most forms studied remind rather of the genus *Planulina* than *Cibicides*. Typical forms exhibit coarsely perforated wall, curved limbate sutures, and granulose initial whorls on the dorsal side. Around the aperture is a fine lip.

Stratigraphical range: In the West Carpathians it was recorded from the Eocene, Oligocene and Miocene.

Genus *Cibicides* Montfort, 1808
Cibicides carinatus (Terquem, 1882)
Pl. LXXXVI, Fig. 6a—b

1882 *Truncatulina carinata* Terquem — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Cibicides carinatus* (Terquem) — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 180—181, fig. 66—68 (cum syn.).

Remark: The associations examined comprise some forms having most features in common with the species *C. carinatus* described by Terquem or Y. Le Calvez (1949, 1970) from the Parisian Basin.

Stratigraphical range: Y. Le Calvez (l. c.) recorded the species from the Thanetian — Upper Eocene of the Parisian Basin. In the West Carpathians the author recorded the species from the Upper Eocene.

Cibicides lobatulus (Walker et Jacob, 1798)
Pl. LXXXVI, Fig. 5a—b

1798 *Nautilus lobatulus* Walker et Jacob — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Cibicides lobatulus* (Walker et Jacob) — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 181—182 (cum syn.).

Stratigraphical range: Paleocene-Recent. In the West Carpathians from the Eocene to the Miocene.

Cibicides lopjanicus Mjatliuk, 1950
Pl. LXXXVI, 2, 3a—b

1950 *Cibicides lopjanicus* Mjatliuk: Stratigrafiya flishevikh osadkov etc., p. 284, tab. 4, fig. 8a, b, v.

1954 *Cibicides lopjanicus* Mjatliuk — V. P. Vasilenko: Anomalinidy, p. 279—280, pl. 31, fig. 8a, b, v.

Remark: In the associations studied the species *C. lopjanicus* Mjatliuk is most common among the representatives of the genus *Cibicides*. Its morphological characteristics is in accordance with that of the holotype described from the East Carpathians.
Stratigraphical range: The holotype described was recorded from the Lower Oligocene. In the Slovak West Carpathians its first appearances were recorded from the Upper Eocene.

Cibicides westi Howe, 1939
Pl. LXXXVI, Fig. 4

1939 *Cibides westi* Howe — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1961 *Cibicides westi* Howe — J. P. H. Kaasschieter: Foraminifera of the Eocene of Belgium.

Remark: The species is rather infrequent in the associations studied. Its forms differ from the holotype in a less convex ventral side and in a shallower umbilicus.
Stratigraphical range: Middle-Upper Eocene. The author recorded it only from the Upper Eocene of the West Carpathians.

Cibicides cf. *pseudoungerianus* (Cushman, 1922)
Pl. LXXXVII, Fig. 6, 7a—b, 8a—b

cf. 1922 *Truncatulina pseudoungeriana* Cushman — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
cf. 1954 *Cibicides pseudoungerianus* Cushman — V. P. Vasilenko: Anomalinidi, p. 174—175, tab. 30, fig. 3a, b, v; 5a, b v; tab. 31, fig. 1a, b (cum syn.).

Remark: The forms ranged to the species show a considerable affinity with the species *C. ungerianus* (Orbigny) from which they differ in the absence of ornamentation on the dorsal side and in a less convolute structure of the test.
Stratigraphical range: Typical forms of the species *C. pseudoungerianus* are current in the Oligocene. The forms depicted were recorded from the Upper Eocene.

Genus *Planorbulina* Orbigny, 1826
Planorbulina difformis Roemer, 1838
Pl. LXXXIII, Fig. 8

1838 *Planorbulina difformis* Roemer — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Planorbulina difformis* Roemer — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 179, tab. 39, fig. 2 (cum syn.).

Remark: Our forms are conspecific with the forms from the Parisian basin described as *Planorbulina difformis* by Y. Le Calvez (l. c.).
Stratigraphical range: The above author recorded the species from the Lower Oligocene (Stampian). In the West Carpathians it was found in the Upper Priabonian sediments of the boreholes studied.

Genus *Nonion* Montfort, 1808
Nonion affine (Reuss, 1851)
Pl. LXXIX, Fig. 2a—b

1851 *Nonionina affinis Reuss* — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1970 *Nonion affine* (Reuss) — Y. Le Calvez: Contribution à l'étude des Foraminifères etc., p. 190—191, tab. 27, fig. 2 (cum syn.).

Stratigraphical range: Middle Eocene-Oligocene. In the Slovak West Carpathians if was recorded from the Upper Eocene and Oligocene.

Nonion aff. *pompiloides* (Fichtel et Moll, 1798)
Pl. LXXIX, Fig. 1a—c

cf. 1798 *Nautilus pompiloides* Fichtel et Moll — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
cf. 1958 *Nonion pompiloides* (Fichtel et Moll) — D. A. J. Batjes: Foraminifera of the Oligocene of Belgium, pl. 6, fig. 14.

Remark: The species *Nonion affine* (Reuss) is sometimes accompanied by forms with a broad suboval test periphery, and with involute structure. With their general structure they remind of the Miocene forms referred to the species *N. pompiloides*. The first appearances of the forms examined were recorded from the top part of the Priabonian.

Genus *Alabamina* Toulmin, 1941
Alabamina oschmanni Hagn, 1956
Pl. LXXXI, Fig. 7

1956 *Alabamina oschmanni* n. sp. — H. Hagn: Geologische und Paleontologische Untersuchungen etc., p. 167, tab. 15, fig. 6a—c.

Remark: Our forms differ from the holotype only in smaller tests. Among the material studied they were rare.
Stratigraphical range: The holotype was recorded from the lower part of the Upper Eocene (sensu H. Hagn). In the West Carpathians the species was found for the first time in the Upper Priabonian sediments.

Alabamina perlata (Andreae, 1884)
Pl. LXXXI, Fig. 6a—b

1884 *Pulvinulina perlata* Andreae — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1958 *Alabamina perlata* (Andreae) — D. A. J. Batjes: Foraminifera of the Oligocene of Belgium, p. 157, tab. 8, fig. 8a—9c.

Remark: In the material studied are rare forms with their structure identic with the species *A. perlata* Andreae, whose detailed description was made by D. A. J. Batjes (l. c.).

Stratigraphical range: The holotype was recorded from the septarian clays in Germany. D. A. J. Batjes (l. c.) recorded it from the Oligocene of Belgium. In the West Carpathians it has been only evidenced in the Upper Priabonian sediments of the area studied.

Genus *Gyroidina* Orbigny 1826
Gyroidina girardana (Reuss 1851)
Pl. LXXXI, Fig. 1—2

1851 *Rotalia girardana* Reuss — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1958 *Gyroidina soldanii* var. *girardana* (Reuss) — D. A. J. Batjes: Foraminifera of the Oligocen of Belgium, p. 147, tab. 7, fig. 12a—c.
1961 *Gyroidina girardana* Reuss — H. Bystrická: Mikrofauna pestrých vrstiev etc., p. 151, tab. 23, fig. 7—8.

Remark: In the material studied the species described was only rare. In basical features the individual forms agree with originally described forms or with forms described by D. A. J. Batjes (l. c.) from Belgium.

Stratigraphical range: Eocene-Recent. In the West Carpathians it was in the Middle Eocene-Miocene.

Gyroidina soldanii Orbigny, 1826
Pl. LXXXI, Fig. 3—4

1826 *Gyroidina soldanii* d'Orbigny — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1953 *Gyroidina soldanii* Orbigny — E. V. Mjatliuk: Spirillinidi etc., p. 61—62, tab. 5, fig. 3a—5v (partim).
1958 *Gyroidina soldanii* d'Orbigny — D. A. J. Batjes: Foraminifera of the Oligocen of Belgium, p. 147, tab. 7, fig. 13a—14c.

Remark: Forms ranged to the species *G. soldanii,* differ from *G. gyrardana* (Reuss 1851) in flush or slightly depressed spiral sutures, in more or less flat dorsal side, and in subspherical to subangular axial margin of chambers.

Stratigraphical range: Eocene-Recent. In the West Carpathians it is in the stratigraphical level analogous to *G. gyrardana* (Reuss).

Genus *Ceratobulimina* Toula, 1915
Ceratobulimina eximia (Rzehak, 1888)
Pl. LXXXI, Fig. 9a—c

1888 *Pulvinulina eximia* Rzehak — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1946 *Ceratobulimina eximia* (Rzehak) — J. A. Cushman: The Genus *Ceratobulimina* etc., p. 109, tab. 17, fig. 6—8 (cum syn.).

Remark: On the pictured form with the last chamber broken off, are clearly visible septal foramen opening into penultimate chamber, and interval serrate partition. Undamaged forms have most features in common with the species *C. eximia.*

Stratigraphical range: According to J. A. Cushman, in North America the species is typical of the Eocene. In the samples studied it is sporadical in the Upper Priabonian.

Genus *Chiloguembelina* Loeblich et Tappan, 1956
Chiloguembelina gracillima (Andreae, 1884)
Pl. XCIII, Fig. 8a—c

1884 *Textilaria gracillima* Andreae — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1968 *Chiloguembelina gracillima* (Andreae) — O. Samuel et J. Salaj: Microbiostratigraphy and Foraminifera etc., p. 183—184, tab. 22, fig. 2a—3; text-fig. 51 (cum syn.).

Remark: It differs in a more elongated and narrower test from the species *Chiloguembelina cubensis* (Palmer 1934) recorded from approximately the same stratigraphical level on the American continent.

Stratigraphical range: Upper Eocene — Oligocene. In the Czechoslovak West Carpathians it is present in the Upper Eocene and Lower Oligocene. In the U. S. S. R. it is recorded from the upper part of the Upper Eocene and throughout the Oligocene.

Genus *Globanomalina* Hague 1956
Globanomalina micra (Cole, 1927)
Pl. XCIII, Fig. 6, 7a—c

1927 *Nonion micrus* Cole — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1968 *Globanomalina micra* (Cole) — O. Samuel et J. Salaj: Microbiostratigraphy and Foraminifera etc., p. 180—181, tab. 20, fig. 5a—b, text-fig. 49 A—B (cum syn.).
1969 *Pseudohastigerina micra* (Cole) — W. H. Blow: Late middle Eocene to recent etc., p. 376, tab. 53, fig. 1, 4—6.

Stratigraphical range: Middle Eocene to Lower Oligocene. In the West Carpathians of Slovakia it appears in the Middle Eocene to the Lower Oligocene.

Genus *Turborotalia* Cushman et Bermúdez, 1949
Turborotalia (T.) centralis (Cushman et Bermúdez, 1937)
Pl. XCVIII, Fig. 6a—b

1937 *Globorotalia centralis* Cushman et Bermúdez — fide B. F. Ellis et Messina: Catalogue of Foraminifera.
1968 *Turborotalia (T.) centralis* (Cushman et Bermúdez) — O. Samuel et J. Salaj: Microbiostratigraphy and Foraminifera etc., p. 159, tab. 20, fig. 2a—c (cum syn.).

Remark: It differs from *Turborotalia (T.) cerroazulensis* (Cushman) in having a more gibbous and in the peripheral part, more oval chambers.

Stratigraphical range: Middle to Upper Eocene. In the West Carpathians of Slovakia it occurs in Middle and Upper Eocene of all tectonic units.

Turborotalia (T.) ex gr. *cerroazulensis* (Cole, 1928)
Pl. XCIII, Fig. 1, 2a—b; Pl. XCVIII, Fig. 5a—b

1928 *Globigerina cerroazulensis* Cole — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1969 *Globorotalia (T.) cerroazulensis* (Cole) — W. H. Blow: Late Middle Eocen to Recent etc., p. 347, tab. 36, fig. 3—4.
1968 *Turborotalia (T.) cocoaensis* (Cushman) — O. Samuel et J. Salaj: Microbiostratigraphy and Foraminifera etc., p. 159—160, tab. 20, fig. 3a—c, text-fig. 42 A—C.

Stratigraphical range: Upper Eocene. In the observed area it occurs in the Upper Eocene.

Turborotalia (T.) cf. *increbescens* (Bandy 1949)
Pl. XCVIII, Fig. 3a—c

1949 *Globigerina increbescens* Bandy — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1969 *G. (T.) increbescens* (Bandy) — W. H. Blow: Late middle Eocene etc., p. 349, tab. 36, fig. 5—6 (cum syn.).

Remark: In the associations studied are some forms with 4 ½—5 ½ chambers in the last whorl. They exhibit most features in common with the species *T (T.) increbescens.*

Stratigraphical range: According to W. H. Blow (1969) the species occurs in the Upper Eocene — Lower Oligocene (the zones? P.14—P.19). In the Slovak West Carpathians it is sparse in the Upper Priabonian — Lower Oligocene.

Genus *Globigerina* Orbigny, 1826
Globigerina ampliapertura Bolli, 1957
Pl. LXXXIX, Fig. 8; Pl. XCVIII, Fig. 1a—c

1957c *Globigerina ampliapertura* Bolli, new species: Planktonic Foraminifera from the Oligocene-Miocene etc., p. 108, tab. 22, fig. 5a—7b (non fig. 4a—c = *G. praesaepis* Blow 1969).
1957b *Globigerina ampliapertura* Bolli — H. M. Bolli: Planktonic Foraminifera from the Eocene etc., p. 164, tab. 36, fig. 8a—c.
1962 *Globigerina ampliapertura* Bolli — V. Pokorný: K charakteristike oligomiocenních vrstev etc., p. 298, text-fig. 2a—c.
1969 *Globigerina ampliapertura* Bolli — W. H. Blow: Late middle Eocene to Recent etc., p. 315, pl. 12, fig. 6, 9, 10 (cum syn.).

Remark: Among the specimens studied, infrequent are forms exhibiting most features in common with the Bolli's or the Blow's forms recorded from the Cipero Formation or San Fernando Formation.
Stratigraphical range: In accordance with H. M. Bolli's (1957 l. c.) or W. H. Blow's (1969) data we may state the first appearances of the species in the upper part of the Upper Eocene and its transition into the Oligocene in the West Carpathians.

Globigerina angiporoides Hornibrook, 1965
Pl. LXXXVIII, Fig. 1a—b, 2, 3a—c

1965 *Globigerina angiporoides* Hornibrook (non vidi).
1969 *Globigerina angiporoides* Hornibrook — W. H. Blow: Late Middle Eocene to Recent etc., p. 315, tab. 12, fig. 3, 4—5.

Remark: *G. angiporoides* is in phylogenetic lineation with the species *G. linaperta* Finlay 1939. *G. linaperta transdanubica* Samuel 1972 differs from the species described in a larger last chamber occupying almost 2/3 of the test diameter, and in small diameter of tests in the initial whorls.
Stratigraphical range: W. H. Blow (1969) found it within the Upper Eocene and Lower Oligocene (zone P.15—P.19). In the West Carpathians it is in the same stratigraphical level.

Globigerina angustiumbilicata Bolli, 1957
Pl. XCVII, Fig. 11a—c

1957 *Globigerina ciperoensis angustiumbilicata* Bolli, new subspecies: Planktonic Foraminifera from the Oligocene-Miocene etc., p. 109, tab. 22, fig. 12a—13c.
1968 *Globigerina* cf. *ciperoensis ciperoensis* Bolli — O. Samuel et J. Salaj: Microbiostratigraphy and Foraminifera etc., p. 110, pl. 7, fig. 4a—c.
1969 *Globigerina angustiumbilicata* Bolli — W. H. Blow: Late middle Eocene to Recent etc., p. 316 (cum syn.).

Remark: In the top part of the boreholes studied found were sporadical forms composed of five chambers, which were identic with the spe-

cies *G. angustiumbilicata* described by H. M. Bolli (l. c.) or by W. H. Blow and F. T. Banner (1962).

Stratigraphical range: In the West Carpathians it was recorded from the top part of the Upper Eocene and Oligocene. After W. H. Blow (1969) it appeared in his zone P.16 and passed over to the zone N.22.

Globigerina corpulenta Subbotina, 1953

Pl. LXXXIX, Fig. 3a—b

1953 *Globigerina corpulenta* Subbotina sp. n: Globigerinidy etc., p. 76—78, tab. 9, fig. 5a, b, v — 7a, b, v; tab. 10, fig. 1a, b, v — 3a, b, v, 4a, b.

1968 *Globigerina corpulenta* Subbotina — O. Samuel et J. Salaj: Microbiostratigraphy and Foraminifera etc., p. 112, pl. 4, fig. 4a—c.

Stratigraphical range: The holotype described was recorded from the Upper Eocene. It is in the same stratigraphical level in the West Carpathians.

Globigerina danvillensis Howe et Wallace, 1932

Pl. XCII, Fig. 5a—c; Pl. XCVII, Fig. 1a—c, 2a—c

1932 *Globigerina danvillensis* Howe and Walace — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1950 *Globigerina* ex gr. *danvillensis* Howe et Walace — E. V. Mjatliuk: Stratigrafiya flishevych osadkov etc., p. 279—280, tab. 4, fig. 2a, b, v.

1955 *Globigerina danvillensis* Howe et Walace — N. I. Maslakova: Stratigrafiya i fauna myelkikh foraminifer etc., p. 79—80, tab. 11, fig. 14—16.

Remark: It is an ancestral form to *Globigerina postcretacea* Mjatliuk from which it differs in less chambers and in stratigraphical diapason.

Stratigraphical range: In the Carpathian System (Poland, U. S. S. R., Czechoslovakia) the species was recorded from the Upper Eocene and Oligocene.

Globigerina eocaena compacta Subbotina, 1953

Pl. XCIV, Fig. 1a—c

1953a *Globigerina pseudoeocaena* var. *compacta* Subbotina sp. et var. n.: Globigerinidy etc., p. 68, tab. 5, fig. 3a, b, v — 4a, b v.

1968 *Globigerina eocaena compacta* Subbotina — O. Samuel et J. Salaj: Microbiostratigraphy and Foraminifera etc., p. 11, text-fig. 19 (cum syn.).

Remark: The subspecies described differs from the species *G. eocaena* Gümbel 1968 emend. Hagn et Lindenberg 1966 mostly in a more compact test structure, in the shape of the aperture and in its stratigraphic position.

Stratigraphical range: N. N. Subbotina (1953) recorded the subspecies described from the Middle and Upper Eocene. In the Slovak West Carpathians it was only found in the Upper Eocene.

Globigerina galavisi Bermúdez, 1961
Pl. LXXXIX, Fig. 1a—b, 2; Pl. XCIV, Fig. 4a—c

1961 *Globigerina galavisi* Bermúdez: Contrib. al Estudio de las Globigerinidae etc., p. 1183, tab. 4, fig. 3 (non vidi; fide W. H. Blow, 1969).
1969 *Globigerina galavisi* Bermúdez — W. H. Blow: Late middle Eocene to Recent etc., p. 319, tab. 3, fig. 12—14 (cum syn.).

Remark: From the species *G. corpulenta* Subbotina it differs in a larger ultimate chamber occupying almost a half of the test diameter, and surpassing the preceding chambers from the ventral side.
Stratigraphical range: According to W. H. Blow (1969) it is found in the uppermost Middle Eocene and throughout the Oligocene (the zone P 13 — Ur. 2). In the Czechoslovak West Carpathians it was recorded from the Priabonian and the Lower Oligocene.

Globigerina gnaucki Blow et Banner
Pl. XC, Fig. 1—6; Pl. XCVIII, Fig. 2a—c

1962 *Globigerina ouachitaensis gnaucki* Blow et Banner subsp. nov.: Fundamentals of Mid-Tertiary etc., p. 91—92, pl. 9, fig. L—N.

Remark: In some associations *G. gnaucki* dominates over other species. Varied are number of chambers, size of the aperture and convexity of the dorsal side.
Stratigraphical range: W. H. Blow (l. c.) recorded the species described from the uppermost Upper Eocene zone (P.17) and from the Lower Oligocene (No.1—P.20). In the West Carpathians the species was found in the Upper Priabonian and Lower Oligocene.

Globigerina gortanii (Borsetti, 1959)
Pl. XCVII, Fig. 10a—b

1959 *Catapsidrax gortanii* n. sp. — A. M. Borsetti: Tre nuovi foraminiferi etc., p. 205—207, tab. 1(13), fig. 1a—d.
1968 *Globigerina* ex gr. *gortanii* (Borsetti, 1959) — O. Samuel et J. Salaj: Microbiostratigraphy and Foraminifera etc., p. 115—116, text-fig. 20 (cum syn.).

Remark: Our specimens differ from the holotype and data presented by W. H. Blow et F. T. Banner (1962) only in a smaller test.
Stratigraphical range: In the West Carpathians it was found in the Upper Eocene and Lower Oligocene.

Globigerina linaperta Finlay, 1939
Pl. LXXXVIII, Fig. 4, 5a—b

1939 *Globigerina linaperta* Finlay — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1957 *Globigerina linaperta* Finlay — H. M. Bolli: The genera Globigerina and Globorotalia etc., p. 70—71, tab. 15, fig. 15—17.

Stratigraphical range: According to some literary data it appeared in the Middle Paleocene and passed over to the Upper Eocene. In the West Carpathians it was recorded from the Upper Paleocene — Upper Eocene.

Globigerina liverovskae (Bykova, 1960) emend Samuel et Salaj, 1968
Pl. XCII, Fig. 6a, b—7; Pl. XCVII, Fig. 6a—c, 7a—c

1953a *Globigerina postcretacea* Mjatliuk — N. N. Subbotina: Globigerinidy etc., p. 60—61, tab. 2, fig. 16a, b, v — 20a, b, v.
1968 *Globigerina liverovskae* (Bykova, 1960) — O. Samuel et J. Salaj: Microbiostratigraphy and Foraminifera etc., p. 122—123, tab. 7, fig. 6a—c; text-fig. 21 A, B (cum syn.).
1970 *Turborotalia bannerblowi* sp. n. — J. Bleicher: »Globigeriny« podmenilitowykh etc., p. 151—152 (resp. 186—187), tab. 4, fig. 4a—b; text-fig. 4.

Remark: The species described differs from the morphologically similar form *G. postcretacea Mjatliuk* 1950 in an almost evolute test structure and in the umbilical-extraumbilical position of the aperture. The forms figured by N. N. Subbotina (1953) from the North Caucasus, denoted as *G. postcretacea* Mjatliuk 1950 is a synonym of the species discussed. The species *Turborotalia bannerblowi* is a synonym of *G. liverovskae*.

Stratigraphical range: *G. liverovskae* was recorded from the lower part of the Chadum horizon (the Lower Oligocene). It was presented by N. N. Subbotina (l. c.) as *G. postcretacea* from the *Bolivina* zone of the North Caucasus. In the Slovak West Carpathians it is in the Lower Oligocene. In the material studied, such forms appear as early as the top part of our zone *Globigerina officinalis* with considerable affinity to the Lower Oligocene forms of the species *G. liverovskae*.

Globigerina officinalis Subbotina, 1953
Pl. XCII, Fig. 1a—b, 2a—b, 3—4; Pl. XCVI, Fig. 5a—c, 6a—b

1953a *Globigerina officinalis* Subbotina sp. n.: Globigerinidy etc., p. 78—79, tab. 11, fig. 1a, b, v — 7a, b, v.
1968 *Globigerina officinalis* Subbotina — O. Samuel et J. Salaj: Microbiostratigraphy and Foraminifera etc., p. 123—124, tab. 6, fig. 3—c; text-fig. 25 (cum syn.).

Remark: In the Flysch formations of the West Carpathians it is among the most frequent species of planktonic foraminifers in the Upper Priabonian and Lower Oligocene. When examined by stereoscan microscope, it exhibits a structure different from that of the species *G.* ex gr. *praebulloides.*

Globigerina opima nana Bolli, 1957

Pl. XCVIII, Fig. 4a—c

1957c *Globorotalia opima nana* Bolli new species, new subspecies: Planktonic Foraminifera from the Oligocene—Miocene etc., p. 118, pl. 28, fig. 3a—c.

1957b *Globorotalia opima nana* Bolli — H. M. Bolli: Planktonic Foraminifera from the Eocene etc., p. 169.

1959 *Globorotalia (T.) opima nana* Bolli — W. H. Blow: Late middle Eocene etc., p. 352—353, pl. 39, fig. 1.

Remark: Sporadically occurring forms exhibit most morphological species in common with the species *G. opima nana* Bolli.

Stratigraphical range: The species described is very rare in the material studied and in the West Carpathians. So far it has only been found in the Upper Eocene and Lower Oligocene.

Globigerina ouachitaensis Howe et Wallace, 1932

Pl. XC, Fig. 7, 8a—b; Pl. XCVII, Fig. 8a—b

1932 *Globigerina ouachitaensis* Howe et Wallace — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.

1968 *Globigerina ouachitaensis* Howe et Wallace — O. Samuel et J. Salaj: Microbiostratigraphy and Foraminifera etc., p. 124—125, tab. 6, fig. 5a—c; tab. 7, obr. 1a—b; text-fig. 26 (cum syn.).

1969 *Globigerina ouachitaensis* Howe et Wallace — W. H. Blow: Late middle Eocene etc., p. 320, tab. 17, fig. 3—4 (cum syn.).

Stratigraphical range: In the Slovak West Carpathians it has been found in the Upper Eocene and Lower Oligocene so far. According to W. H. Blow's (1969) data the age diapason of the species is within the zones P.15—N.2.

Globigerina praebulloides praebulloides Blow, 1959

Pl. XCI, Fig. 2—4; Pl. XCVI, Fig. 1a—c

1959 *Globigerina praebulloides* Blow: Age, correlation and biostratigraphy etc., p. 180, pl. 8, fig. 47a—c; tab. 9, fig. 48 (non vidi; fide W. H. Blow, 1962).

1969 *Globigerina praebulloides praebulloides* Blow: Late middle Eocene etc., p. 320—321, tab. 18, fig. 1, 2 (cum syn.).

Remark: Among the specimens examined, the species and its two subspecies predominate. Their test morphology and wall structure agree with W. M. Blow's description (l. c.).

Stratigraphical range: W. H. Blow (1969) recorded the species from the Upper Priabonian — Miocene (the zone P.16—N.17). In the area studied, its first occurrences were recorded from the Upper Priabonian. It passed over to the Oligocene.

Globigerina praebulloides leroyi Blow et Banner, 1962
Pl. CXI, Fig. 5, 6a—b, 7a—b, 8; Pl. XCVI, Fig. 3a—c.

1962 Globigerina praebulloides leroyi Blow et Banner subsp. nov.: in fundamentals of Mid-Tertiary etc., p. 93, tab. 9, fig. R—T.

Remark: It differs from the above species in a symmetrical, less elongated test, in a smaller umbilicus, and in its aperture provided with a well-developed lip. Its general test morphology reminds of the species *G. officinalis* Subbotina 1953. It only differs in a greater test size, in a larger umbilicus and in wall structure.

Stratigraphical range: In the West Carpathians it has been recorded from the Upper Priabonian and Oligocene so far. W. H. Blow (1969) found it in the zones P.16 to N.8 (the Upper Priabonian — Lower Miocene).

Globigerina praebulloides occlusa Blow et Banner, 1962
Pl. XCI, Fig. 1a—c; Pl. XCVI, Fig. 2a—c

1962 *Globigerina praebulloides occlusa* Blow et Banner subsp. nov.: In Fundamentals Mid-Tertiary etc., p. 93—94, tab. 9, fig. V—W.

Remark: It differs from *G. praebulloides praebulloides* Blow 1969 in a smaller and shallower umbilicus, in a smaller aperture and a more compact test structure.

Stratigraphical range: In the Slovak West Carpathians it is present in the population of the above two taxons; the Upper Priabonian — Oligocene.

Globigerina prasaepis Blow, 1969
Pl. XCV, Fig. 1a—c, 2a—c

1969 *Globigerina prasaepis*, n. sp. — W. H. Blow: Late middle Eocene etc., p. 382—383, pl. 10, fig. 13, tab. 18, fig. 3—7 (cum syn.).

Remark: In the associations studied the forms referred to this species are very sparse.

Stratigraphical range: After W. H. Blow (l. c.) the species occurs throughout the zones P.17—P.21 (= No.2). Besides in the area studied, it was found sporadically in the Uppermost Priabonian and Lower Oligocene in the West Carpathians.

Globigerina pseudoampliapertura Blow et Banner, 1962
Pl. XCVI, Fig. 7a—c

1962 *Globigerina pseudoampliapertura* Blow et Banner sp. nov. — in Fundamentals of Mid-Tertiary etc., p. 95, tab. 12, fig. A—C (cum syn.).
1968 *Globigerina pseudoampliapertura* Blow et Banner — O. Samuel et J. Salaj: Microbiostratigraphy and Foraminifera etc., p. 126—127, text-fig. 28.

Stratigraphical range: W. H. Blow (1969) recorded the species from the Upper Eocene — Lower Oligocene (P.16—N.19). Its stratigraphic position is analogous in the area studied of the Slovak West Carpathians.

Globigerina pseudovenezuelana Blow et Banner, 1962
Pl. LXXXIX, Fig. 7; Pl. XCIV, Fig. 2a—c

1962 *Globigerina yeguensis pseudovenezuelana* Blow et Banner subspec. nov.: in Fundamentals of Mid-Tertiary etc., p. 100—101, tab. XI, fig. J—L; N, O.
1968 *Globigerina* cf. *venezuelana* Hedberg — O. Samuel et J. Salaj: Microbiostratigraphy and Foraminifera etc., p. 136—173, tab. 5, fig. 2—3b; text-fig. 34 (cum syn.; non *G. venezuelana* Hedberg, 1937).
1969 *Globigerina pseudovenezuelana* Blow et Banner — W. H. Blow: Late middle Eocene etc., p. 321, tab. 19, fig. 1, 2.

Remark: In contrast to this type, the Carpathian forms possess less distinct lip, and their ultimate chamber overlaps the umbilicus most frequently.

Stratigraphical range: W. H. Blow (1969) quotes the species occurrences within the upper part of the Middle Lutetian and the Lower Oligocene (the zone P.13—N.19). In the Slovak part of the West Carpathians it has been recorded in the Middle (Lutetian) and Upper Eocene (Priabonian).

Globigerina senilis Bandy, 1959
Pl. LXXXVIII, Fig. 6, 7a—b; Pl. XCV, Fig. 3a—c

1949 *Globigerina ouachitaensis* Howe et Wallace var. *senilis* Bandy: Eocene and Oligocene foraminifera etc., p. 121, tab. 22, fig. 5 fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1969 *Globigerina senilis* Bandy — W. H. Blow: Late middle Eocene etc., p. 322, tab. 19, fig. 3 (cum syn.).

Remark: It differs from the species *Globigerina ouachitaensis* Howe et Wallace 1932 in a more compact test structure, and in a smaller aperture. The forms examined agree well with the description and pictures by W. H. Blow et F. T. Banner (in F. E. Eames et all., l. c.) or by W. H. Blow (1969).

Stratigraphical range: W. H. Blow recorded it from the zones P.16 to N.2. In the West Carpathians, in the area studied it is present throughout the Upper Eocene — Lower Oligocene.

Globigerina aff. *tapuriensis* Blow et Banner, 1962
Pl. XCV, Fig. 4a—c, 5a—c

1962 *Globigerina tripartita tapuriensis* Blow et Banner subsp. nov.: In Fundamentals of Mid-Tertiary etc., p. 97—98, tab. 10, fig. H—K.

Remark: In the material examined found are infrequent forms with their morphology most resembling *G. tapuriensis*.

Stratigraphical range: W. H. Blow (1969) placed the lower limit of its occurrence in the zone P.18 referred to the Oligocene. The forms *G. tapuriensis* appear firstly in the uppermost part of the Carpathian zone *Globigerina officinalis,* as shown by the material studied.

Globigerina tripartita Koch, 1926
Pl. LXXXIX, Fig. 5a—b, 6; Pl. XCIV, Fig. 3a—c

1926 *Globigerina bulloides* d'Orbigny var. tripartita Koch, 1926 — fide B. F. Ellis et A. R. Messina: Catalogue of Foraminifera.
1968 *Globigerina tripartita* Koch — O. Samuel et J. Salaj: Microbiostratigraphy and Foraminifera etc., p. 132—133, tab. 6, fig. 4a—c; text-fig. 31 (cum syn.).

Stratigraphical range: According to W. H. Blow's (1969) data it is practically present throughout the Upper Eocene — Oligocene (the zone P.14—Nr. 3). In the West Carpathians, in the area studied it was found in the Upper Eocene and Oligocene sediments.

Globigerina turcmenica Chalilov, 1948
Pl. XC, Fig. 9, 10a—b; Pl. XCVI, Fig. 4a—c

1948 *Globigerina turcmenica* nov. sp. — D. M. Chalilov: Stratigrafiya verkhnemyelovych a paleogen. etc., p. 69—70, tab. 10, fig. 7a, b.
1953a *Globigerina apertura* Cushman — N. N. Subbotina: Globigerinidy etc., p. 71, tab. 7, fig. 2a, b, v — 5a, b, v.
1968 *Globigerina* cf. *apertura* Cushman — O. Samuel et J. Salaj: Microbiostratigraphy and Foraminifera etc., p. 107—108, tab. 5, fig. 5a—c.

Remark: It differs in a less convex dorsal side, in a more compact test structure and a larger aperture from the morphologically resembling species *G. ouachitaensis* Howe et Wallace 1932.

Stratigraphical range: W. H. Blow (1969) found it throughout the Upper Eocene — Lower Oligocene (the zones P.15—N.19). It was found in the same stratigraphical level in the West Carpathians.

Genus *Globorotaloides* Bolli 1957
Globorotaloides suteri Bolli, 1957
Pl. XCIII, Fig. 3—5

1957c *Globorotaloides suteri* Bolli, new species: Planktonic Foraminifera from the Oligocene etc., p. 117, tab. 27, fig. 9a—13b.

1957b *Globorotaloides suteri* Bolli — H. M. Bolli: Planktonic Foraminifera from the Eocene etc., p. 166, tab. 37, fig. 10a—12.

Stratigraphical range: After H. M. Bolli's data it is in the Upper Lutetian to the Miocene (the zone *Porticulasphaera mexicana — Globigerinatella insueta)*. In the Slovak West Carpathians it is in the level corresponding to Bolli's zone *Globigerapsis kugleri* (the upper part of the Carpathian zone *T. (A.) crassata densa* up to the Lower Oligocene.

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Explanations of plates LXV—XCVIII

Plate LXV

Fig. 1 *Pyrgo bulloides* (Orbigny) Ľubietová, borehole P-4, 39—40 m. Upper Priabonian. 3045/74 (150×).

Fig. 2a—b *Pyrgo simplex* (Orbigny) Ľubietová, borehole P-8, 46—47 m. Upper Priabonian. 2a-3046 (150×); 2b-3047 (300×).

Fig. 3a—c *Lagena scalariformis* (Williamson), Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. 3a-5699/73 (400×); 3b-5700/73 (1000×); 3c-5701 (2000×).

Fig. 4a—d *Lagena hexagona* (Williamson), Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. 4a-3124/72 (450×); 4b-3125/72 (3000×); 4c-3126/72 (10 000×); 4d-5341/73 (1500×).

Fig. 5 *Nodosaria coarctata* Hantken, Ľubietová, borehole P-8, 46—47 m. Upper Priabonian. 3055/74 (200×).

Fig. 6 *Lagena* sp., Ľubietová, borehole P-8, 8,6 m. Upper Priabonian. 3083/74 (200×).

Fig. 7 *Lagena* aff. *isabelleana* (Orbigny), Ľubietová, borehole P-8, 7,5 m. Upper Priabonian. 5342/73 (200×).

Plate LXVI

Fig. 1a—c *Lagena asperoides* Gallowey et Morrey, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 1a-5331/73 (1200×); 1b-5328/73 (250×); 1c-5329/73 (2000×).

Fig. 2 *Lagena asperoides* Gallowey et Morrey, Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. 3062/74 (150×).

Fig. 3a—b *Lagena tenuis ornata* Reuss, Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. 3a-5702/73 (200×); 3b-5703 (200×).

Fig. 4a—b *Lagena gracilis* Williamson, Ľubietová, borehole P-8, 81—82 m. Upper Priabonian. 4a-5359/73 (200×); 4b-5360/73 (1000×).

Fig. 5a—b *Lagena amphora* Reuss, Ľubietová, borehole P-8, 7,5 m. Upper Priabonian. 5a-365/74 (200×); 5b-366/74 (200×).

Fig. 6 *Lagena isabelleana* (Orbigny), Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 1048/74 (200×).

Fig. 7—8 *Lagena striata* (Orbigny), Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 7-5456/73 (200×); 8-5457/73 (200×).

Plate LXVII

Fig. 1a—b *Fissurina orbignyana orbignyana* Seguenza, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 1a-955/74 (250×); 1b-956/74 (600×).

Fig. 2 *Fissurina orbignyana orbignyana* Seguenza, Ľubietová, borehole P-4, 32—34 m. Upper Priabonian. 3455/74 (200×).

Fig. 3 *Fissurina marginata* (Walker et Boys), Ľubietová, borehole P-4, 51—52 metres. Upper Priabonian. 1077/74 (200×).

Fig. 4 *Fissurina orbignyana tricarinata* Terquem, Ľubietová, borehole P-4, 7—8 metres. Upper Priabonian. 3737/73 (200×).

Fig. 5 *Fissurina orbignyana tricarinata* Terquem, Ľubietová, borehole P-8, 26,8 metres. Upper Priabonian. 3738/72 (250×).

Fig. 6 *Fissurina* sp., Ľubietová, borehole P-8, 81—82 m. Upper Priabonian. 3057/74 (200×).

Fig. 7 *Fissurina marginatoperforata* (Seguenza), Ľubietová, borehole P-4, 27—28 metres. Upper Priabonian. 5338/73 (300×).

Fig. 8 *Fissurina marginatoperforata* (Seguenza), Ľubietová, borehole P18, 81—82 m. Upper Priabonian. 5336/73 (300×).

Fig. 9 *Fissurina praeclara* Cushman et Renz, Ľubietová, borehole P-4, 39—40 m. Upper Priabonian. 5357/73 (300×).

Fig. 10a—b *Fissurina praeclara* Cushman et Renz, Ľubietová, borehole P-4, 39—40 m. Upper Priabonian. 5357/73 (300×).

Plate LXVIII

Fig. 1a—c *Fissurina carpathica* nov. sp., Ľubietová, borehole P-8, 7,5 m. Upper Priabonian. 1a-733/74 (400×); 1b-717/74 (400×); 1c-5353/73 (400×).

Fig. 2a—b *Fissurina laevigata* (Reuss). Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 2a-5354/73 (450×); 2b-5355/74 (1350×).

Fig. 3 *Fissurina laevigata* (Reuss), Ľubietová, borehole P-8, 64—65 m. Upper Priabonian. 728/74 (400×).

Fig. 4a—b *Fissurina aperta* Seguenza, Ľubietová, borehole P-8, 64—65 m. Upper Priabonian. 4a-711/74 (350×); 4b-709/74 (350×).

Fig. 5 *Fissurina aperta* Seguenza, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 957/74 (350×).

Fig. 6a—b *Fissurina latistoma* Seguenza, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 6a-3071/74 (350×); 6b-3073/74 (350×).

Fig. 7 *Parafissurina sp.*, Ľubietová, borehole P-8, 64—65 m. Upper Priabonian. 725/74 (300×).

Plate LXIX

Fig. 1 *Dentalina intermedia* Hantken, Ľubietová, borehole P-4, 32—34 m. Upper Priabonian. 5825-7/73 (50×).

Fig. 2—3 *Dentalina intermedia* Hantken, Ľubietová, borehole P-8, 87—88 m. Upper Priabonian. 2-164/74 (100×); 3-165/74 (100×).

Fig. 4 *Dentalina pauperata* Hantken, non Orbigny, Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 5834/73 (100×).

Fig. 5 *Dentalina approximata* Reuss, Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 5710/74 (100×).

Fig. 6 *Dentalina approximata* Reuss, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 3074/74 (100×).

Fig. 7 *Nodosaria consobrina* (Orbigny), Ľubietová, borehole P-4, 35—36 metres. Upper Priabonian. 3030/74 (120×).

Fig. 8 *Nodosaria consobrina* (Orbigny), Ľubietová, borehole P-4, 35—36 metres. Upper Priabonian. 3029/74 (120×).

Fig. 9 *Nodosaria consobrina* (Orbigny), Ľubietová, borehole P-4, 35—36 metres. Upper Priabonian. 3027/74 (100×).

Fig. 10 *Nodosaria* sp. (cf. *N. ewaldi* Reuss 1851), Ľubietová, borehole P-4, 39—40 metres. Upper Priabonian. 5828/73 (100×).

Fig. 11 *Nodosaria sp.* (cf. *D. badensis* Orbigny 1846), Ľubietová, borehole P-16, 16,4 m. Upper Priabonian. 3454/74 (100×).

Fig. 12a—b *Nodosaria exilis* Nougeboren, Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 12a-5711/73 (100×); 12b-5712/73 (650×).

Fig. 13 *Nodosaria exilis* Nougeboren, Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 5713/73 (100×).

Fig. 14 *Nodosaria exilis* Nougeboren, Ľubietová, borehole P-8, 8,6 m. Upper Priabonian. 3470/74 (150×).

Fig. 15a—b *Nodosaria spinescens* (Reuss), Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 15a-5715/73 (150×); 15b-5716/73 (3500×).

Fig. 16a—b *Nodosaria spinescens* (Reuss), Ľubietová, borehole P-8, 8,6 m. Upper Priabonian. 16a-3409/74 (150×); 16b-3410/74 (1200×).

Fig. 17 *Nodosaria* sp. (cf. *Stilostomella curvatura spinea* Cushman 1939), Ľubietová, borehole P-16, 16,4 m. Upper Priabonian. 3028/74 (100×).

Plate LXX

Fig. 1a—c *Nodosaria setosa* (Hantken), Ľubietová, borehole P-4, 39—40 m. Upper Priabonian. 1a-5832/73 (450×); 1b-5833/73 (500×); 1c-5830/73 (150×).

Fig. 2a—b *Nodosaria adolphina* (Orbigny), Ľubietová, borehole P-4, 35—36 metres. Upper Priabonian. 2a-686/74 (300×); 2b-684/74 (100×).

Fig. 3 *Nodosaria acuminata Hantken,* Ľubietová, borehole P-8, 46—47 m. Upper Priabonian. 707/74 (50×).

Fig. 4—5 *Nodosaria contorta* Hantken, Ľubietová, borehole P-16, 16,5 m. Upper Priabonian. 4-3450/74 (50×); 5-3453/74 (50×).

Fig. 6 *Nodosaria* sp., Ľubietová, borehole P-4, 59 m. Upper Priabonian. 100/74 (150×).

Fig. 7 *Nodosaria tutkowskii* Kitchapov, Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. 678/74 (120×).

Fig. 8 *Dentalina megalopolitana* Reuss, Ľubietová, borehole P-16, 16,5 m. Upper Priabonian. 3080/74 (200×).

Fig. 9 *Nodosaria spinocosta* Orbigny, Ľubietová, borehole P-8, 87—88 m. Upper Priabonian. 139/74 (100×).

Fig. 10 *Nodosaria* sp. (cf. *N. crassa* Hantken 1875), Ľubietová, borehole P-8, 60,5 metres. Upper Priabonian. 703/74 (150×).

Fig. 11 *Marginulina behmi* (Reuss), Ľubietová, borehole P-16, 16,5 m. Upper Priabonian. 3451/74 (50×).

Fig. 12 *Marginulina infracompressa* Krayeva et Zernicky, non Thalmann, Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 124/74 (100×).

Fig. 13a—b *Marginulina subbullata* Hantken, Ľubietová, borehole P-8, 87—88 metres. Upper Priabonian. 13a-571/74 (150×); 13b-569/74 (150×).

Plate LXXI

Fig. 1 *Globulina gibba punctata* Orbigny, Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. 3463/74 (150×).

Fig. 2—3 *Guttulina problema* Orbigny, Ľubietová, borehole P-8, 46—47 m. Upper Priabonian. 2-3054/74 (150×).

Fig. 4a—c *Globulina gibba gibba* Orbigny, Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. 4a-1072/74 (200×); 4b-1071/74 (500×); 4c-1070/74 (200×).

Fig. 5a—d *Globulina gibba gibba* Orbigny, Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 5a-700/74 (150×); 5b-701/74 (300×); 5c-598/74 (150×); 5d-599/74 (150×).

Fig. 6 *Glandulina radicula* (Linné), Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. 1040/74 (50×).

Fig. 7 *Glandulina aequalis* Reuss, Ľubietová, borehole P-4, 64—65 metres. Upper Priabonian. 3076/74 (150×).

Plate LXXII

Fig. 1 *Bulimina kasselensis* Batjes, Ľubietová, borehole P-8, 26,8 m. Upper Priabonian. 3421/74 (100×).

Fig. 2a—b *Bulimina* sp., Ľubietová, borehole P-8, 7—9 m. Upper Priabonian. 2a-156/74 (150×); 2b-158/74 (150×).

Fig. 3 *Buliminella elegantissima* (Orbigny), Ľubietová, borehole P-8, 64—65 m. Upper Priabonian. 585/74 (200×).

Fig. 4 *Bulimina parisiensis* Kaasschieter, Ľubietová, borehole P-8, 87—88 m. Upper Priabonian. 3064/74 (120×).

Fig. 5 *Buliminella bullina* Le Calvez, Ľubietová, borehole P-8, 87—88 m. Upper Priabonian. 3069/74 (120×).

Fig. 6a—b *Buliminella pulchra* (Terquem), Ľubietová, borehole P-8, 64—65 metres. Upper Priabonian. 6a-579/74 (150×); 6b-580/74 (500×).

Fig. 7a—c *Buliminella rara* Pischvanova, Ľubietová, borehole P-8, 26,8 m. Upper Priabonian. 7a-5453/73 (400×); 7b-5452/73 (200×); 5c-5451/73 (200×).

Fig. 8 *Buliminella rara* Pischvanova, Ľubietová, borehole P-8, 26,8 m. Upper Priabonian. 5387/73 (200×).

Plate LXXIII

Fig. 1 *Bolivina crenulata* Cushman, Ľubietová, borehole P-8, 18,5 m. Upper Priabonian. 104/74 (100×).

Fig. 2a—c *Bolivina crenulata* Cushman, Ľubietová, borehole P-8, 18,5 m. Upper Priabonian. 2a-101/74 (100×); 2b-106/74 (100×); 2c-107/74 (300×).

Fig. 3a—b *Bolivina budensis* (Hantken), Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 3a-5820/73 (100×); 3b-5822/73 (100×).

Fig. 4—5 *Bolivina beyrichi* Reuss, Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. 4-5697/73 (100×); 5-5724/73 (100×).

Fig. 6a—c *Bolivina budensis* (Hantken), Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 6a-5818/73 (300×); 6b-5823/73 (100×); 6c-5817 (600×).

Fig. 7 *Bolivina reticulata* Hantken, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 946/74 (100×).

Fig. 8a—b *Bolivina reticulata* Hantken, Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 8a-5796/73 (100×); 8b-5797/73 (200×).

Plate LXXIV

Fig. 1a—b *Bolivina* sp., Ľubietová, borehole P-4, 35 m. Upper Priabonian. 1a-5793/73 (100×); 1b-5794/73 (300×).

Fig. 2 *Bolivina* sp. (cf. *B. aenariensiformis* Mjatliuk) 1960, Ľubietová, borehole P-8, 26,8 m. Upper Priabonian. 3063/74 (120×).

Fig. 3 *Bolivina cookei* Cushman, Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 3438/74 (80×).

Fig. 4 *Bolivina nobilis* Hantken, Ľubietová, borehole P-16, 80,6. Upper Priabonian. 3471/74 (80×).

Fig. 5a—c *Bolivina nobilis* Hantken, Ľubietová, borehole P-16, 80,5 m. Upper Priabonian. 5a-3034/74 (50×); 5b-3031/74; 5c-3033/74 (160×).

Fig. 6 *Bolivina nobilis* Hantken, Ľubietová, borehole P-16, 80,5 m. Upper Priabonian. 3472/74 (80×).

Fig. 7a—c *Bolivinella rugosa* Howe, Ľubietová, borehole P-8, 7,5 m. Upper Priabonian. 7a-1030/74 (180×); 7b-1031/74 (180×); 7c-1032 (1500×).

Fig. 8 *Bolivinella rugosa* Howe, Ľubietová, borehole P-8, 7,5 m. Upper Priabonian. 1033/74 (100×).

Fig. 9 *Virgulina schreibersiana* Czjzek, Ľubietová, borehole P-16, 58,5 m. Upper Priabonian. 3058 (50×).

Fig. 10 *Sagrina aspera* (Terquem), Ľubietová, borehole P-16, 58,5 m. Upper Priabonian. 3473/74 (60×).

Plate LXXV

Fig. 1 *Bulimina punctatocostata* Cushman et Stone, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 1034/74 (100×).

Fig. 2a—b *Bulimina puctatocostata* Cushman et Stone, Ľubietová, borehole P-8, 99—100 m. Upper Priabonian. 2a-343/74 (100×); 1b-342/74 (1500×).

Fig. 3 *Bulimina ovata* Orbigny, Ľubietová, borehole P-8, 64—65 m. Upper Priabonian. 338/74 (100×).

Fig. 4 *Bulimina kasselensis* Batjes, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 3171/72 (150×).

Fig. 5 *Bulimina kasselensis* Batjes, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 982/74 (200×).

Fig. 6a—c *Bulimina aksuatica* Morozova, Ľubietová, borehole P-4, 32—35 m. Upper Priabonian. 6a-5405/73 (200×); 6b-5406/73 (1000×); 6c-5407/73 (1000×).

Fig. 7 *Bulimina aksuatica* Morozova, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 5397/73 (300×).

Fig. 8 *Bulimina aksuatica* Morozova, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 369/74 (300×).

Fig. 9 *Bulimina aksuatica* Morozova, Ľubietová, borehole P-4, 32—35 m. Upper Priabonian. 5395/73 (100×).

Plate LXXVI

Fig. 1a—c *Uvigerina pygmea* Orbigny, Ľubietová, borehole P-8, 9—10 m. Upper Priabonian. 1a-5707/73 (120×); 1b-5708/73 (600×); 1c-5709/73 (840×).

Fig. 2a—c *Uvigerina pygmea* Orbigny, Ľubietová, borehole P-8, 7,5 m. Upper Priabonian. 2a-5850/73 (120×); 2b-5852/73 (200×); 2c-5853/73 (840×).

Fig. 3a—c *Uvigerina costellata* Morozova, Ľubietová, borehole P-8, 26,8 m. Upper Priabonian. 3a-576/74 (120×); 2b-577/74 (600×); 2c-578/74 (840×).

Fig. 4a, 5 *Uvigerina hispida* Schwager, Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. 4a-5789/73 (840×); 5-5788/73 (120×).

Fig. 4b *Uvigerina hispida* Schwager, Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. 1989/72 (120×).

Plate LXXVII

Fig. 1a—b, 2 *Trifarina wilcoxensis* (Cushman et Ponton), Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. 1a-670/74 (120×); 1b-691/74 (840×); 2-672/74 (840×).

Fig. 3 *Angulogerina gracilis oligocenica* (Andreae), Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 670/74 (120×).

Fig. 4a—b *Angulogerina gracilis germanica* Cushman et Edwards, Ľubietová, borehole P-4, 39—40 m. Upper Priabonian. 4a-5422/73 (120×); 4b-5423/73 (600×).

Fig. 5 *Angulogerina muralis* (Terquem), Ľubietová, borehole P-4, 64—65 metres. Upper Priabonian. 3048/74 (160×).

Fig. 6 *Angulogerina muralis* (Terquem), Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 5424/73 (500×).

Fig. 7a—b *Angulogerina angulosa* (Wiliamson), Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 7a-3540 72 (160×); 7b-3541/72 (600×).

Fig. 8a—b *Siphogenerina elegans* (Hantken), Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 8a-960/74 (120×); 8b-963/74 (360×).

Plate LXXVIII

Fig. 1 *Cassidulina subglobosa* Brady, Ľubietová, borehole P-8, 7,5 m. Upper Priabonian. 5835/73 (200×).

Fig. 2a—b *Cassidulina subglobosa* Brady, Ľubietová, borehole P-8, 7,5 m. Upper Priabonian. 2a-5811/73 (200×); 2b-5836 73 (1000×).

Fig. 3a—b *Sphaeroidina austriaca* Orbigny, Ľubietová, borehole P-8, 7,5 m. Upper Priabonian. 3a-5408/73 (160×); 3b-5409/73 (500×).

Fig. 4a—b *Sphaeroidina bulloides* Orbigny, Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 4a-5362/73 (200×); 4b-5363/73 (1000×).

Fig. 5a—b *Pullenia bulloides* (Orbigny), Ľubietová, borehole P-4, 32—33 m. Upper Priabonian. 5a-351/74 (120×); 5b-352/74 (600×).

Fig. 6a—b *Pullenia quinqueloba* (Reuss), Ľubietová, borehole P-8, 64—65. Upper Priabonian. 6a-353/74 (120×); 6b-354/74 (1800×).

Fig. 7 *Pullenia quinqueloba* (Reuss), Ľubietová, borehole P-4, 7—8 m. Upper Priabonian. 3736 72 (120×).

Plate LXXIX

Fig. 1a—c *Nonion* aff. *pompiloides* (Fichtel et Moll), Ľubietová, borehole P-8, 7,5 m. Upper Priabonian. 1a-126/74 (120×); 1b-127/74 (160×); 7c-128 (120×).

Fig. 2a—b *Nonion affine* (Reuss), Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 2a-704/74 (120×); 2b-706/74 (160×).

Fig. 3a—b *Elphidium* sp. [cf. *E. laeve* (Orbigny 1826)]. Ľubietová, borehole P-8, 46,47 m. Upper Priabonian. 3a-3078 74 (120×); 3b-3079/74 (120×).

Fig. 4a—b *Elphidium* sp. Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 950/74 (120×); 4b-951/74 (120×).

Fig. 5 *Elphidium subcarinatum* (Egger), Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 3077/74 (160×).

Fig. 6a—b *Elphidium subcarinatum* (Egger), Ľubietová, borehole P-4, 39—40 metres. Upper Priabonian. 6a-3458/74 (120×); 6b-3710/72 (120×).

Plate LXXX

Fig. 1 *Elphidium inflatum* (Reuss), Ľubietová, borehole P-4, 7—8 m. Upper Priabonian. 3744/72 (100×).

Fig. 2 *Elphidium inflatum* (Reuss), Ľubietová, borehole P-4, 7—8 m. Upper Priabonian. 3699/72 (100×).

Fig. 3 *Elphidium inflatum* (Reuss), Ľubietová, borehole P-8, 8,6 m. Upper Priabonian. 3469 74 (100×).

Fig. 4a—b *Robulus* sp., Ľubietová, borehole P-8, 46—47 m. Upper Priabonian. 4a-3025 (70×); 4b-026 (150×).

Fig. 5 *Almaena cf. crenata* (Marie), Ľubietová, borehole P-8, 46—47 m. Upper Priabonian. 3425/74 (80×).

Fig. 6 *Caucasina coprolithoides* (Andreae), Ľubietová, borehole P-8, 64—65 m. Upper Priabonian. 363/74 (250×).

Fig. 7 *Caucasina coprolithoides* (Andreae), Ľubietová, borehole P-8, 64—65 m. Upper Priabonian. 5348/73 (400×).

Fig. 8 *Caucasina coprolithoides* (Andreae), Ľubietová, borehole P-8, 64—65 m. Upper Priabonian. 362/74 (350×).

Fig. 9 *Caucasina coprolithoides* (Andreae), Ľubietová, borehole P-8, 64—65 m. Upper Priabonian. 363/74 (150×).

Fig. 10 *Caucasina coprolithoides* (Andreae), Ľubietová, borehole P-8, 99—100 m. Upper Priabonian. 383/74 (220×).

Fig. 11a—b *Caucasina tenebricosa* Pischvanova, Ľubietová, borehole P-8, 99—100 metres. Upper Priabonian. 11a-3081/74 (120×); 11b-3082/74 (120×).

Plate LXXXI

Fig. 1 *Gyroidina girardana* (Reuss), Ľubietová, borehole P-8, 7,5 m. Upper Priabonian. 372/74 (100×).

Fig. 2 *Giroidina girardana* (Reuss), Ľubietová, borehole P-8, 7,5 m. Upper Priabonian. 371/74 (100×).

Fig. 3 *Gyroidina soldanii* Orbigny, Ľubietová, borehole P-4, 39—40 m. Upper Priabonian. 5718/74 (100×).

Fig. 4 *Gyroidina soldanii* Orbigny, Ľubietová, borehole P-4, 59,4 m. Upper Priabonian. 3559/74 (100×).

Fig. 5a—b *Epistomina cf. elegans* (Orbigny), Ľubietová, borehole P-4, 29—30 m. Upper Priabonian. 5a-150/74 (100×); 5b-151/74 (100×).

Fig. 6a—b *Alabamina perlata* (Andreae), Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 6a-1046/74 (300×); 6b-1045/74 (300×).

Fig. 7 *Alabamina oschmanni* Hagn, Ľubietová, borehole P-8, 7—8 m. Upper Priabonian. 114/74 (180×).

Fig. 9a—c *Ceratobulimina eximia* (Rzehak), Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 8a-1029/74 (80×); 8b-1027/74 (80×); 8c-1028/74 (360×).

Plate LXXXII

Fig. 1a—b *Discorbis discoides* (Orbigny), Ľubietová, borehole P-4, 112,7 m. Upper Priabonian. 1a-3067/74 (180×); 1b-3068/74 (180×).

Fig. 2a—c *Rosalina quadrata* (Terquem), Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 2a-3419/74 (200×); 2b-3043/74 (220×); 2c-136/74 (220×).

Fig. 3a—b *Rosalina douwillei* (Cushman), Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 3a-144/74 (150×); 3b-143 74 (180×).

Fig. 4a—b *Cancris subconicus* (Terquem), Ľubietová, borehole P-8, 64—65 m. Upper Priabonian. 4a-712/74 (150×); 4b-713/74 (150×).

Fig. 5a—b *Baggina parisiensis* (Orbigny), Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 5a-3404/74 (120×); 5b-3403/74 (120×).

Fig. 6a—b *Eponides polygonus* Le Calvez, Ľubietová, borehole P-8, 87—88 m. Upper Priabonian. 6a-3052/74 (100×); 6b-3053 (100×).

Plate LXXXIII

Fig. 1a—b *Eponides pygmeus* (Hantken), Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 1a-5800/73 (200×); 1b-5801/73 (1000×).

Fig. 2a—b *Eponides pygmeus* (Hantken), Ľubietová, borehole P-4, 39—40 m. Upper Priabonian. 2a-5806/73 (200×); 2b-5807/73 (1500×).

Fig. 3a—b *Eponides pygmeus* (Hantken), Ľubietová, borehole P-4, 39—40 m. Upper Priabonian. 3a-5805/73 (400×); 3b-5804/73 (200×).

Fig. 4 *Eponides pygmeus* (Hantken), Ľubietová, borehole P-4, 31—34 m. Upper Priabonian. 163/74 (200×).

Fig. 5 *Siphonina reticulata* (Czjzek), Ľubietová, borehole P-8, 7,5 m. (100×).

Fig. 6 *Siphonina reticalata* (Czjzek), Ľubietová, borehole P-4, 7—8 m. Upper Priabonian. 3712/72 (80×).

Fig. 7a—b *Siphonina lamarckana* Cushman, Ľubietová, borehole P-8, 64—65 metres. Upper Priabonian. 7a-5725/73 (100×); 7b-5726/73 (350×).

Fig. 8 *Planorbulina difformis* Roemer, Ľubietová, borehole P-8, 46—47 m. Upper Priabonian. 137/74 (150×).

Plate LXXXIV

Fig. 1a—c *Glabratella excavata* (Terquem), Ľubietová, borehole P-8, 26,8 m. Upper Priabonian. 1a-1069/74 (120×); 1b-1068/74 (120×); 1c-1066/74 (120×).

Fig. 2 *Glabratella diadematoides* (Le Calvez), Ľubietová, borehole P-8, 86 m. Upper Priabonian. 3535/72 (120×).

Fig. 3 *Glabratella diadematoides* (Le Calvez), Ľubietová, borehole P-8, 26,8 m. Upper Priabonian. 5694/74 (120×).

Fig. 4 *Glabratella diadematoides* (Le Calvez), Ľubietová, borehole P-4, 64—65 metres. Upper Priabonian. 1064/74 (120×).

Fig. 5 *Glabratella turbinata* (Terquem), Ľubietová, borehole P-8, 18,5 m. Upper Priabonian. 590/74 (150×).

Fig. 6a—b *Glabratella turbinata* (Terquem), Ľubietová, borehole P-8, 18,5 m. Upper Priabonian. 6a-588/74 (150×); 6b-591/74 (150×).

Fig. 7a—b *Glabratella turbinata* (Terquem), Ľubietová, borehole P-8, 18,5 m. Upper Priabonian. 7a-587/74 (150×); 7b-589/74 (600×).

Fig. 8 ?*Pijpersia coronaeformis* (Pijpers), Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 357/74 (120×).

Plate LXXXV

Fig. 1a—c *Glabratella herouvalensis* (Le Calvez), Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 1a-3465/74 (180×); 1b-3466/74 (550×); 1c-3467/74 (180×).

Fig. 2a—d *Glabratella ubiqua* (Le Calvez), Ľubietová, borehole P-8, 26,8 m. Upper Priabonian. 2a-3428/74 (150×); 2b-3427/74 (150×); 2c-3429 (150×); 2d-3430/74 (150×).

Fig. 3a—c, 4 *Glabratella hronica* nov. sp., Ľubietová, borehole P-8, 26,8 m. Upper Priabonian, 3a-3411/75 (150×); 3b-3415/74 (150×); 3c-3414/74 (130×) — holotype, 4-3413/74 (150×) — paratype.

Fig. 5a—b Intermediate form between *Glabratella diadematoides* (Le Calvez) and *Glabratella hronica* nov. sp., Ľubietová, borehole P-8, 26,8 m. Upper Priabonian. 4a-3456/74 (150×); 4b-3457/74 (150×).

Plate LXXXVI

Fig. 1a—c *Neocorbina* sp., Ľubietová, borehole P-8, 9—10 m. Upper Priabonian. 1a-596/74 (200×); 1b-597/74 (4000×); 1c-595/74 (4000×).

Fig. 2 *Cibicides lopjanicus* Mjatliuk, Ľubietová, borehole P-8, 8,6 m. Upper Priabonian. 3189/72 (120×).

Fig. 3a—b *Cibicides lopjanicus* Mjatliuk, Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 3a-360/74 (120×); 3b-361/74 (500×).

Fig. 4 *Cibicides westi* Howe, Ľubietová, borehole P-8, 26,8 m. Upper Priabonian. 3448/74 (160×).

Fig. 5a—b *Cibicides lobatulus* (Walker et Jacob), Ľubietová, borehole P-8, 87—88 metres. Upper Priabonian. 5a-5681/73 (130×); 5b-5680/73 (130×).

Fig. 6a—b *Cibicides carinatus* (Terquem), Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 6a-147/74 (150×); 6b-148/74 (150×).

Fig. 7a—b *Pseudogloborotalia* nov. sp., Ľubietová, borehole P-8, 26,8 m. Upper Priabonian. 7a-3443/74 (150×); 7b-3416/74 (150×).

Plate LXXXVII

Fig. 1 *Planulina ungeriana* (Orbigny), Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. 5848/73 (100×).

Fig. 2a—b *Planulina ungeriana* (Orbigny), Ľubietová, borehole P-8, 7,5 m. Upper Priabonian. 2a-5403/73 (100×); 2b-5402/73 (100×).

Fig. 3 *Planulina ungeriana* (Orbigny), Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 5790/73 (100×).

Fig. 4a—c *Planulina ambiqua* (Franzenau), Ľubietová, borehole P-8, 7,5 m. Upper Priabonian. 4a-119/74 (120×); 4b-121/74 (120×); 4c-122/74 (260×).

Fig. 5a—b *Planulina cf. burlingtonensis tendami* Kaasschieter, Ľubietová, borehole P-8, 7,5 m. Upper Priabonian. 5a-3407/74 (100×); 5b-3405/74 (100×).

Fig. 6 *Planulina pseudoungerianus* (Cushman), Ľubietová, borehole P-4, 39—40 m. Upper Priabonian. 3444/74 (100×).

Fig. 7a—b *Cibicides cf. pseudoungerianus* (Cushman), Ľubietová, borehole P-4, 39—40 m. Upper Priabonian. 7a-3434/74 (80×); 7b-3435/74 (80×).

Fig. 8a—b *Cibicides cf. pseudoungerianus* (Cushman), Ľubietová, borehole P-8, 7,5 m. Upper Priabonian. 8a-3436/74 (80×); 8b-3440/74 (70×).

Plate LXXXVIII

Fig. 1a—b *Globigerina angioporoides* Hornibrook, Ľubietová, borehole P-4, 51—52 metres. Upper Priabonian. 1a-1058/74 (120×); 1b-1060/74 (140×).

Fig. 2 *Globigerina angioporoides* Hornibrook, Ľubietová, borehole P-4, 33—34 metres. Upper Priabonian. 3155/72 (120×).

Fig. 3a—c *Globigerina angioporoides* Hornibrook, Ľubietová, borehole P-4, 51—52 metres. Upper Priabonian. 3a-3150/72 (120×); 3b-3151/72 (120×); 3c-3152/72 (360×).

Fig. 4 *Globigerina linaperta* Finlay, Ľubietová, borehole P-8, 9—10 m. Upper Priabonian. 389/74 (120×).

Fig. 5a—b *Globigerina linaperta* Finlay, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 5a-3158/72 (120×); 5b-3159/72 (400×).

Fig. 6 *Globigerina senilis* Bandy, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 979/74 (120×).

Fig. 7a—b *Globigerina senilis* Bandy, Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 7a-3561/72 (100×); 7b-3562/72 (220×).

Plate LXXXIX

Fig. 1a—b *Globigerina galavisi* Bermúdez, Ľubietová, borehole P-8, 9—10 m. Upper Priabonian. 1a-5730/73 (120×); 1b-5731/74 (300×).

Fig. 2 *Globigerina galavisi* Bermúdez, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 969/74 (120×).

Fig. 3a—b *Globigerina corpulenta* Subbotina, Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. 3a-5838/73 (120×); 3b-5839/73 (320×).

Fig. 4 *Globigerina* sp., Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 95/74 (150×).

Fig. 5a—b *Globigerina tripartita* Koch, Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 5a-1073/74 (100×); 5b-1075/74 (200×).

Fig. 6 *Globigerina tripartita* Koch, Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. 1088/74 (100×).

Fig. 7 *Globigerina pseudovenezuelana* Blow et Banner, Ľubietová, borehole P-4, 29—30 m. Upper Priabonian. 1086/74 (120×).

Fig. 8 *Globigerina* aff. *ampliapertura* Bolli, Ľubietová, borehole P-4, 29—30 m. Upper Priabonian. 1087/74 (120×).

Fig. 9 *Globigerinita dissimilis* (Cushman et Bermúdez), Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 5364/73 (100×).

Plate XC

Fig. 1 *Globigerina gnaucki* Blow et Banner, Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 5317/73 (120×).

Fig. 2 *Globigerina gnaucki* Blow et Banner, Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 378/74 (120×).

Fig. 3 *Globigerina gnaucki* Blow et Banner, Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 393/74 (120×).

Fig. 4 *Globigerina gnaucki* Blow et Banner, Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 2004/72 (120×).

Fig. 5 *Globigerina gnaucki* Blow et Banner, Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 375/74 (120×).

Fig. 6 *Globigerina gnaucki* Blow et Banner, Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. 380/74 (120×).

Fig. 7 *Globigerina ouachitaensis* Howe et Wallace, Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 394/74 (120×).

Fig. 8a—b *Globigerina ouachitaensis* Howe et Wallace, Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 8a-5319/74 (120×); 8b-5321/74 (260×).
Fig. 9 *Globigerina turcmenica* Chalilov, Ľubietová, borehole P-8, 81—82 m. Upper Priabonian. 113/74 (120×).
Fig. 10a—b *Globigerina turcmenica* Chalilov, Ľubietová, borehole P-8, 81—82 m. Upper Priabonian. 10a-108/74 (120×); 10b-112/74 (120×).

Plate XCI

Fig. 1a—c *Globigerina praebulloides occlusa* Blow et Banner, Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 1a-5840/73 (120×); 1b-5841/73 (120×); 1c-5842 (240×).
Fig. 2 *Globigerina praebulloides praebulloides* Blow, Ľubietová, borehole P-4, Upper Priabonian. 5844/70 (120×).
Fig. 3 *Globigerina praebulloides praebulloides* Blow, Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 5771/73 (120×).
Fig. 4 *Globigerina praebulloides praebulloides* Blow, Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 5416/74 (140×).
Fig. 5 *Globigerina praebulloides leroy* Blow et Banner, Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 5685/73 (120×).
Fig. 6a—b *Globigerina praebulloides leroy* Blow et Banner, Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 6a-5688/73 (120×); 6b-5689/73 (360×).
Fig. 7a—b *Globigerina praebulloides leroy* Blow et Banner, Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 7a-5684/73 (120×); 7b-5781/73 (600×).
Fig. 8 *Globigerina praebulloides leroy* Blow et Banner, Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 5682/73 (120×).

Plate XCII

Fig. 1a—b *Globigerina officinalis* Subbotina, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 1a-965/74 (120×); 1b-966/74 (380×).
Fig. 2a—b *Globigerina officinalis* Subbotina, Ľubietová, borehole P-4, 32—33 m. Upper Priabonian. 3a-1993/72 (180×); 2b-1994/72 (720×).
Fig. 3 *Globigerina officinalis* Subbotina, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 964/74 (160×).
Fig. 4 *Globigerina officinalis* Subbotina, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 985/74 (140×).
Fig. 5a—c *Globigerina danvillensis* Howe et Wallace, Ľubietová, borehole P-8, 46—47 m. Upper Priabonian. 5a-91/74 (150×); 5b-94/74 (150×); 5c-95 74 (150×).
Fig. 6a—b, 7 *Globigerina liverowskae* (Bykova), Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 6a-130/74 (250×); 6b-133/74 (250×); 6c-153/74 (150×).

Plate XCIII

Fig.1 *Turborotalia (T.)* ex gr. *cerroazulensis* (Cole), Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. 395/74 (150×).
Fig. 2a—b *Turborotalia (T.)* ex gr. *cerroazulensis* (Cole), Ľubietová, borehole P-4, 98,3 m. Upper Priabonian. 2a-5379/73 (150×); 2b-5380/73 (450×).
Fig. 3 *Globorotaloides suteri* Bolli, Ľubietová, borehole P-8, 20—21 m. Upper Priabonian, 5352/73 (150×).
Fig. 4 *Globorotaloides suteri* Bolli, Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 947/74 (180×).
Fig. 5 *Globorotaloides suteri* Bolli, Ľubietová, borehole P-4, 51—52 m. 943/74 (180×).
Fig. 6 *Globanomalina micra* (Cole), Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 5446/74 (200×).
Fig. 7a—b *Globanomalina micra* (Cole), Ľubietová, borehole P-4, 51—52 m. Upper Priabonian. 7a-5374/74 (200×); 7b-5375/74 (600×).
Fig. 8a—c *Chiloguembelina gracillima* (Andreae), Ľubietová, borehole P-4, 35—36 metres. Upper Priabonian. 8a-5814 73 (600×); 8b-5812/73 (200×); 8c-5813/73 (1500×).

Plate XCIV

Fig. 1a—c *Globigerina eocaena compacta* Subbotina, Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. No 10471 — 70×.
Fig. 2a—c *Globigerina pseudovenezuelana* Blow et Banner, Ľubietová, borehole P-4, 32—33 m. Upper Priabonian. No — 70×.

Fig. 3a—c *Globigerina tripartita* Koch, Ľubietová, borehole P-4, 9—10 m. Upper Priabonian. No 10480 — 70X.

Fig. 4a—c *Globigerina galavisi* Bermúdez, Ľubietová, borehole P-4, 59,4 m. Upper Priabonian. No 10468 — 70X.

Plate XCV

Fig. 1a—c *Globigerina prasaepis* Blow, Ľubietová, borehole P-4, 64—65 m. Upper Priabonian. No 10476 — 70X.

Fig. 2a—b *Globigerina prasaepis* Blow, Ľubietová, borehole P-8, 9—10 m. Upper Priabonian. No 10478 — 70X.

Fig. 3a—c *Globigerina senilis* Bandy, Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. No 105LL — 70X.

Fig. 4a—c *Globigerina* aff. *tapurensis* Blow et Banner, Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. No 10484 — 70X.

Fig. 5a—c *Globigerina* aff. *tapurensis* Blow et Banner, Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. No 10766 — 70X.

Plate XCVI

Fig. 1a—c *Globigerina praebulloides praebulloides* Blow, Ľubietová, borehole P-4, 29—30 m. Upper Priabonian. No 10495 — 70X.

Fig. 2a—c *Globigerina praebulloides occlusa* Blow et Banner, Ľubietová, borehole P-8, 46—47 m. Upper Priabonian. No 10496 — 70X.

Fig. 3a—c *Globigerina praebulloides leroyi* Blow et Banner, Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. No 10497 — 70X.

Fig. 4a—c *Globigerina turcmenica* Chalilov, Ľubietová, borehole P-8, 81—82 metres. Upper Priabonian. No 10493 — 70X.

Fig. 5a—b *Globigerina variabiliformis* Chalilov, Ľubietová, borehole P-8, 60,5 m. Upper Priabonian. No 10762 — 70X.

Fig. 6a—b *Globigerina officinalis* Subbotina, Ľubietová, borehole P-4, 51—54 m. Upper Priabonian. No 10518 — 70X.

Fig. 7a—c *Globigerina pseudoampliapertura* Blow et Banner, Ľubietová, borehole P-4, 29—30 m. Upper Priabonian. No 10760 — 70X.

Plate XCVII

Fig. 1a—c *Globigerina danvillensis* Howe et Wallace, Ľubietová, borehole P-4, 39—40. Upper Priabonian. No 10515 — 70X.

Fig. 2a—c *Globigerina danvillensis* Howe et Wallace, Ľubietová, borehole P-8, 31—32 m. Upper Priabonian. No 10514 — 70X.

Fig. 3a—c *Globigerina postcretacea* Mjatliuk, Ľubietová, borehole P-8, 31—32 m. Upper Priabonian. No 10517 — 70X.

Fig. 4a—c *Globigerina postcretacea* Mjatliuk, Ľubietová, borehole P-4, 39—40 m. Upper Priabonian. No 10761 — 70X.

Fig. 5a—b *Globigerina variabiliformis* Chalilov, Ľubietová, borehole P-8, 60,5 m. Upper Priabonian. No 10762 — 70X.

Fig. 6a—c *Globigerina liverovskae* (Bykova), Ľubietová, borehole P-8, 9—10 metres. Upper Priabonian. No 10763 — 70X.

Fig. 7a—c *Globigerina liverovskae* (Bykova), Ľubietová, borehole P-4, 39—40 m. Upper Priabonian. No 10764 — 70X.

Fig. 8a—b *Globigerina ouachitaensis* Howe et Wallace, Ľubietová, borehole P-4, 35—36 m. Upper Priabonian. No 10458 — 70X.

Fig. 9a—b Intermediate form between *Globigerina ouachitaensis* Howe et Wallace and *Globigerina gortanii* (Borsetti), Ľubietová, borehole P-4, 29—30 m. Upper Priabonian. No 10486 — 70X.

Fig. 10a—b *Globigerina gortanii* (Borsetti), Ľubietová, borehole P-4, 29—30 metres. Upper Priabonian. No 10487 — 70X.

Fig. 11a—c *Globigerina angustiumbilicata* Bolli, Ľubietová, borehole P-4, 33—34 m. Upper Priabonian. No 10505 — 70X.

Fig. 12a—b *Globigerina* sp. [*G. gortanii* (Borsetti)], Ľubietová, borehole P-4, 59,5 m. Upper Priabonian. No 10491 — 70X.

Plate XCVIII

Fig. 1a—c *Globigerina ampliapertura* Bolli, Ľubietová, borehole P-4, 51—54 m. Upper Priabonian. No 10479 — 70X.

Fig. 2a—c *Globigerina gnaucki* Blow et Banner, Ľubietová, borehole P-8, 81—82 m. Upper Priabonian. No 10502 — 70×.
Fig. 3a—c *Turborotalia (T.)* cf. *increbescens* (Bandy), Ľubietová, borehole P-4, 59,5 metres. Upper Priabonian. No 10765 — 70×.
Fig. 4a—c *Globigerina opima nana* (Bolli), Ľubietová, borehole P-8, 71—72 m. Upper Priabonian. No 10450 — 70×.
Fig. 5a—b *Turborotalia (T.)* ex gr. *cerroazulensis* (Cole), Ľubietová, borehole P-4, 35—36 m. Opper Priabonian. No 10560 — 70×.
Fig. 6a—b *Turborotalia (T.) centralis* (Cushman et Bermúdez), Ľubietová, borehole P-4, 98,3 m. Upper Priabonian. No 10558 — 70×.

Ondrej Samuel

Vrchnopriabónske foraminifery z okolia Ľubietovej

Resumé anglického textu

Relikty centrálnokarpatského paleogénneho sedimentačného cyklu (vrchný lutét — — spodný oligocén) boli v horehronskej intramontánnej depresii známe už D. Štúrovi (1966, 1968; fide 1960 — slov. preklad). Ďalšie veľmi stručné údaje sa objavujú prakticky až o sto rokov, väčšinou v súvise s výskumom mladších miocénnych a pliocénnych útvarov (viď. lit.). Geologický výskum v tejto oblasti robili v predchádzajúcich rokoch J. Lozert — M. Náprstek (1957), L. Horák — B. Pacltová (1963), I. Jaroš et al. (1966). Na základe najmä stratigrafických výskumov I Cichu a B. Pacltovej (viď lit.) vymedzili okrem centrálnokarpatského sedimentačného cyklu ďalší morský chat-akvitánský sedimentačný cyklus. Súčasne v tejto oblasti pracoval kolektív pracovníkov z Geologického ústavu Dionýza Štúra (M. Pulec, E. Planderová, M. Vaňová, O. Samuel, viď lit.), ktorý dospel v súvise s morským chat-akvitánskym sedimentačným cyklom k odlišným záverom ako vyššie spomínaní autori. Autor v predloženej práci opisuje mikrofaunu zo slienito-ílovcovej litofácie, ktorá bola zachytená vrtmi P-4 a P-8 v blízkosti Ľubietovej, odkiaľ I. Cicha (1960) opísal akvitánske sedimenty. Na základe mikrobiostratigrafickej analýzy z vyššie uvedených vrtov možno konštatovať:

1. Foraminifery z vrtov P-4 a P-8 (okolie Ľubietovej) poukazujú na to, že slienito-ílovcová litofácia v horehronskej intramontánnej depresii zodpovedá vrchnej časti karpatskej zóny *Globigerina officinalis*, ktorú dávame do vzťahu s najvyšším priabónom. V prospech tohto názoru hovoria aj veľké foraminifery, ktoré prestavujú ve vývojovom rade *Nummulites fabianii* (Prever) → *N. fichteli Michelotti* prechodné medzi uvedenými druhmi; z nich prvý je charakteristický pre priabón, kým druhý už pre spodný oligocén.

2. Do spodného oligocénu v horehronskej intramontánnej depresii patrí najvyššia časť morských sedimentov, preukázaná vo vrchnej časti vrtu P-16 (Polomka), brakické sedimenty vystupujúce na povrch pri JRD Polomky (s *Ammonia propinqua*) a sladkovodné sedimenty odkryté v lome pri železnici v Brezne (porov. E. Planderová 1973).

3. »Chat-akvitánske« sedimenty v Ľubietovej, o ktorých sa zmieňuje I. Cicha (1960) neboli v tejto oblasti potvrdené. Podobne neboli doteraz potvrdené sedimenty tohto veku ani z okolia Banskej Bystrice. Vrt P-3 bol situovaný do súvrstvia, ktoré L. Horák — B. Pacltová (1963; str. 125, obr. 1) vymedzili ako chat-akvitán. Prevŕtal celý komplex vrstiev až do podložia (porov. E. Planderová — M. Pulec — O. Samuel). V spodnej časti vrtu na mezozoickom substráte (150,5—137 m) sú vyvinuté arkózovité a vápnité pieskovce s vrchnopriabónskou faunou veľkých foraminifér (115 m: N. *striatus* (Bruguière), N. *striatus minor* (Archiac et Haim. N. *striatus pannonicus* (Rozlozsnik), N. *incrasatus incrasatus* Harpe — fide M Vaňová, 1972). Smerom do nadložia začína pribúdať pelitická zložka, ktorá sa rytmicky strieda

s lavicami pieskovcov, čím súvrstvie od strednej časti vrtu (od 95 m) nadobúda charakter netypického flyšu. Z uvedeného vyplýva, že súvrstvie aj po litofaciálnej stránke má všetky znaky centrálnokarpatského paleogénu, vyvinutého hlavne v južných častiach vnútorných Západných Karpát.

4. Pri analýze foraminifér neboli pozorované stopy po redeponácii, ani staršie vrchnolutétske, resp. spodnopriabónske formy, s ktorými by sme sa museli zákonite stretnúť, ak by sme pripustili, že ide o preplavené asociácie z centrálnokarpatského paleogénu (vrchný lutét — spodný oligocén) do tzv. chat-akvitánskeho sedimentačného cyklu.

5. Zo stratigrafickej paralelizácie vyplýva, že karpatská zóna *Globigerina officinalis* má najviac spoločných znakov z H. M. Bolliho (1957b) zónou *Globorotalia cerroazulensis* (alebo s jej ekvivalentnou zónou *Globigerina gortanii*), ktorá sa viac-menej kryje s W. H. Blowovou (1969) zónou P-16 a P-17. Vychádzajúc z výsledkov vrtov P-4 a P-8 môžeme konštatovať, že Blowova zóna P-17 sa kryje iba s vrchnou časťou našej zóny *Globigerina officinalis* a s najnižšou časťou zóny *Globigerina postcretacea*. Podľa týchto kritérií hranica medzi vrchným eocénom (priabónom) a spodným oligocénom by u nás prebiehala v najspodnejšej časti zóny *G. postcretacea*. Pravda, vzťah planktonických zón k medzinárodnej chronostratigrafickej škále, ako aj vlastné postavenie doteraz opísaných oligocénnych stratotypov nie sú stále tak objasnené, aby nám nespôsobili pri interregionálnej stratigrafickej korelácii určité ťažkosti.

ZÁPADNÉ KARPATY

séria paleontológia 1

Vydal Geologický ústav Dionýza Štúra vo Vede, vydavateľstve Slovenskej akadémie vied, v Bratislave roku 1975.

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Zodpovedná redaktorka: Irena Bročková.
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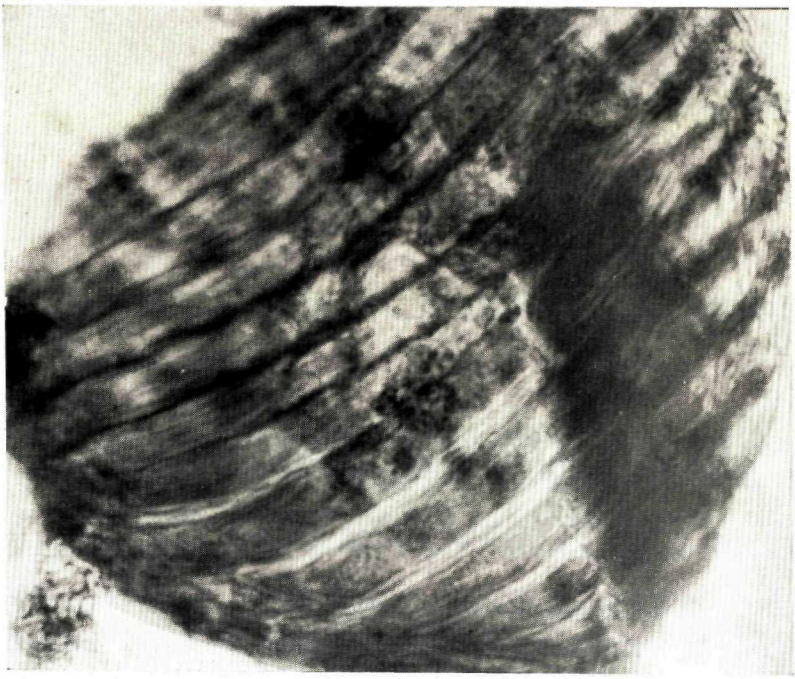
Cena brož. výtl. Kčs 36,—.

PLATES I — CIV



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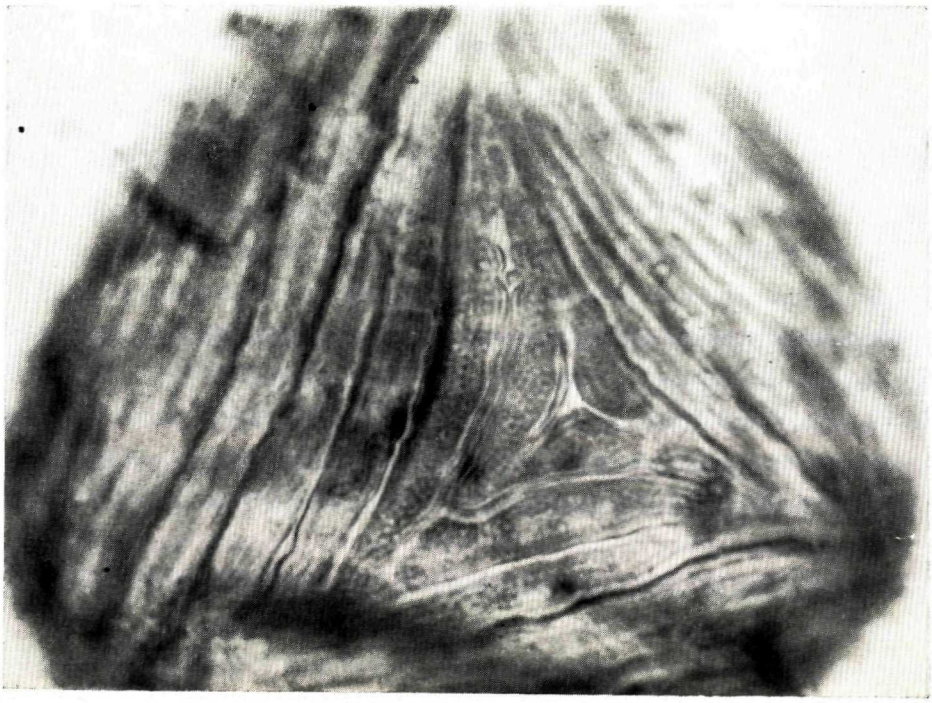

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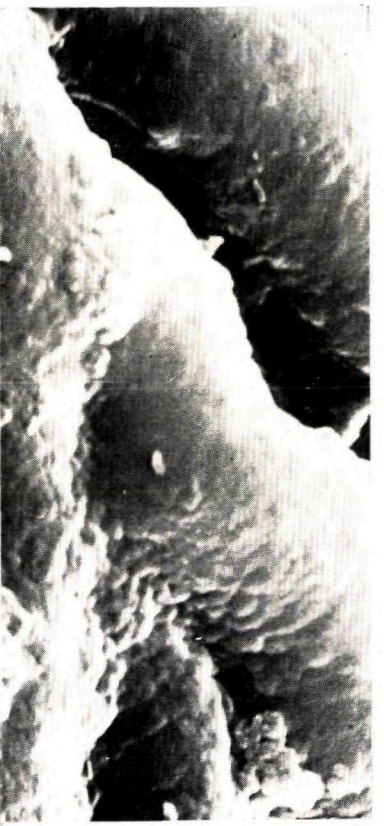

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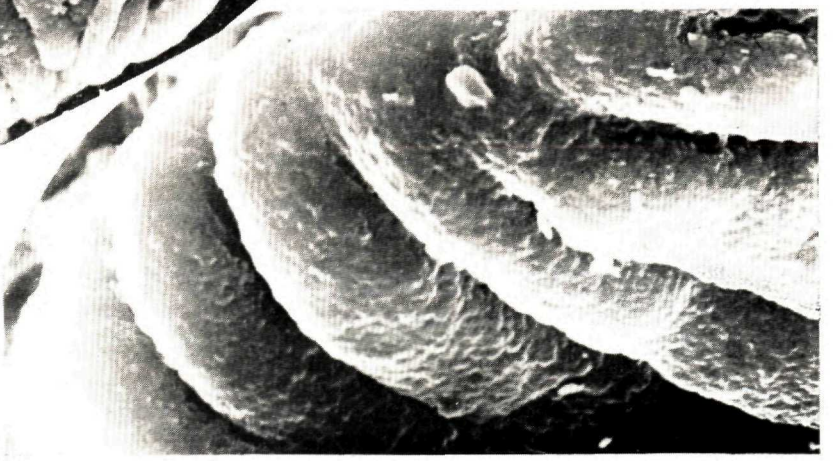

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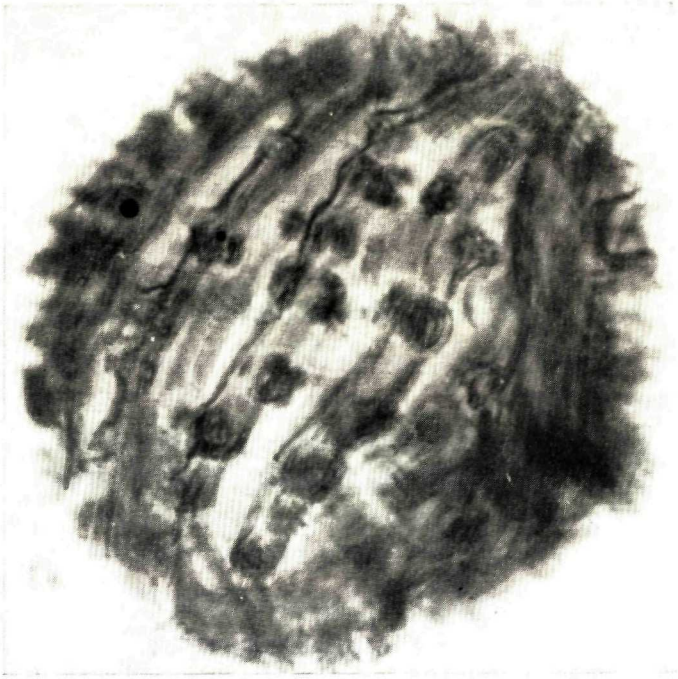

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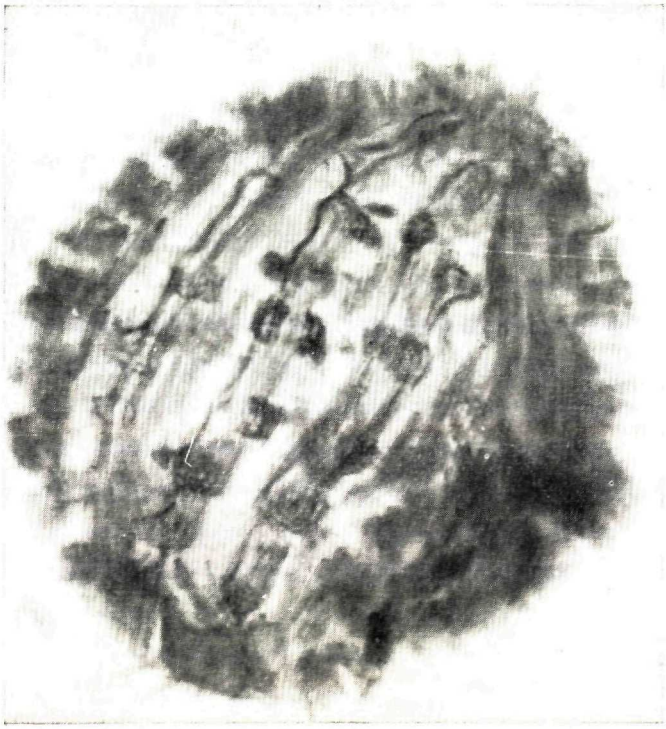

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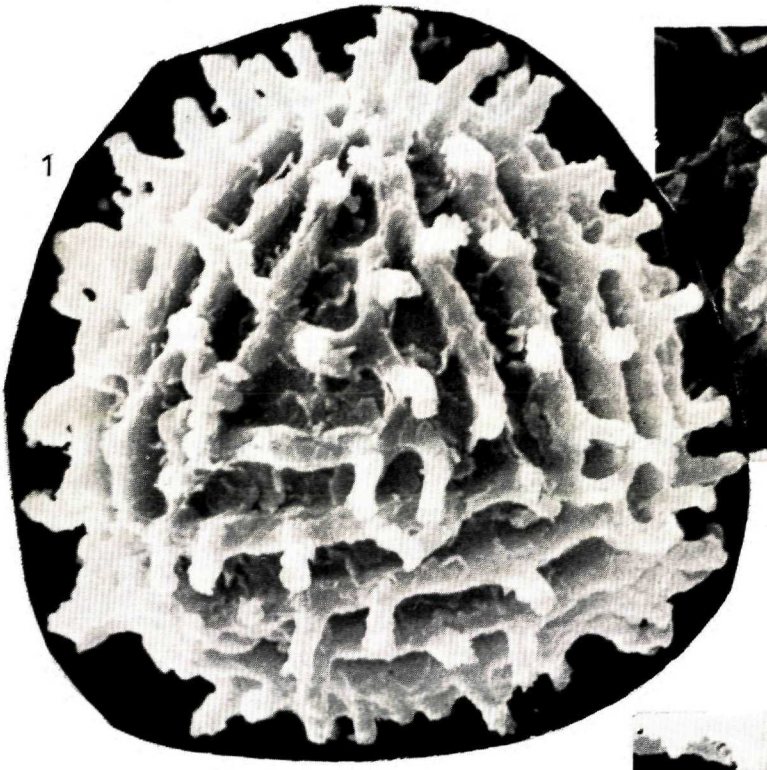
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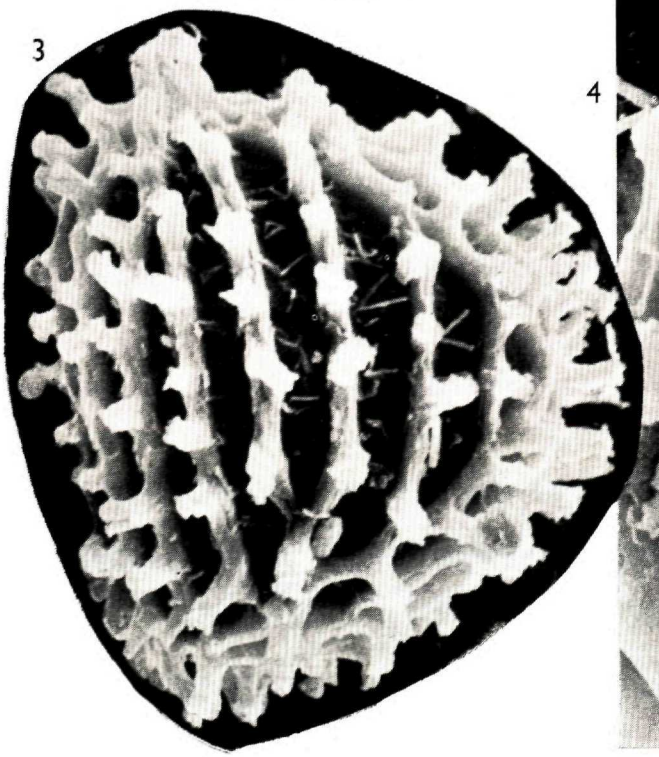
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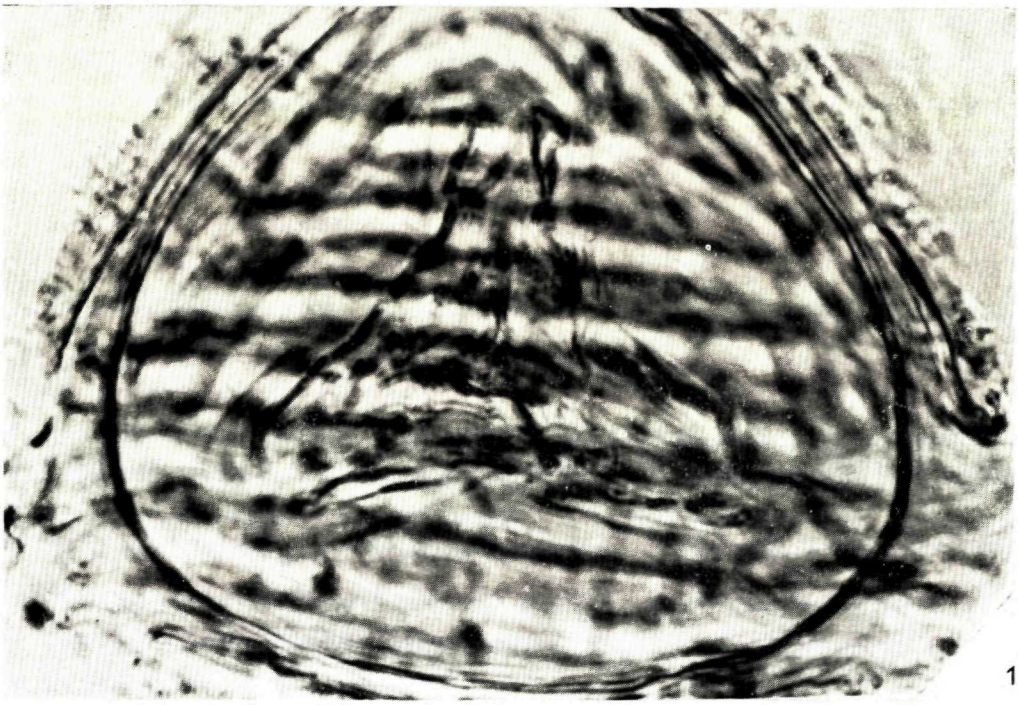

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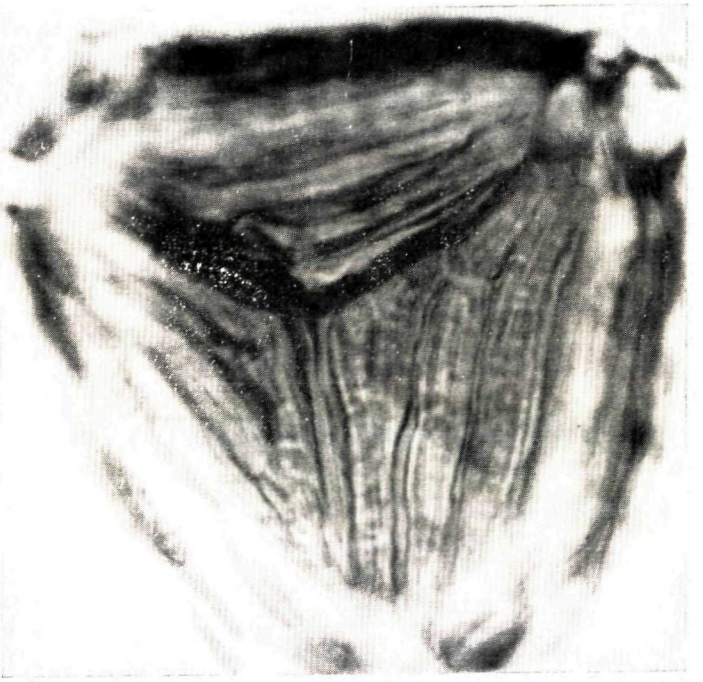

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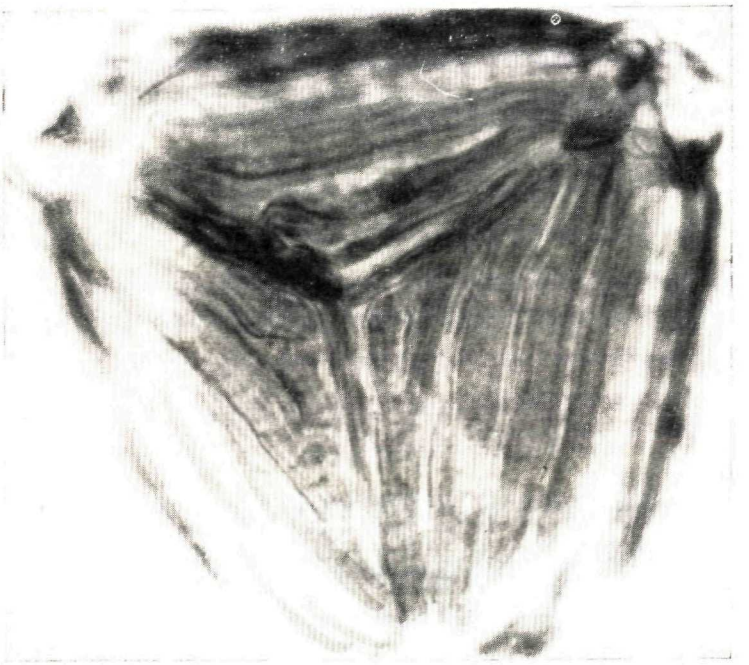

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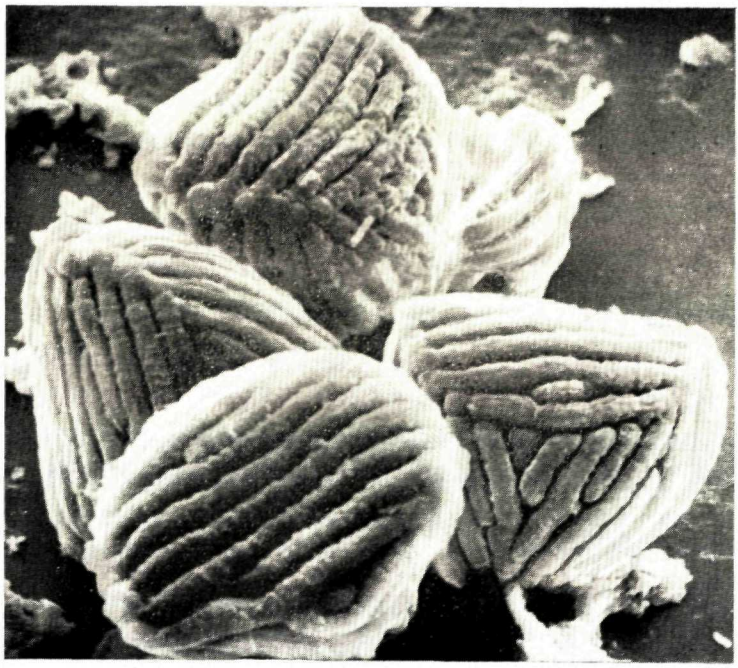

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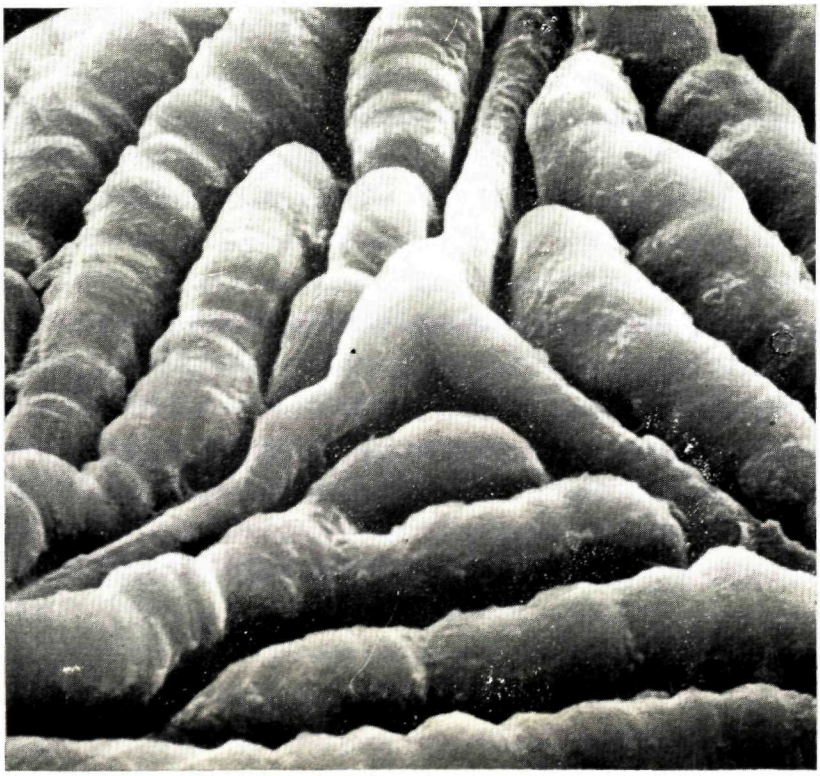

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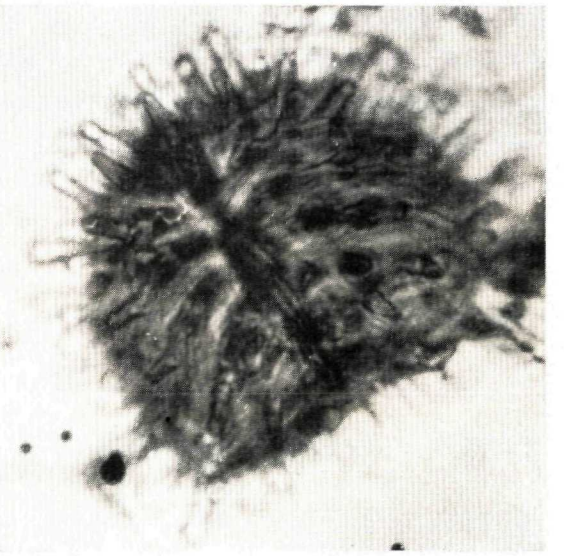

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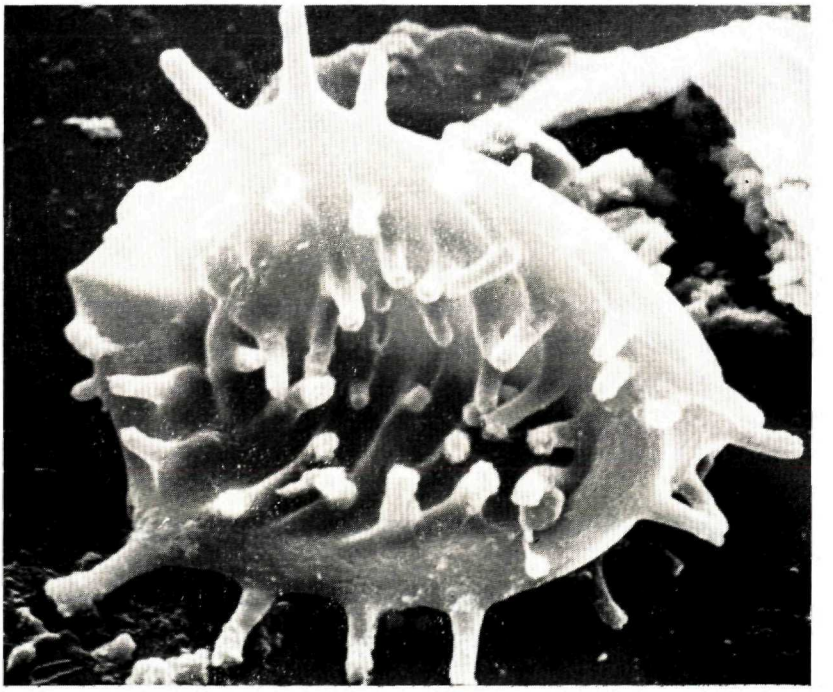

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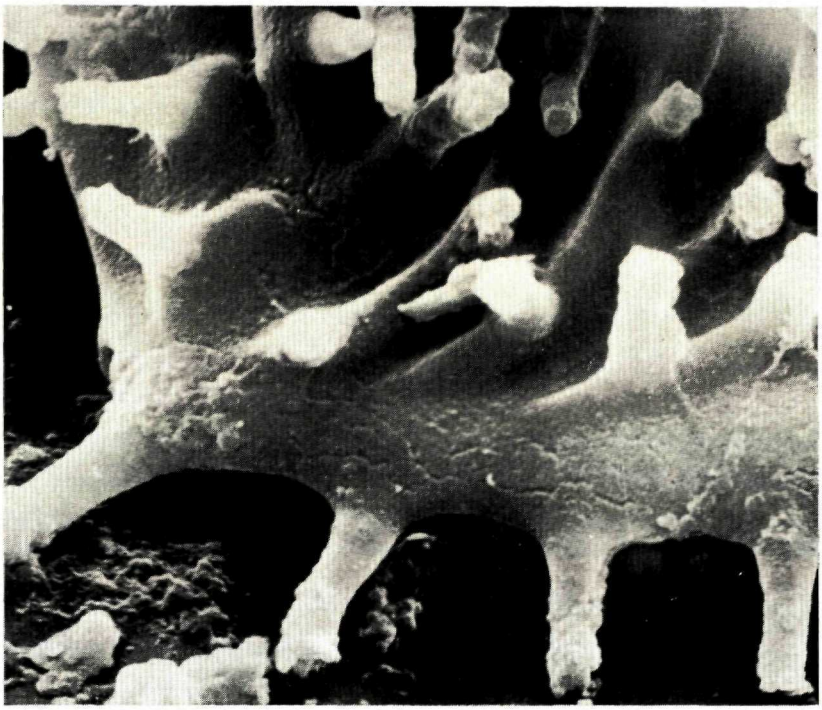

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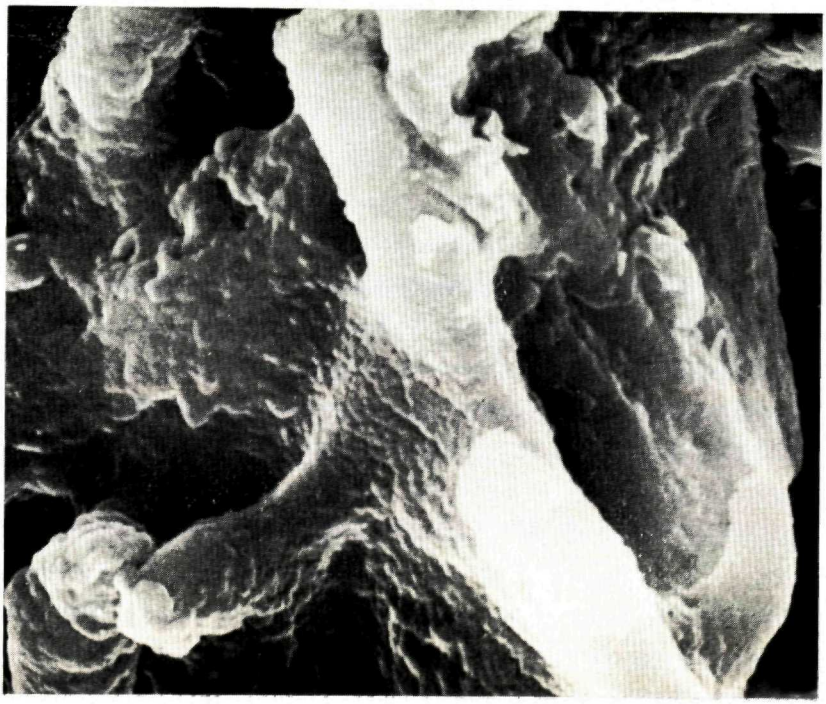

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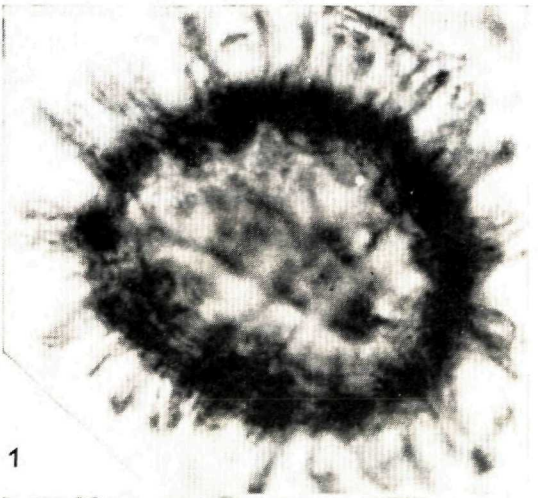

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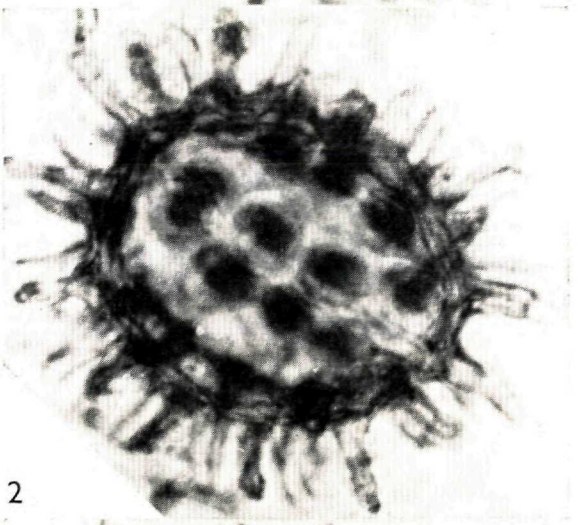

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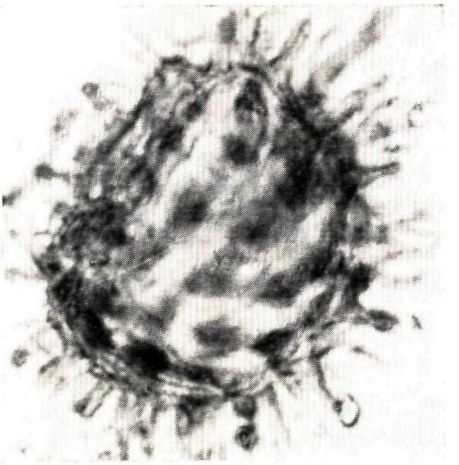

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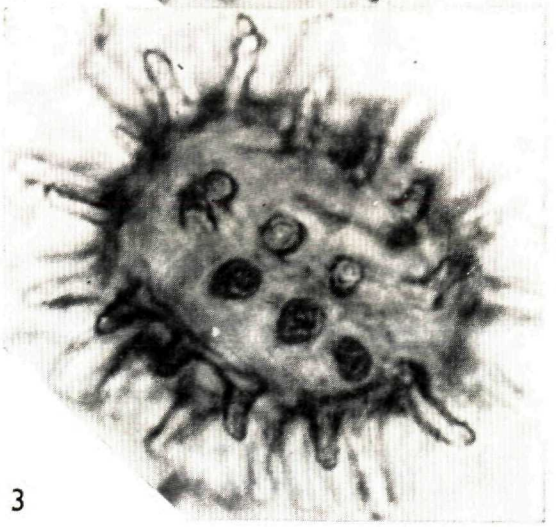

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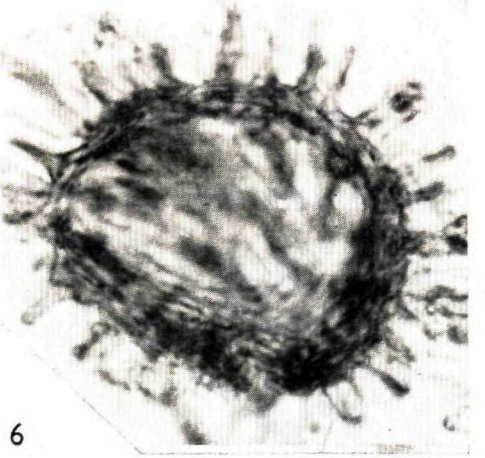

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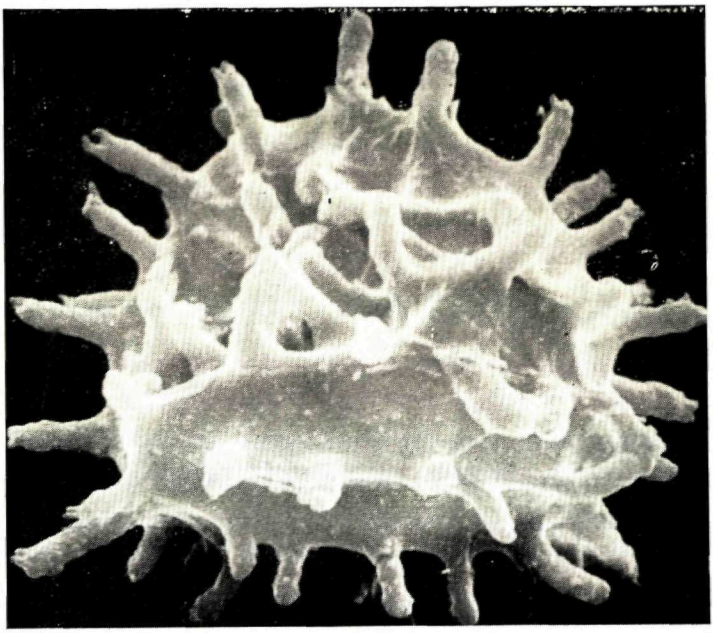

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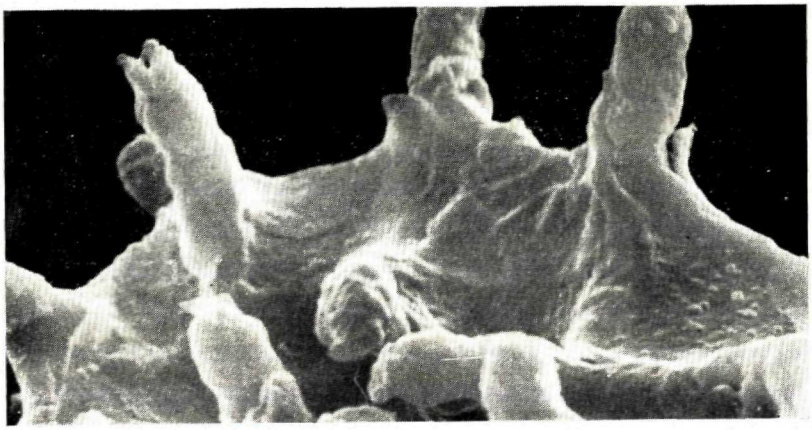

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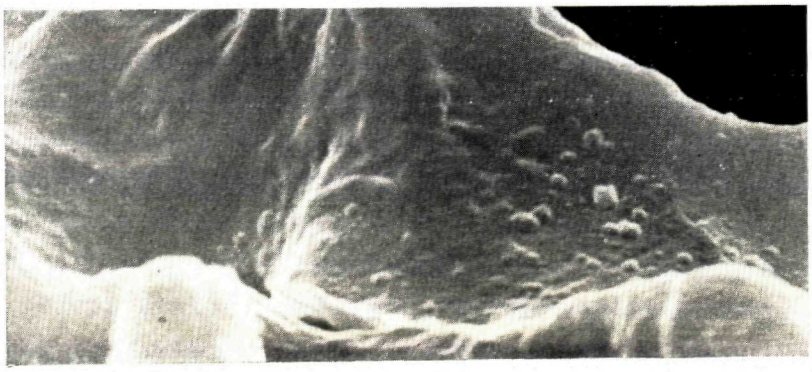

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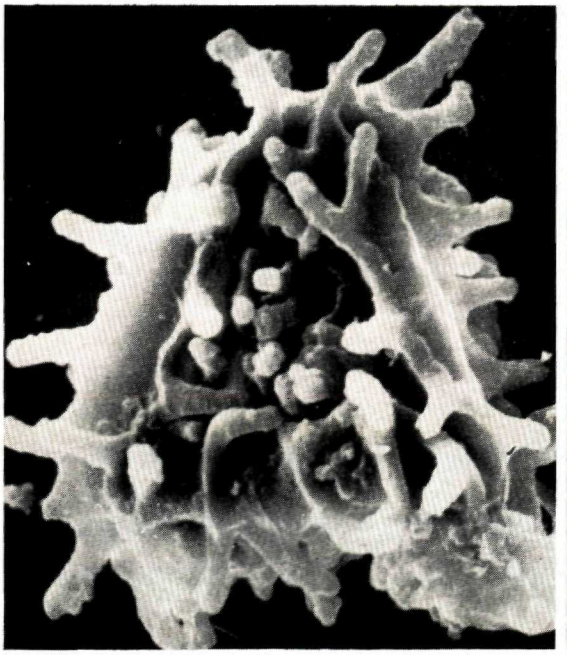

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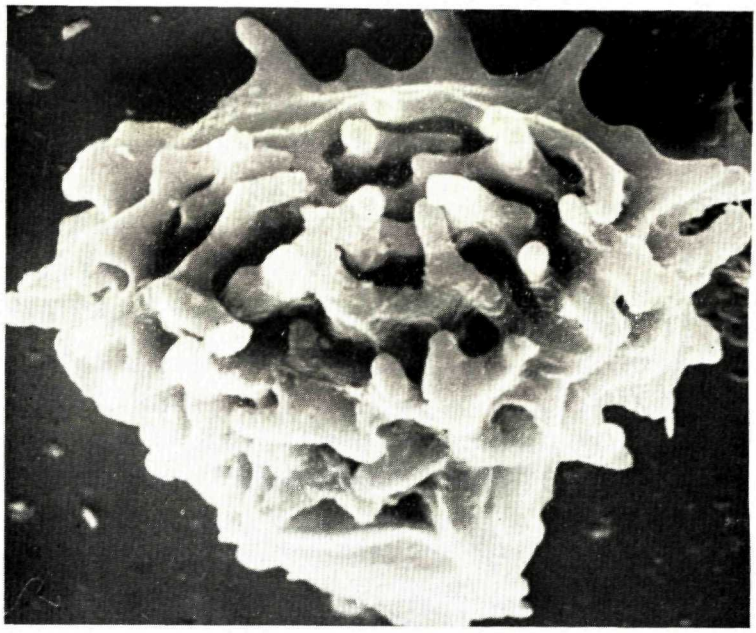

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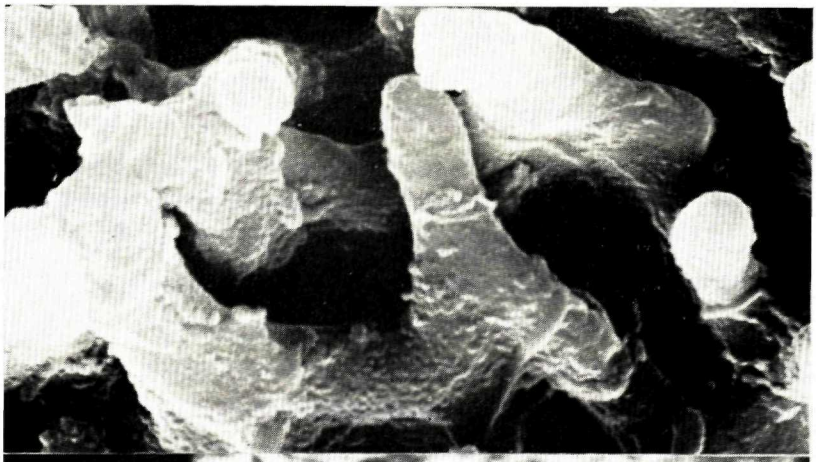

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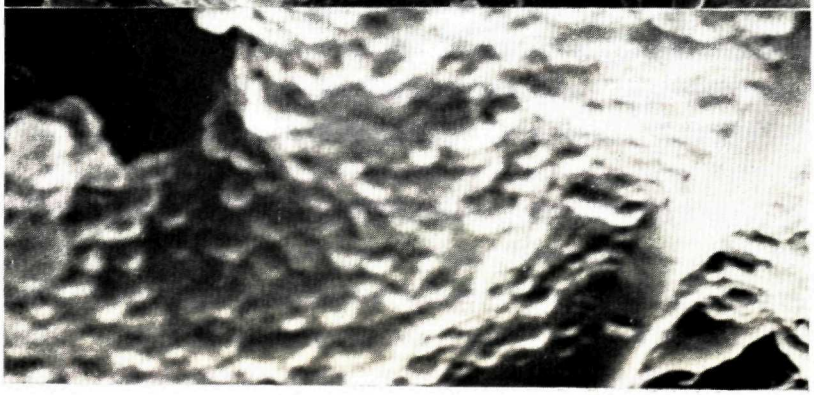

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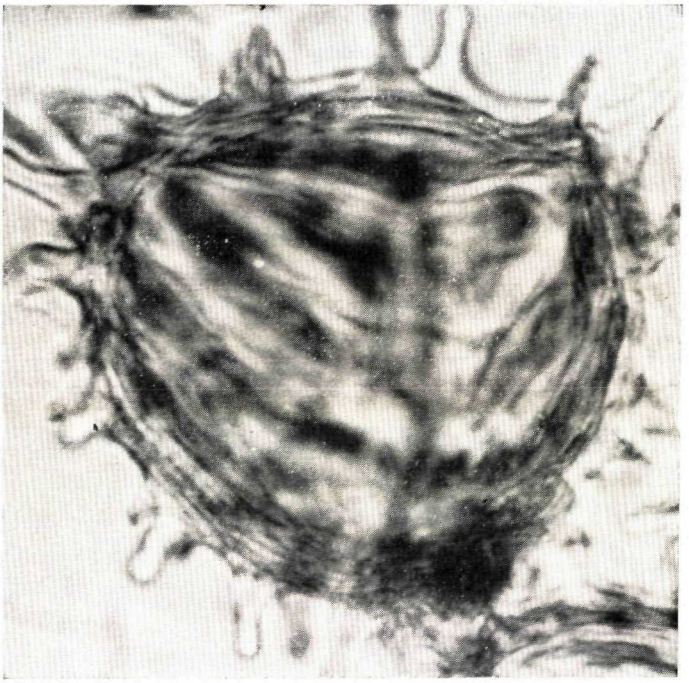

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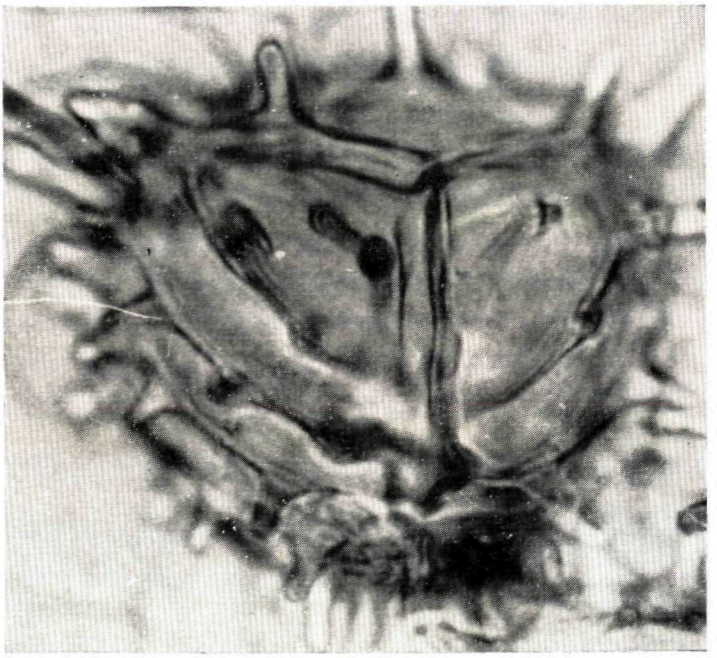

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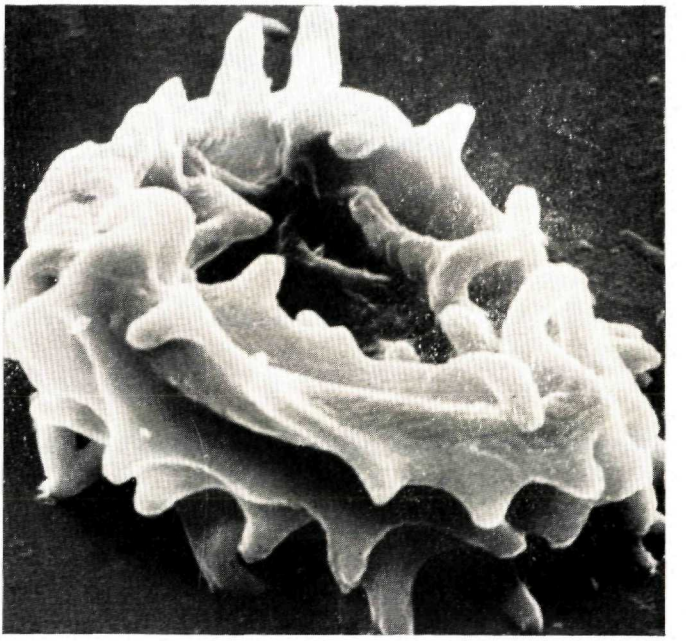

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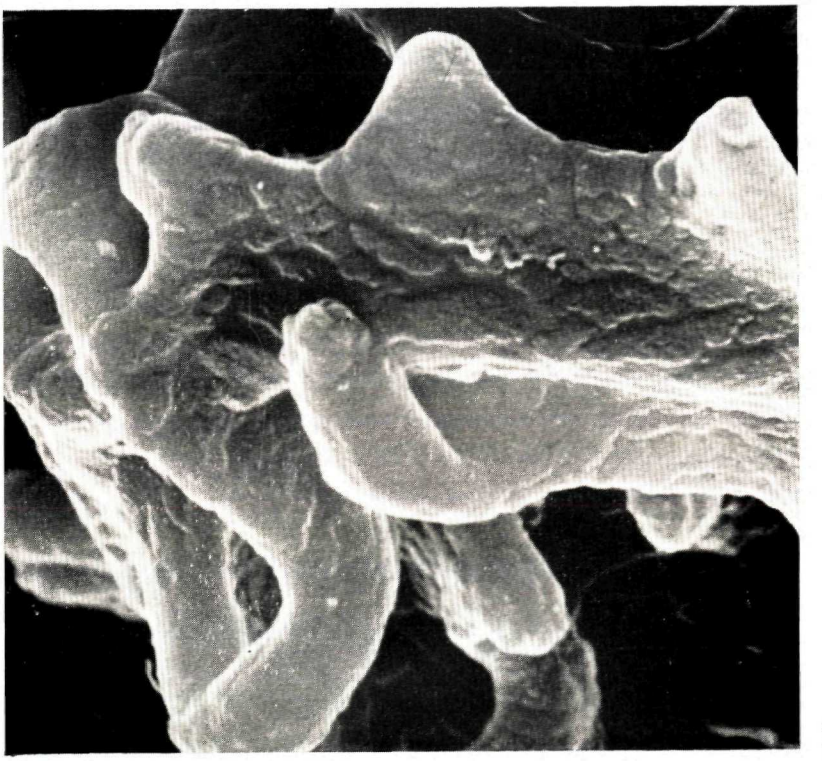

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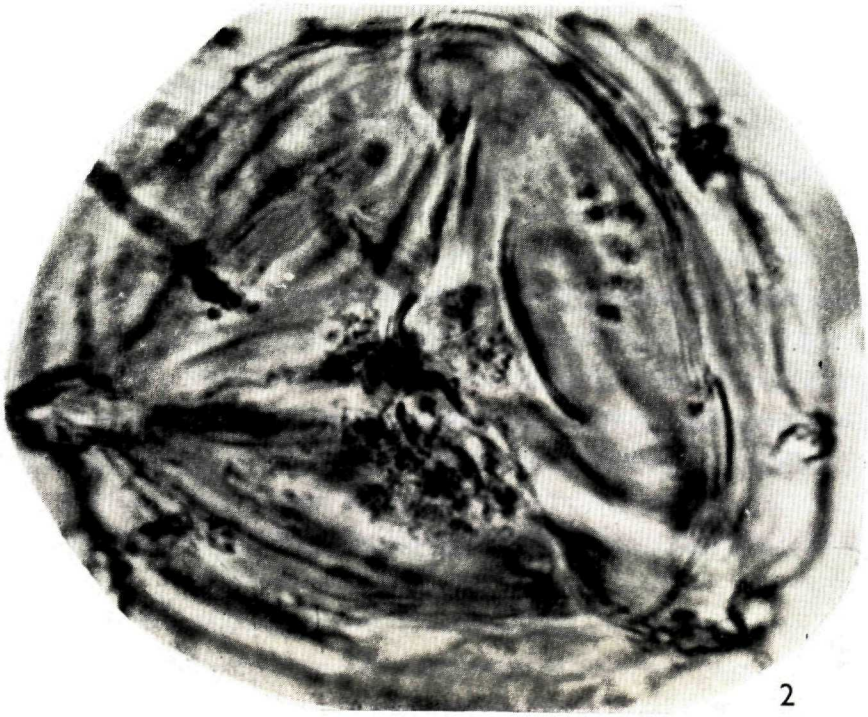

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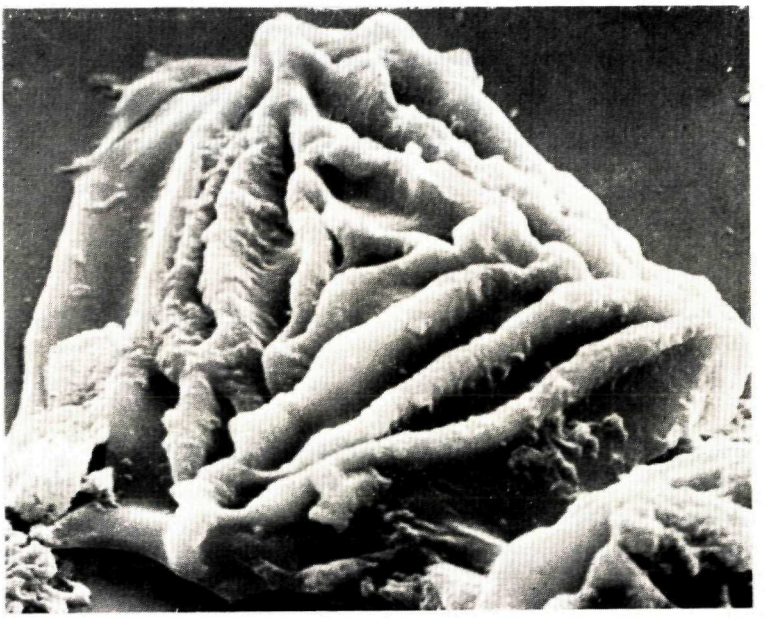

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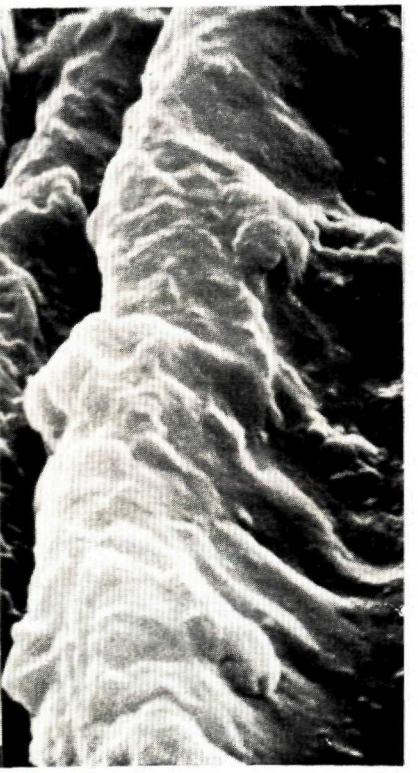

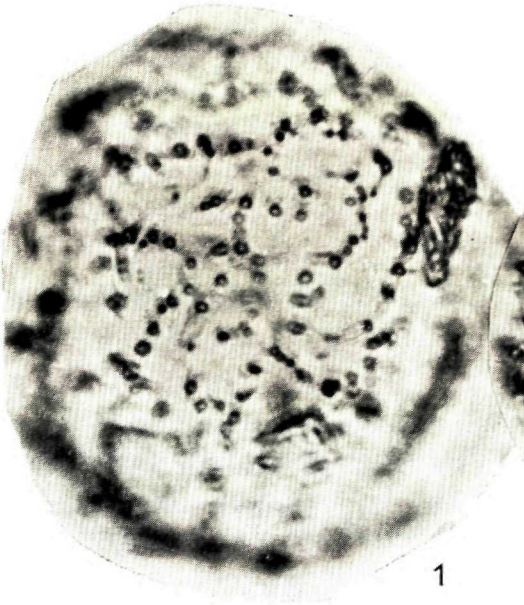

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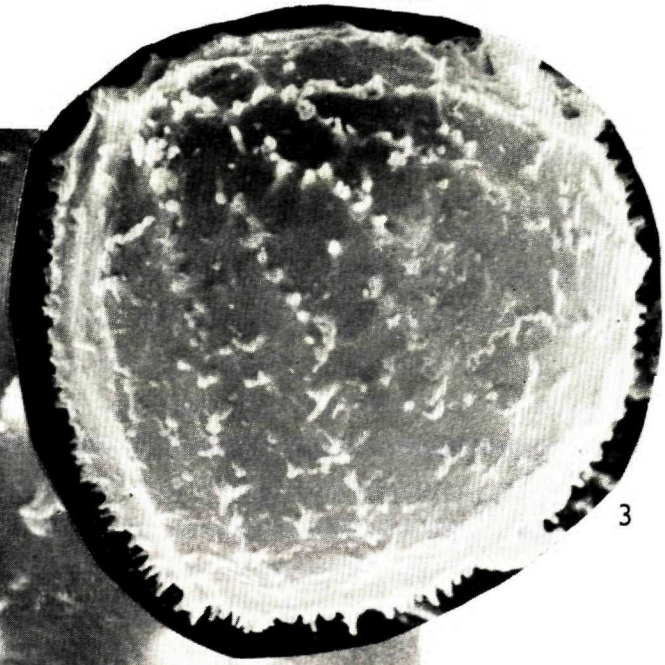

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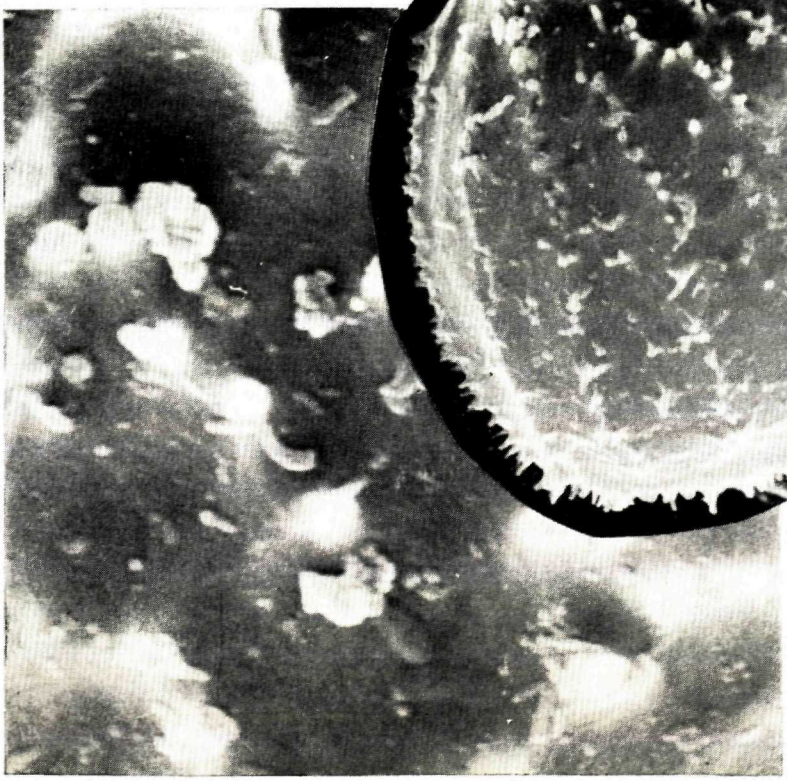

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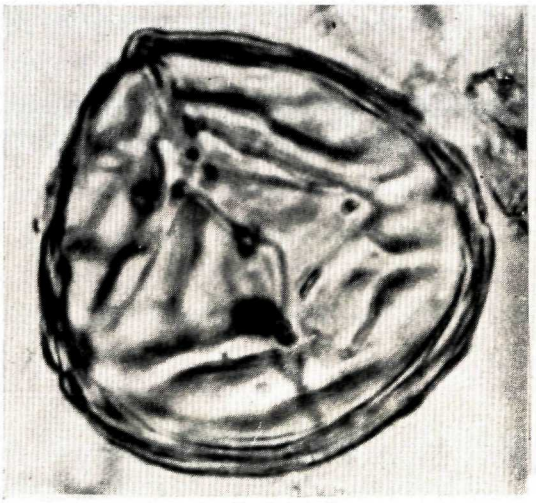

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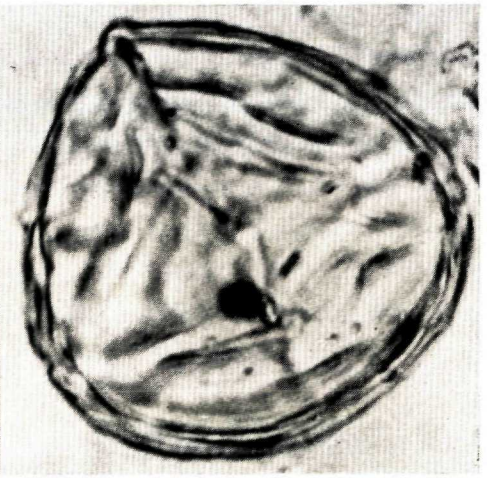

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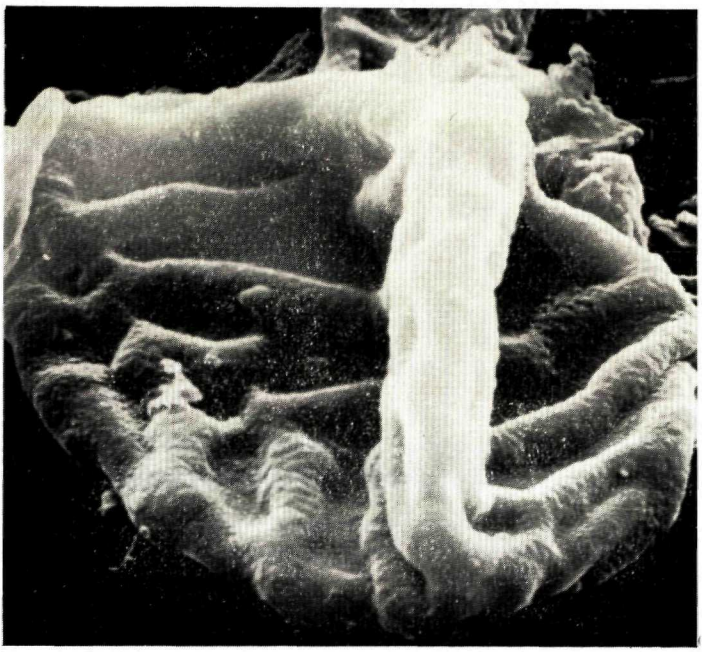

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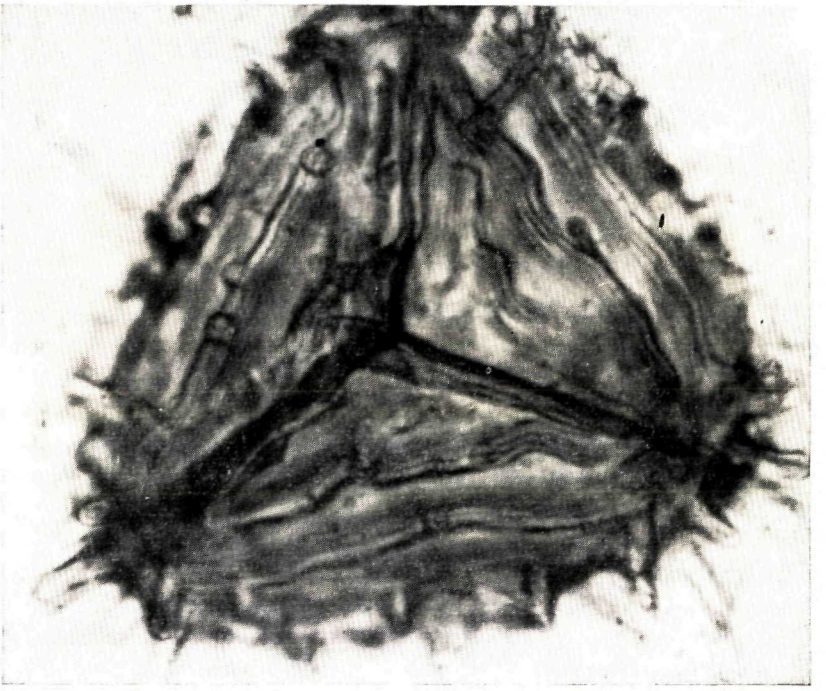

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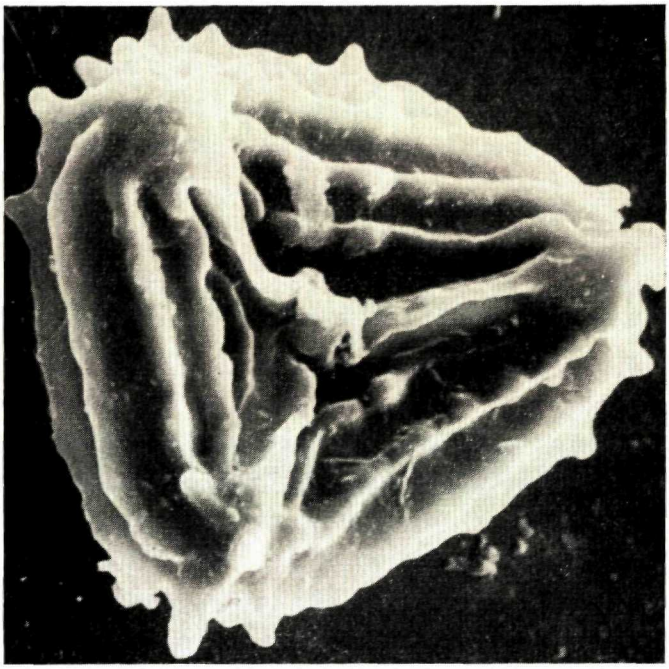

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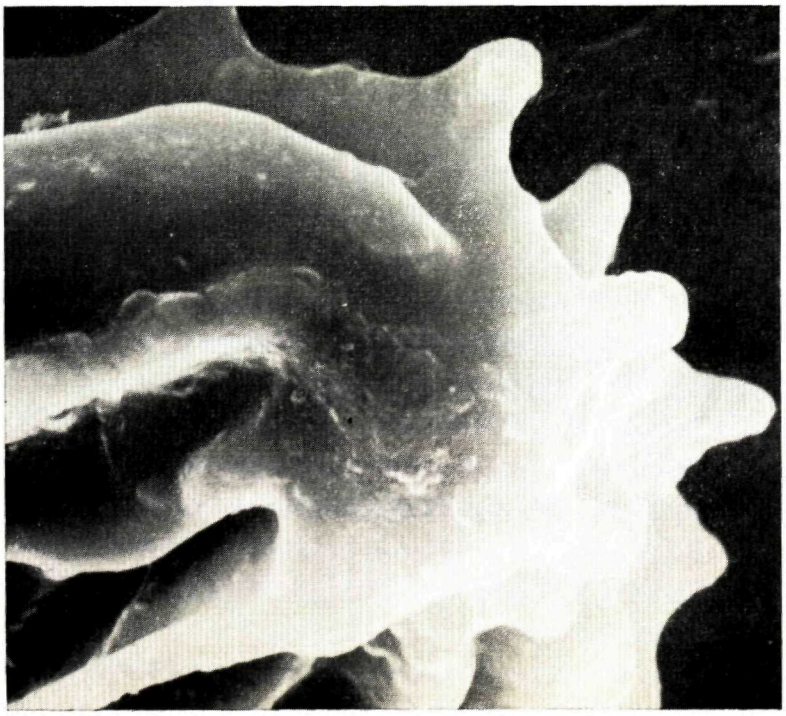

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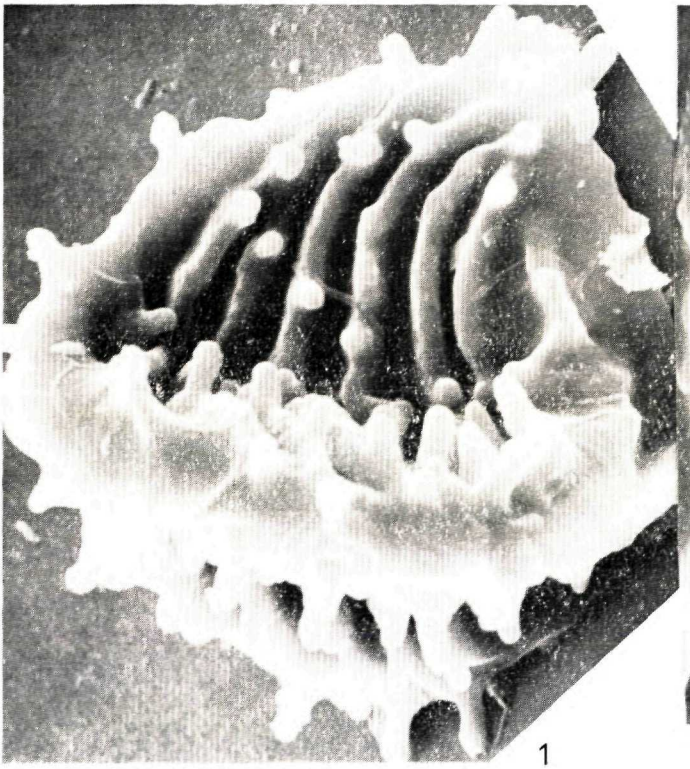

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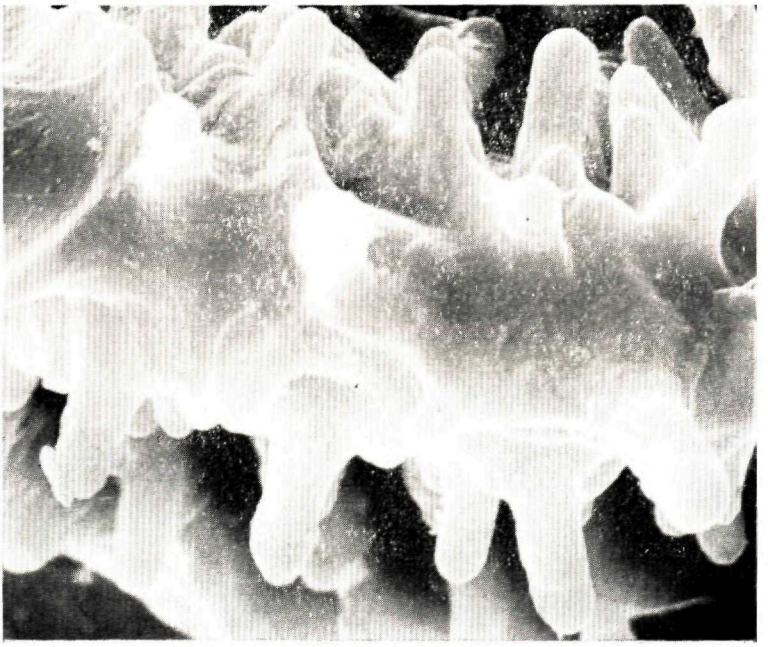

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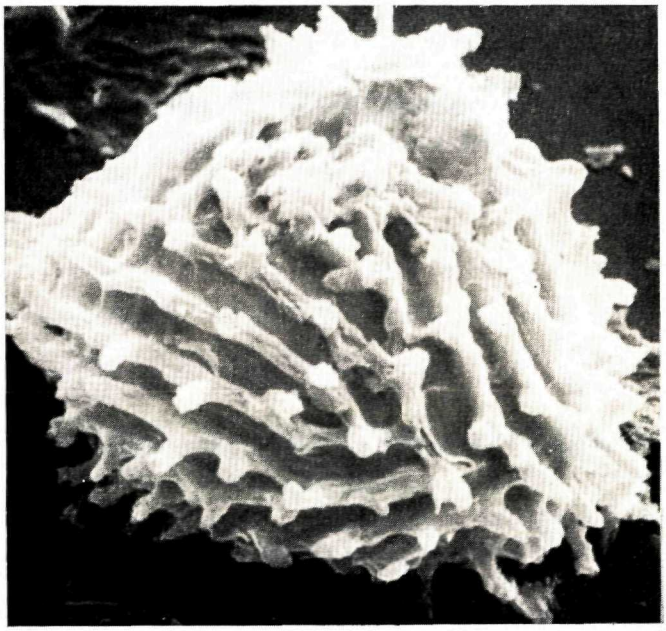

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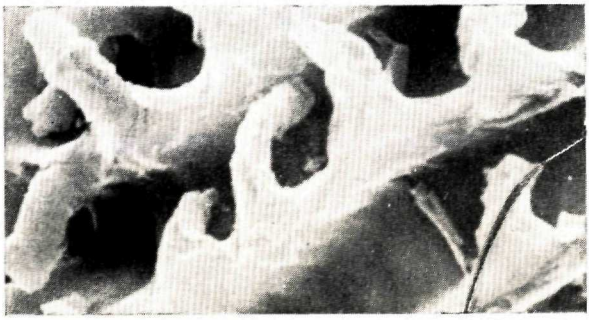

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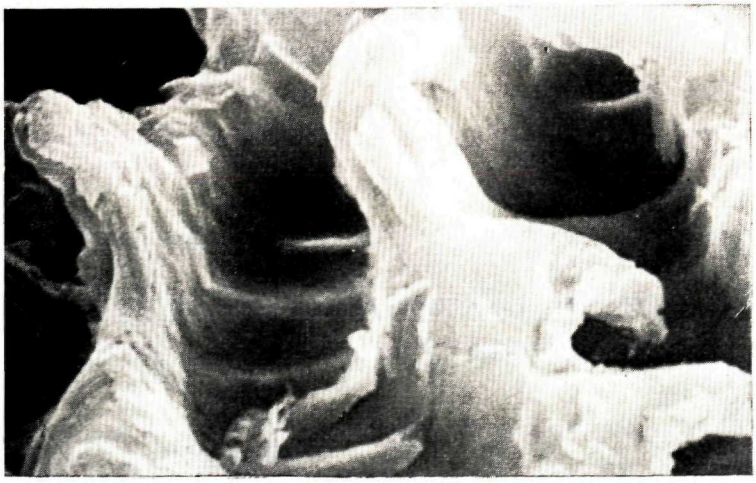

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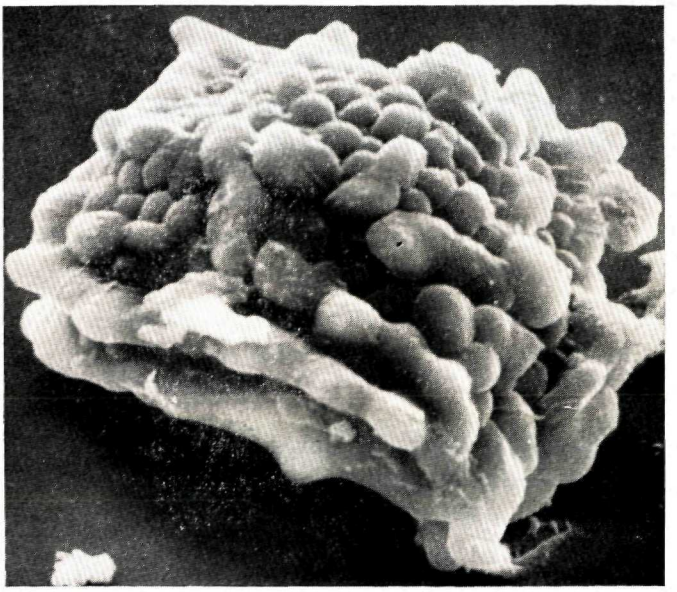

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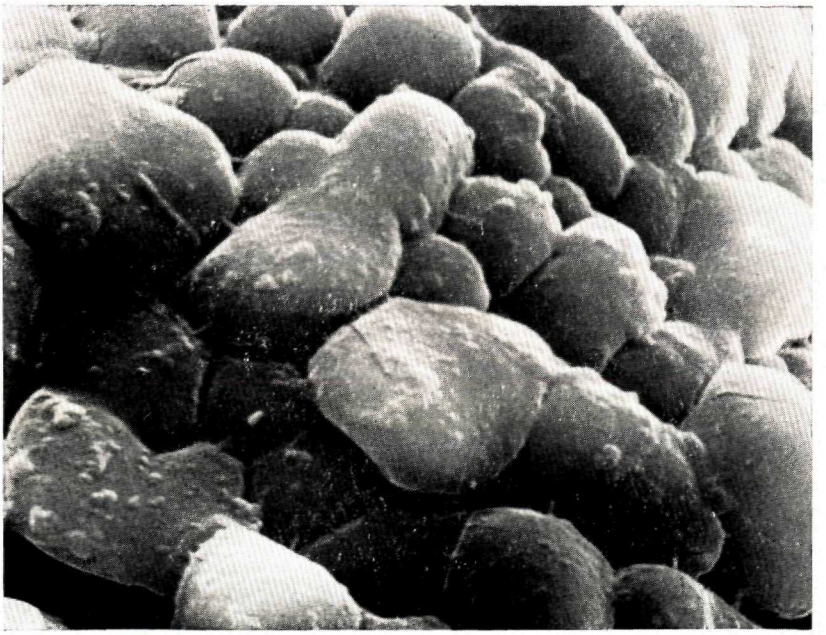

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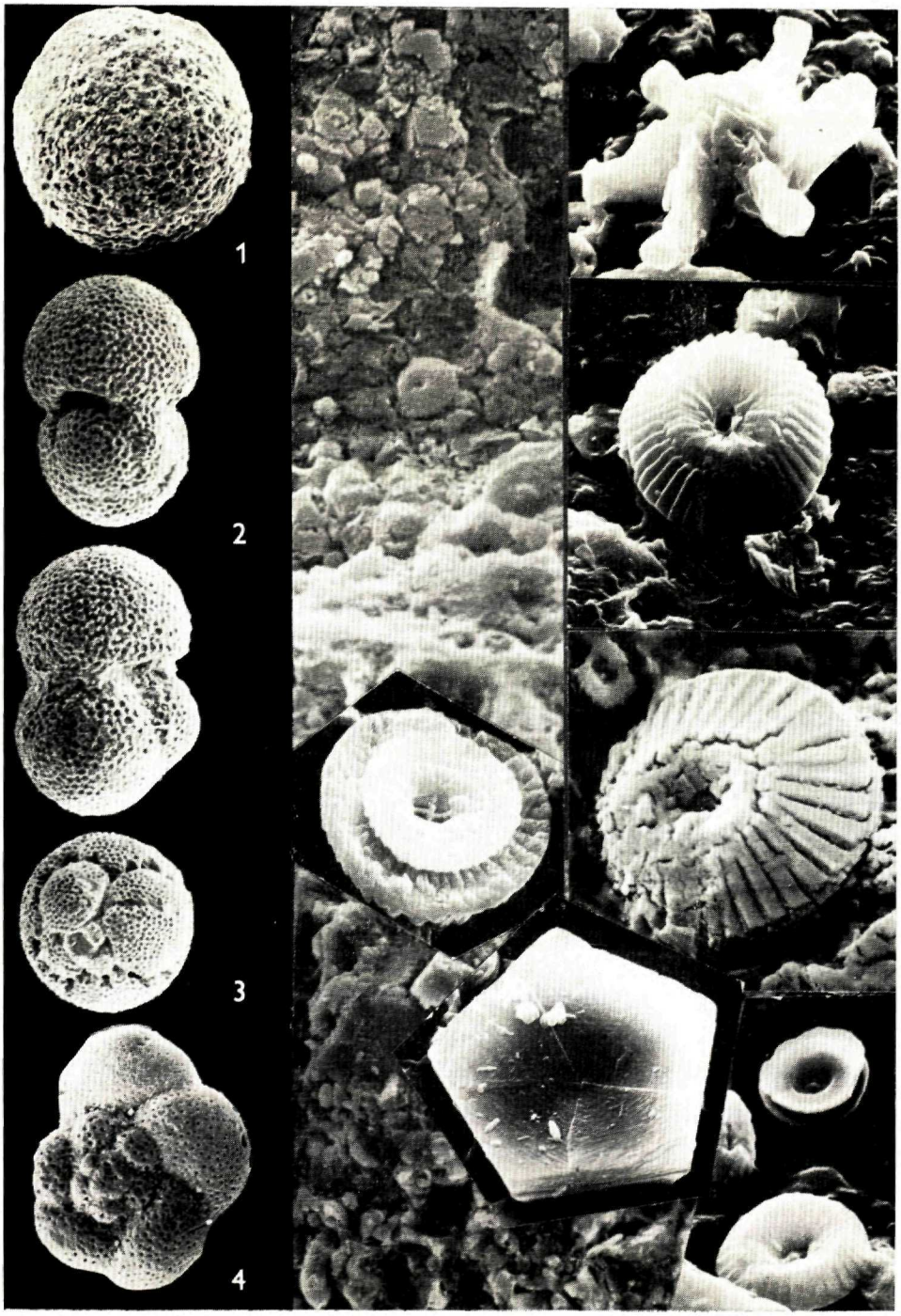
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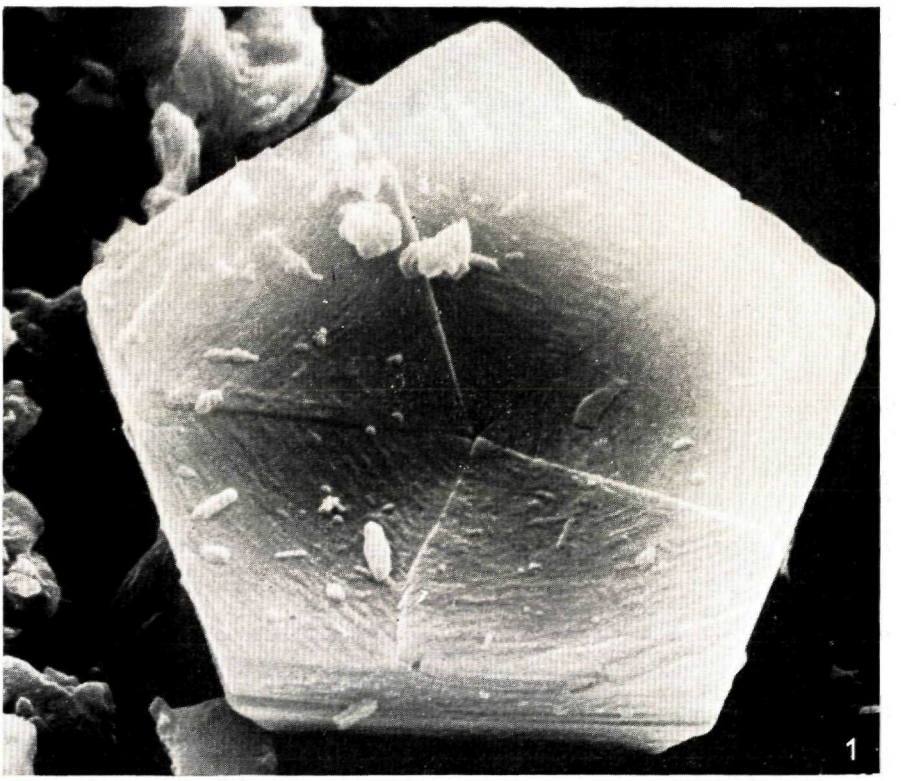
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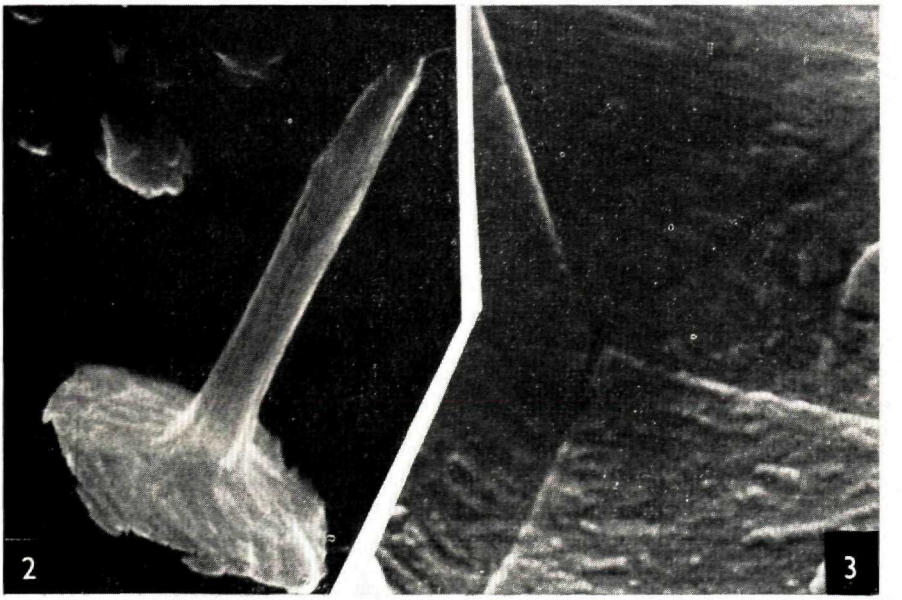
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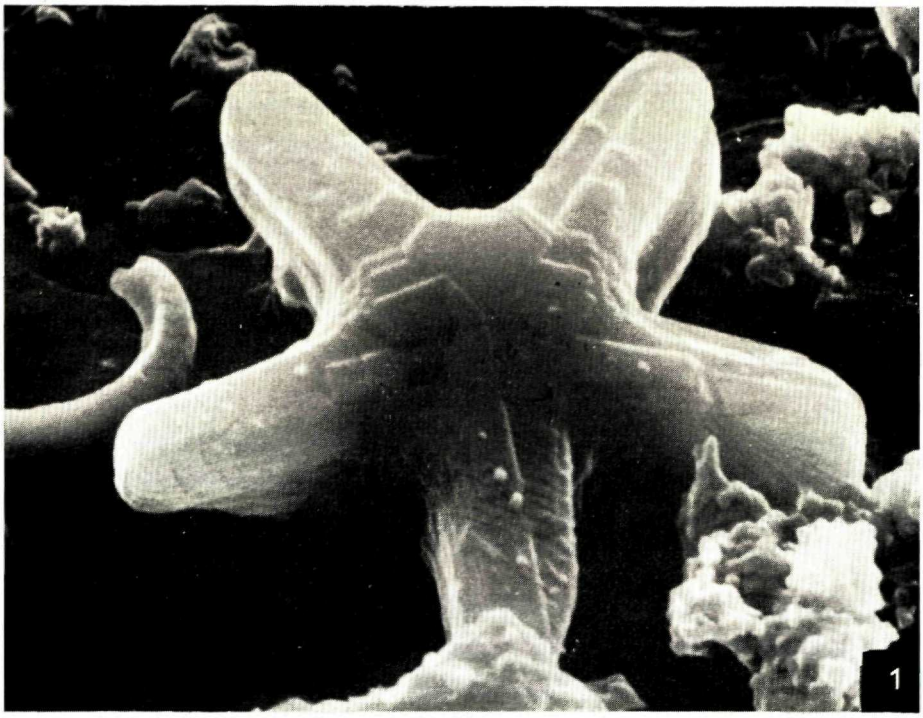
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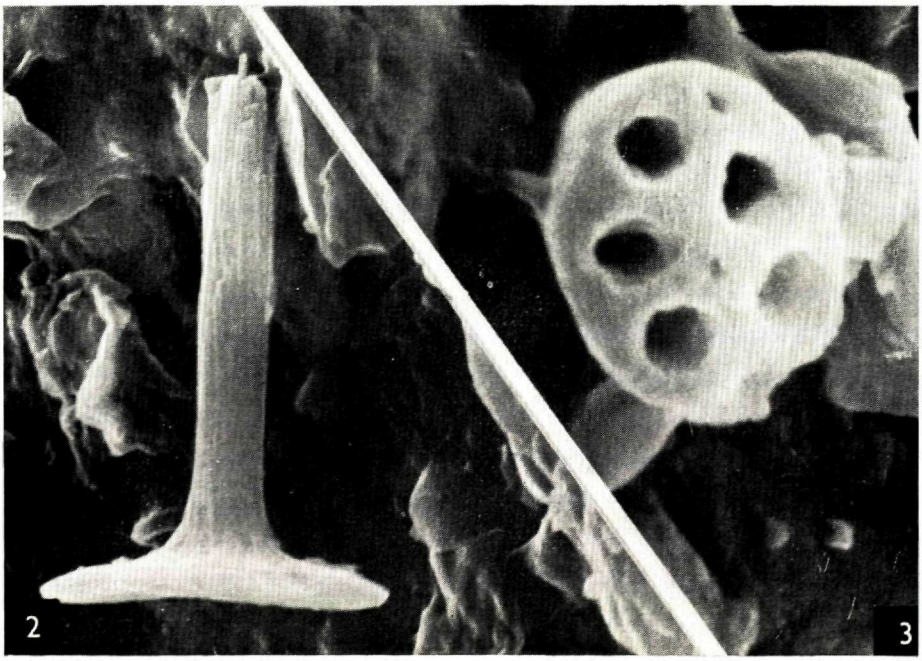
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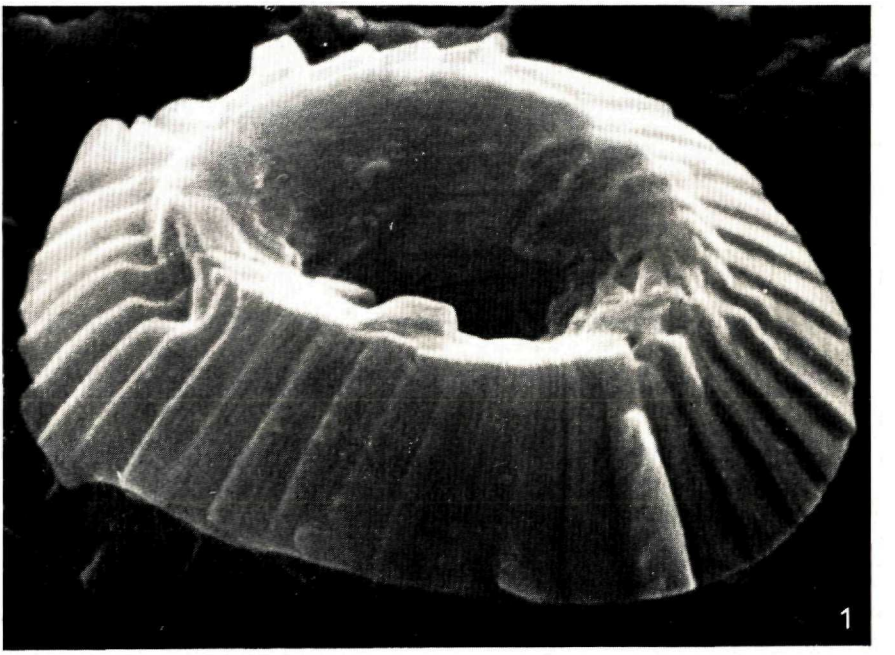
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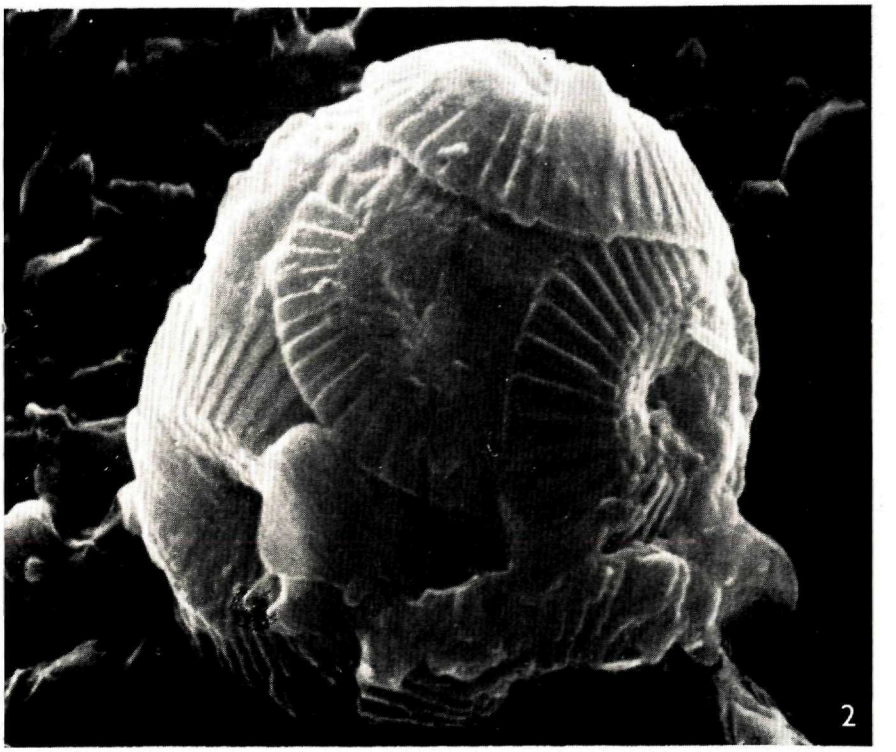
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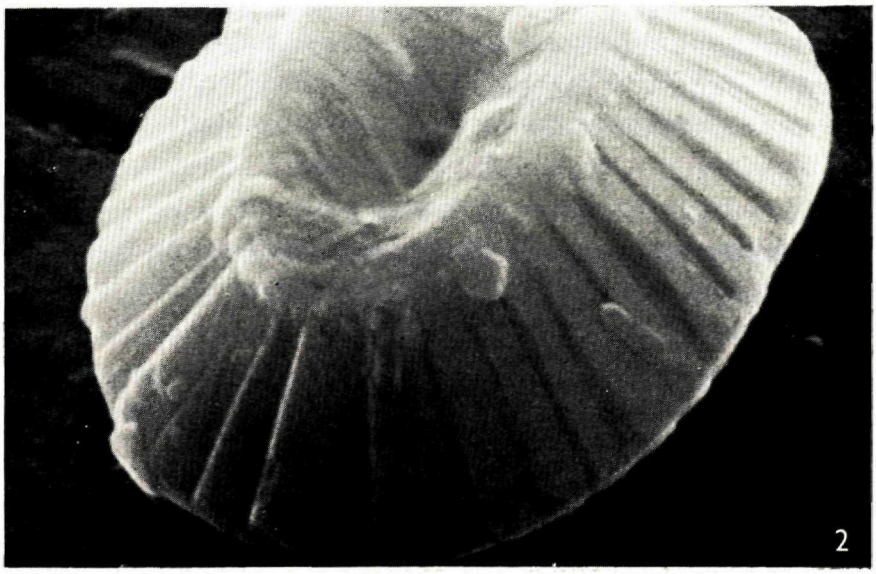
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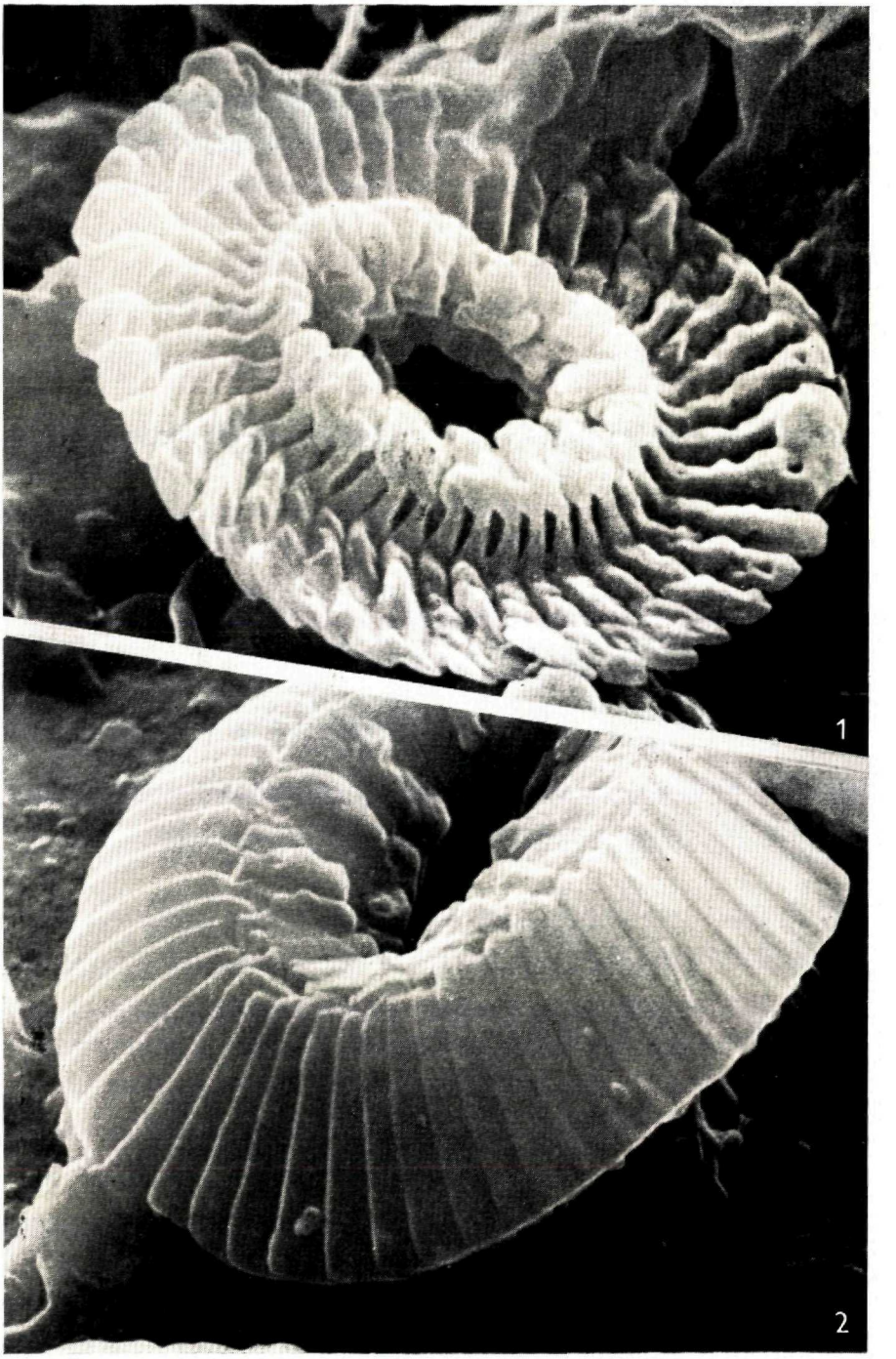
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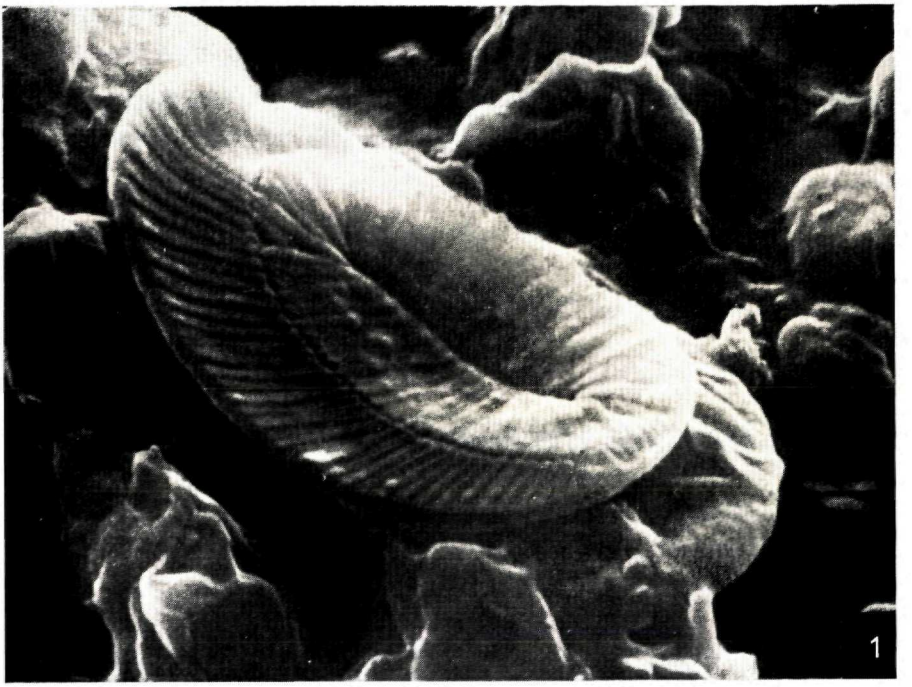
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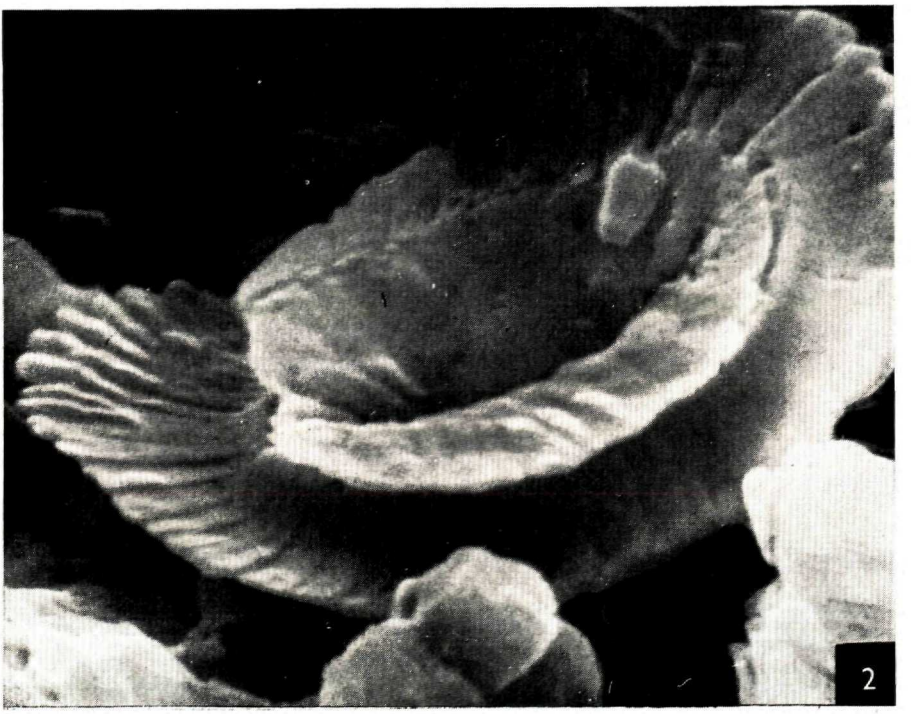
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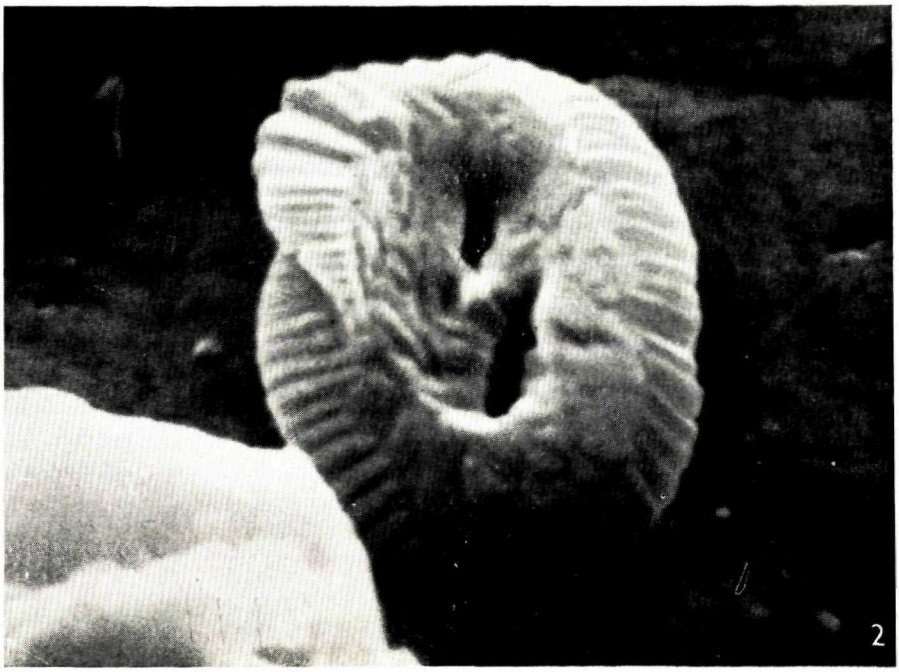
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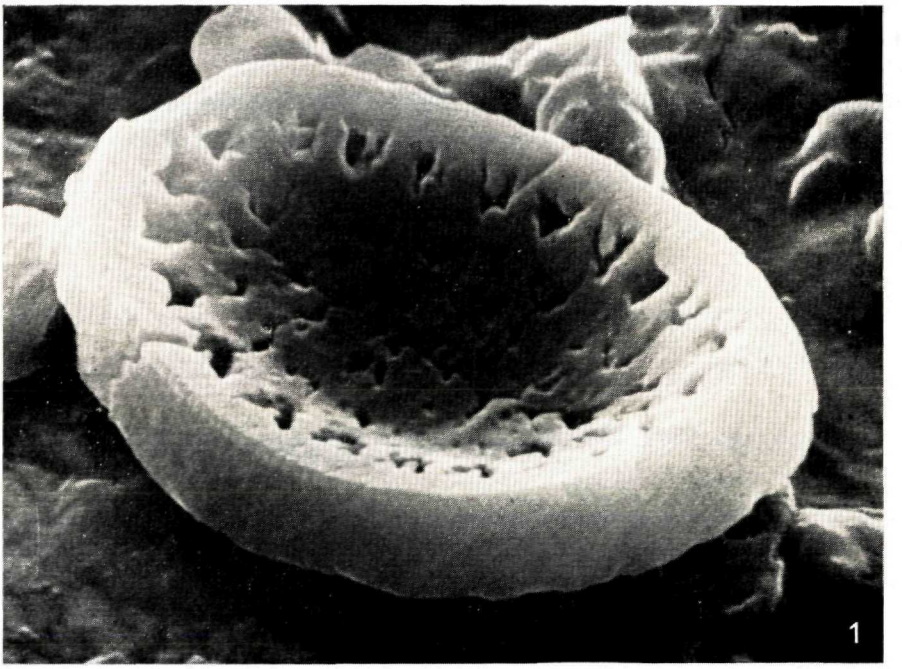
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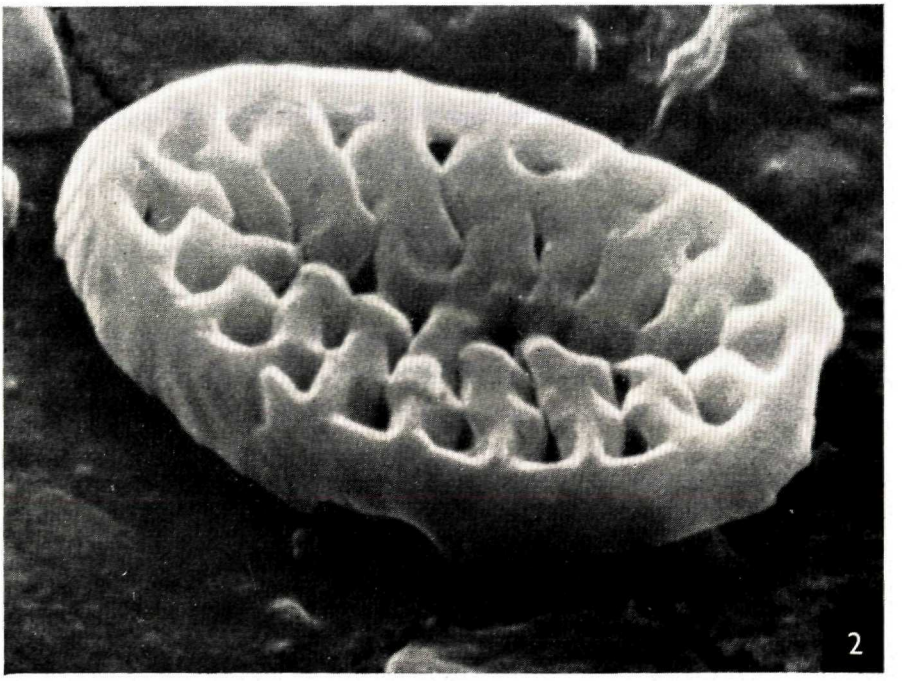
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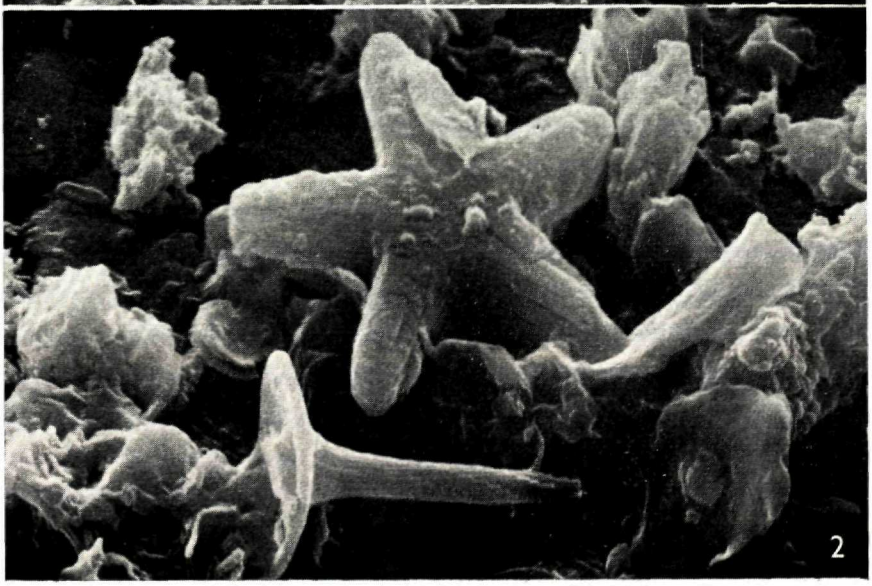
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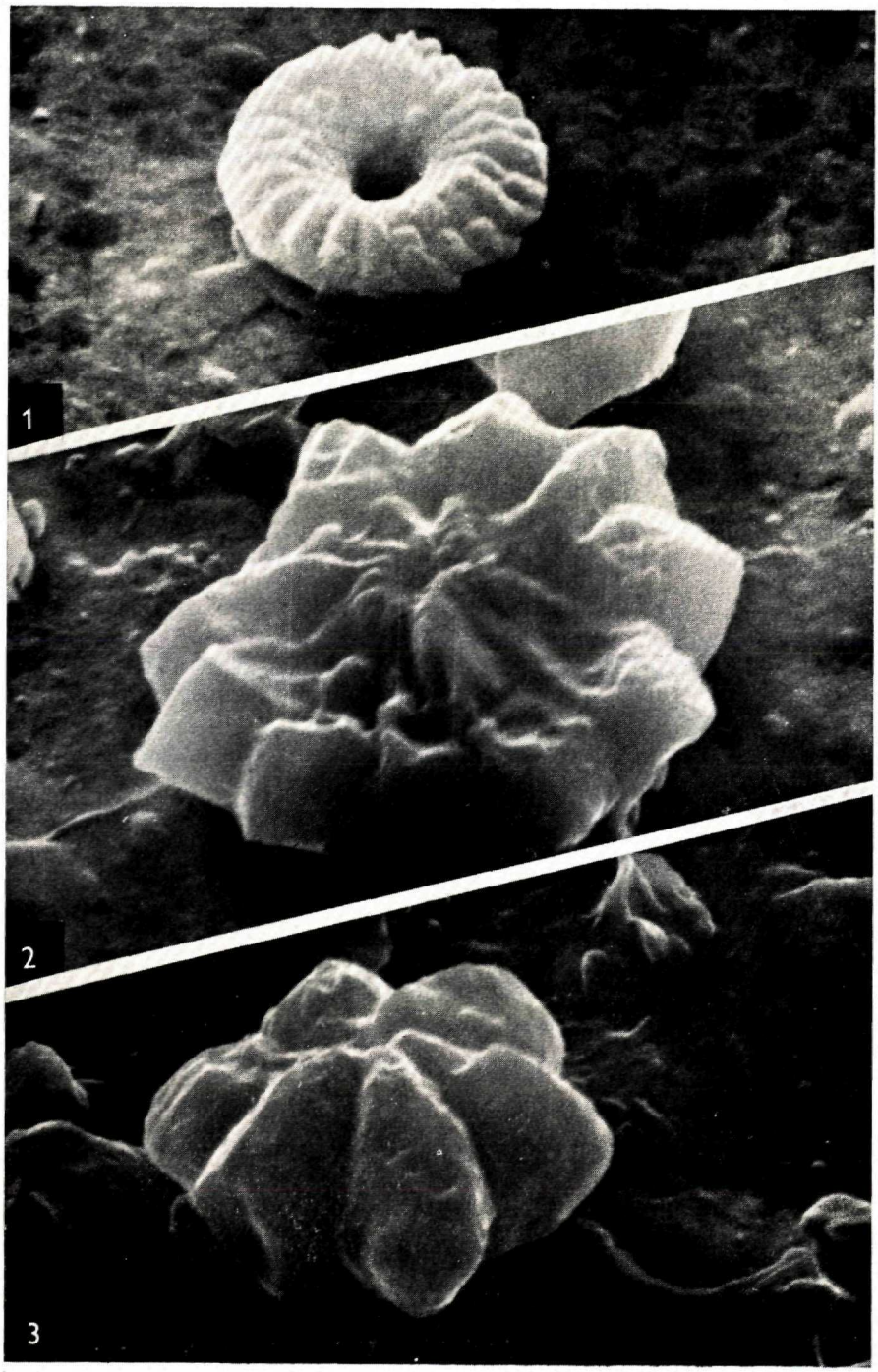
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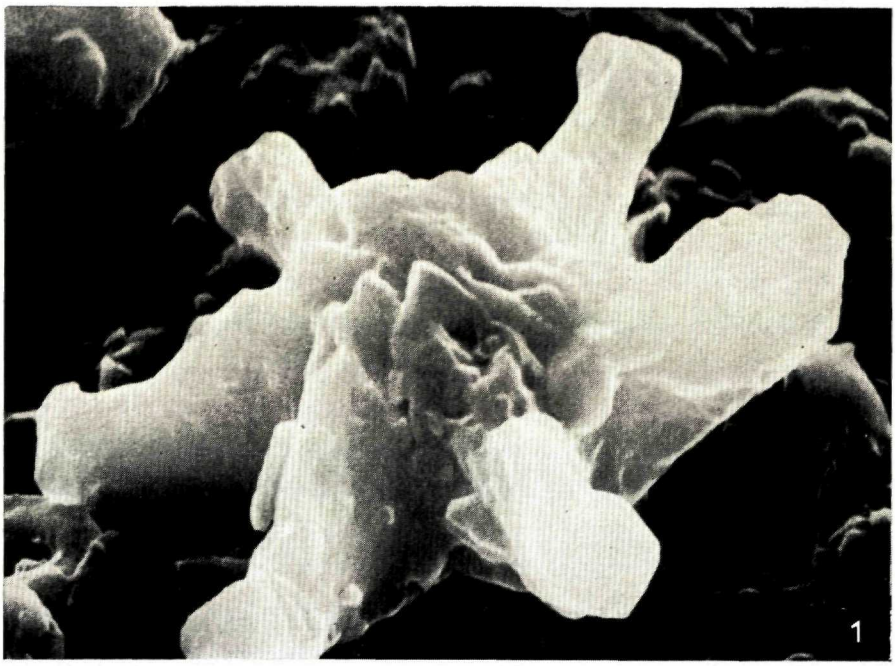
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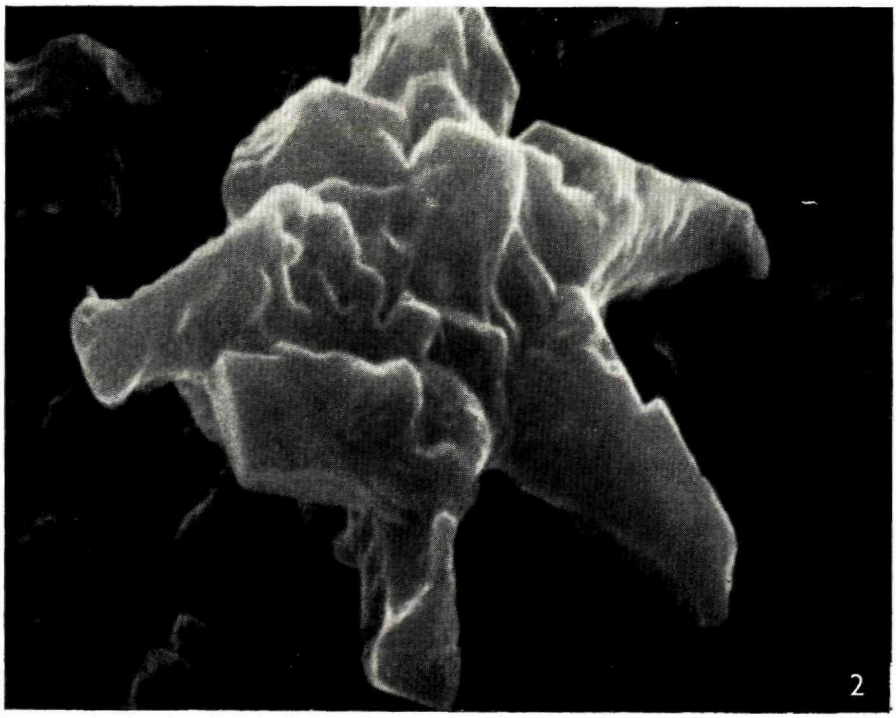
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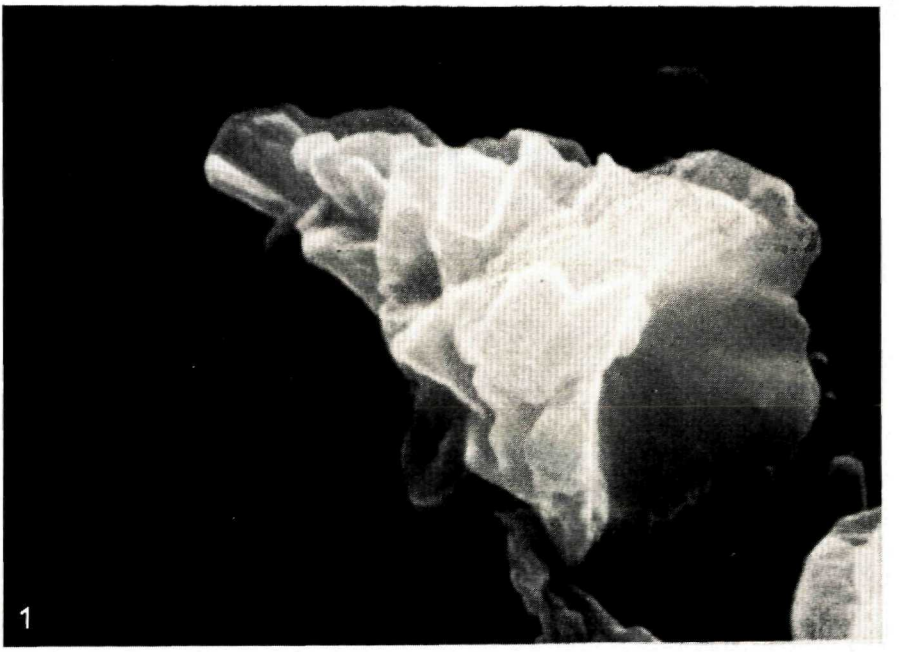
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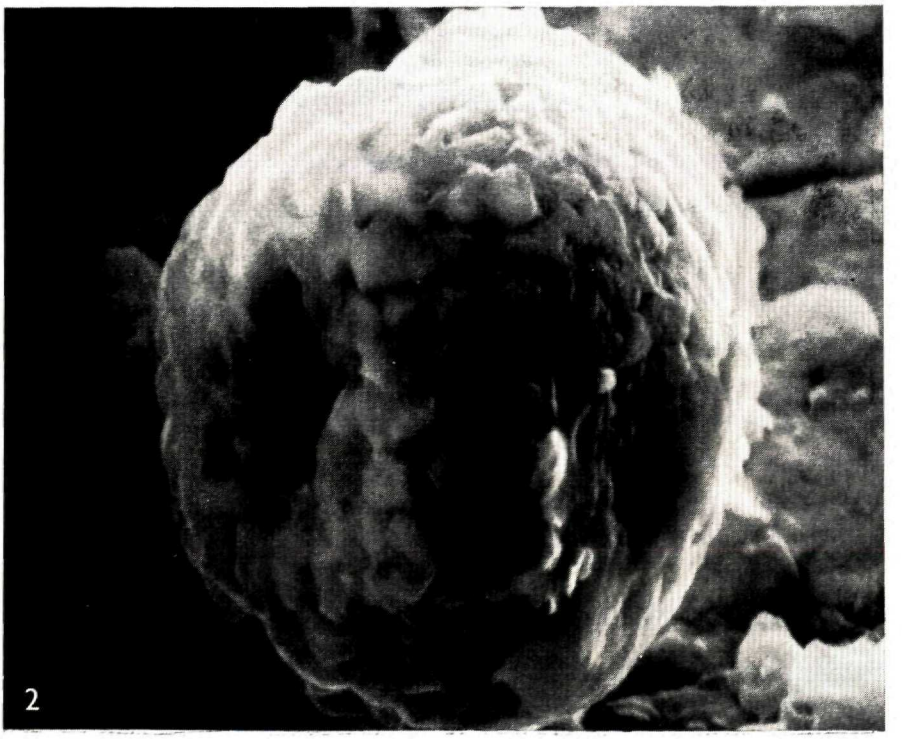
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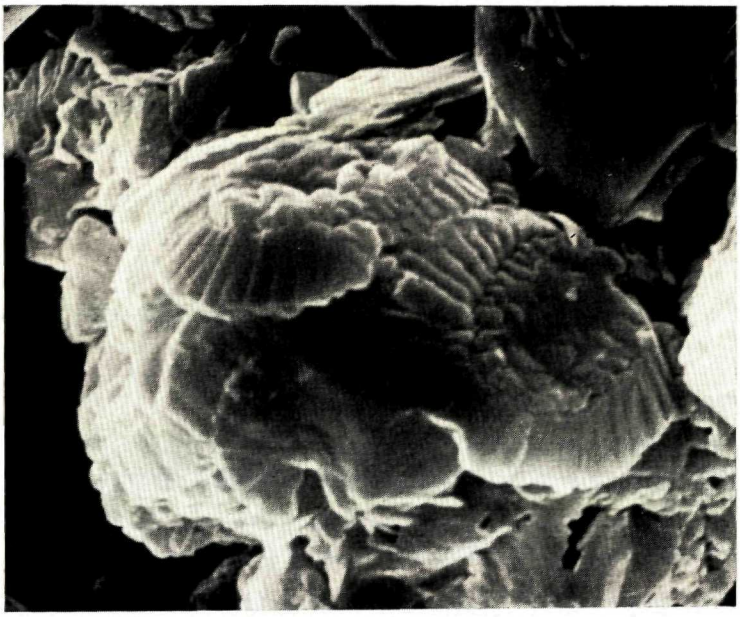

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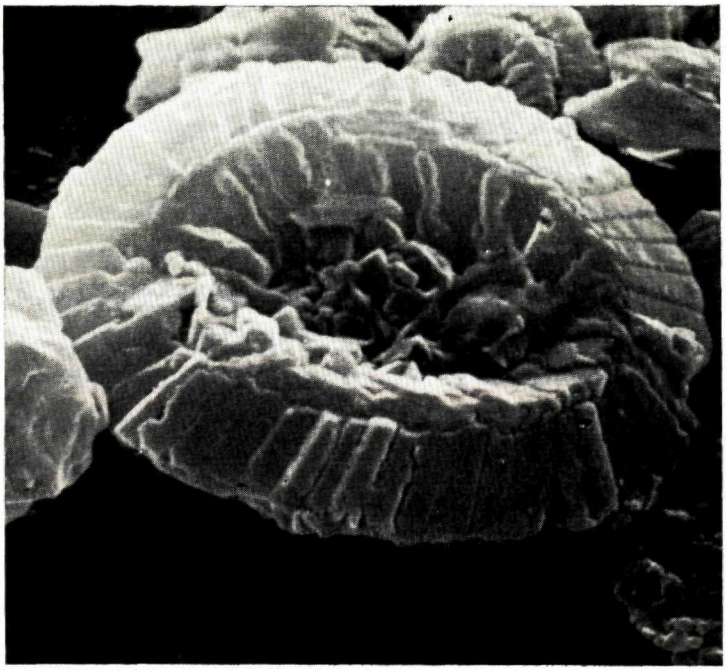

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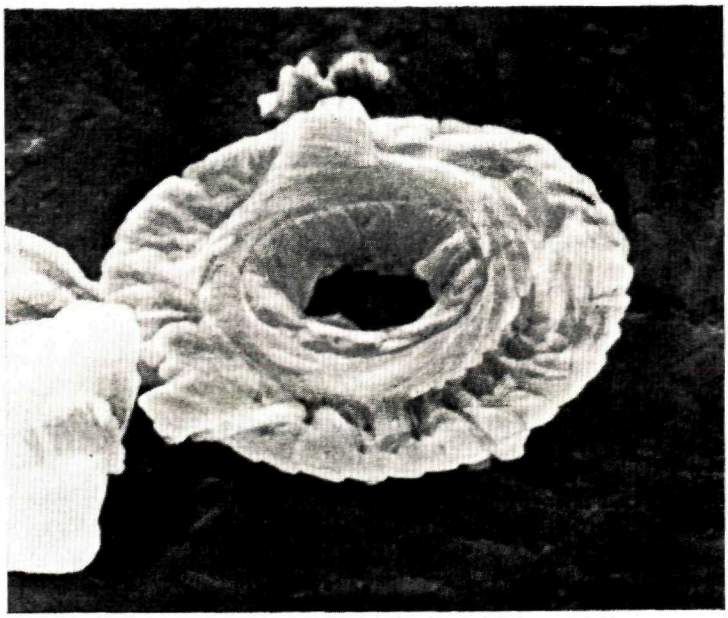

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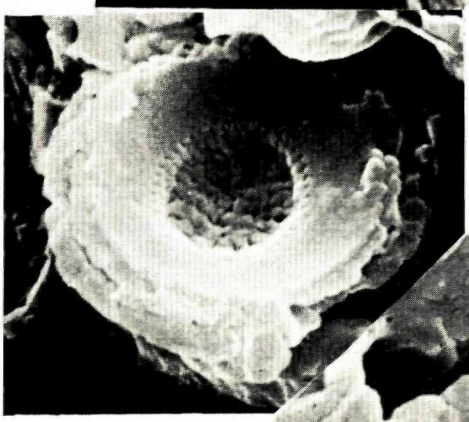

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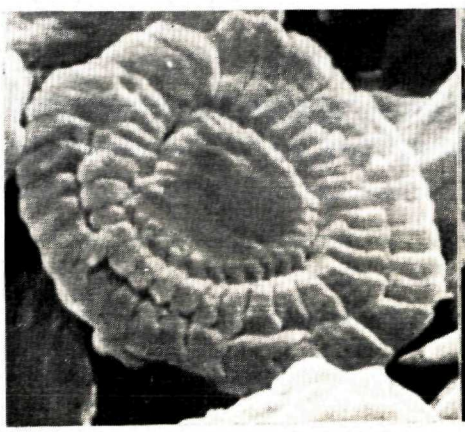

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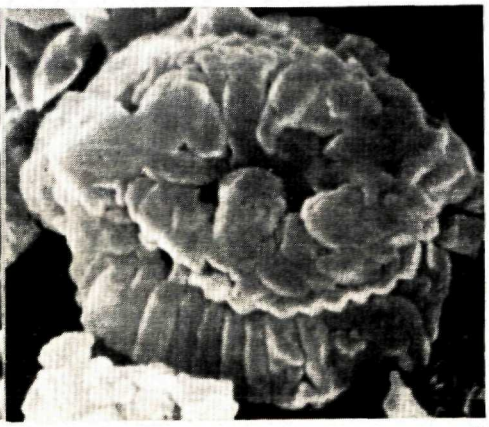

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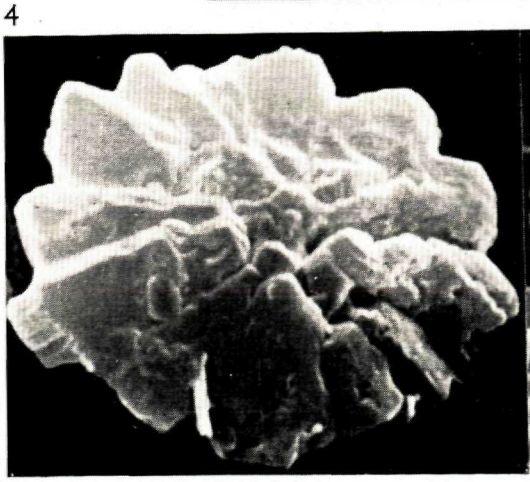

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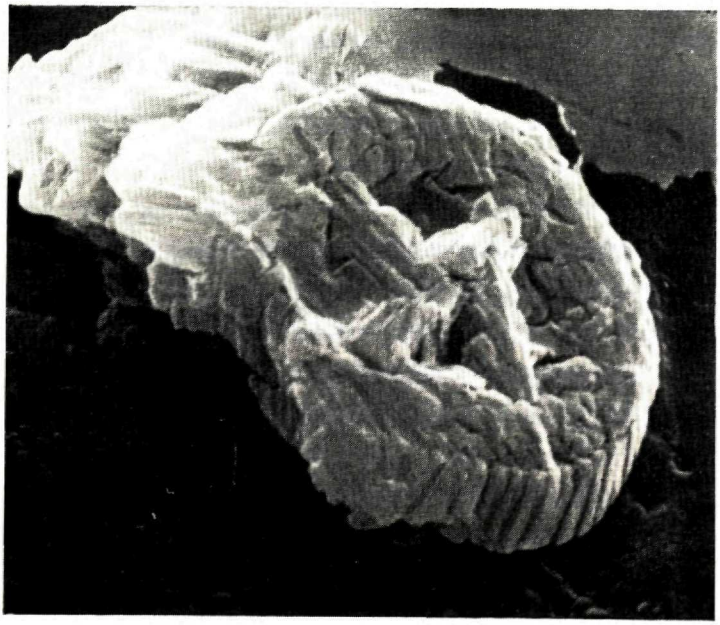

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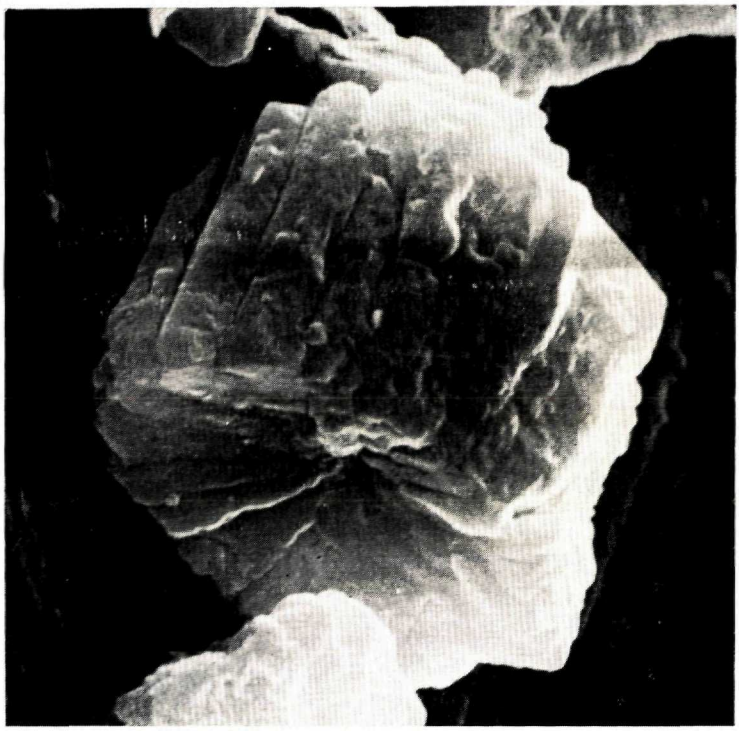

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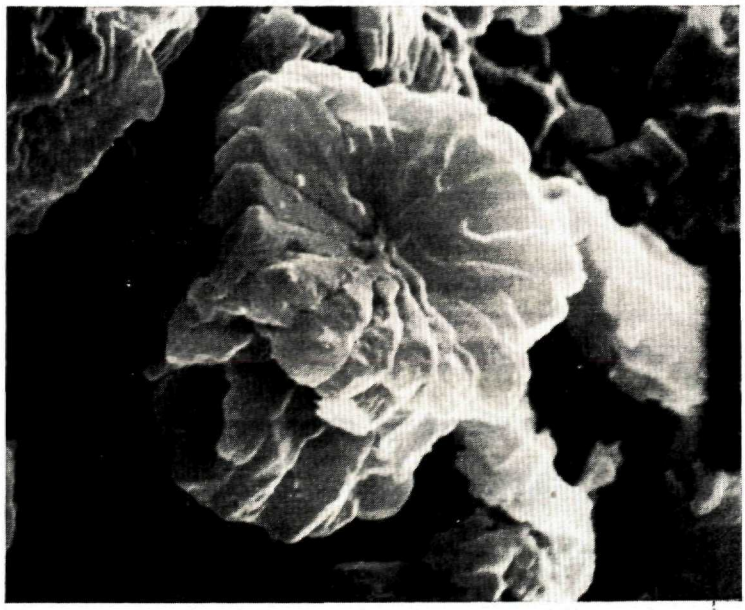

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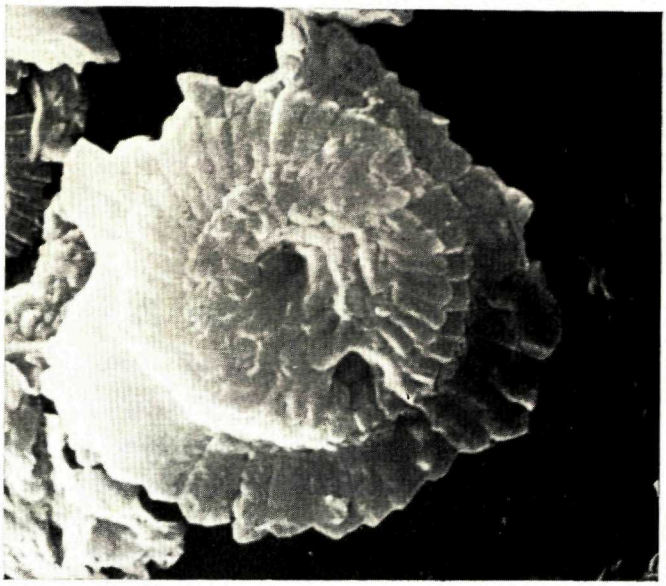

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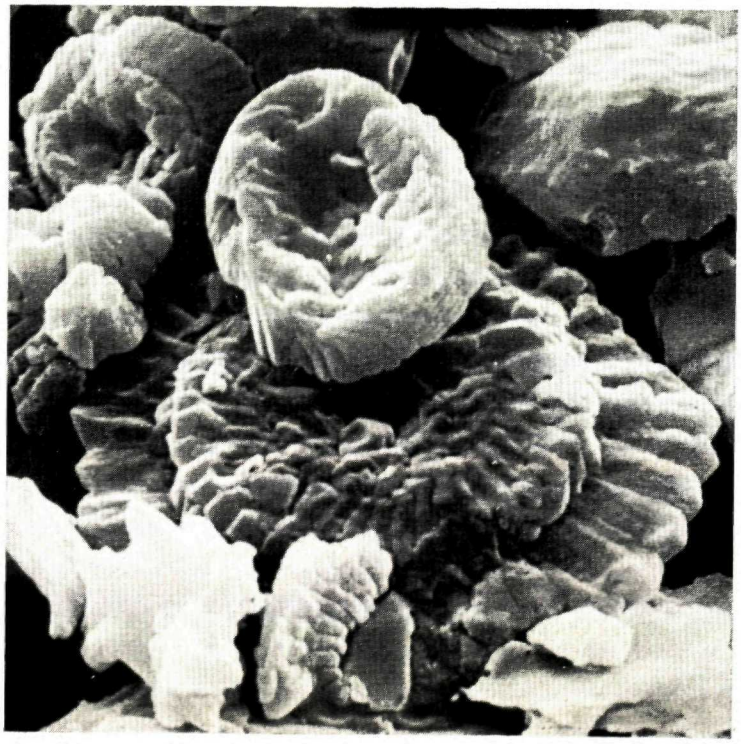

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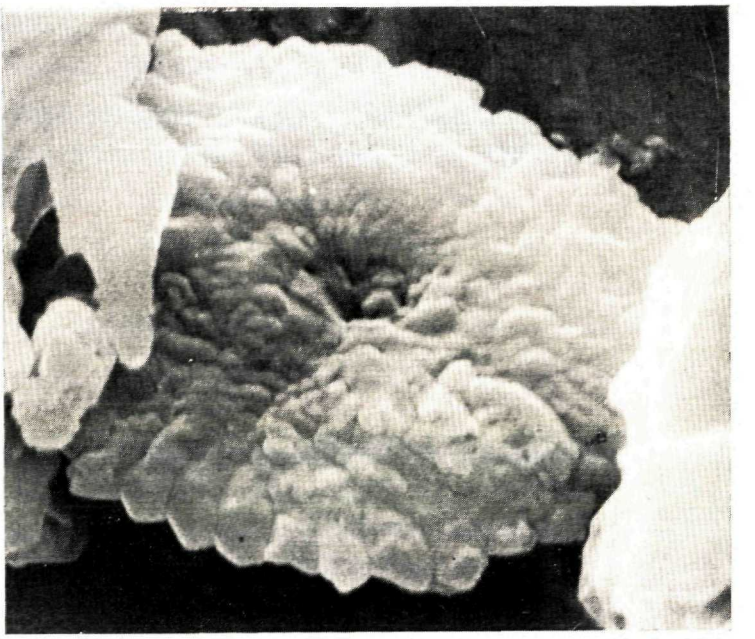

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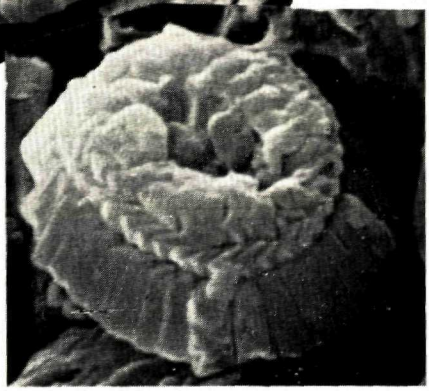

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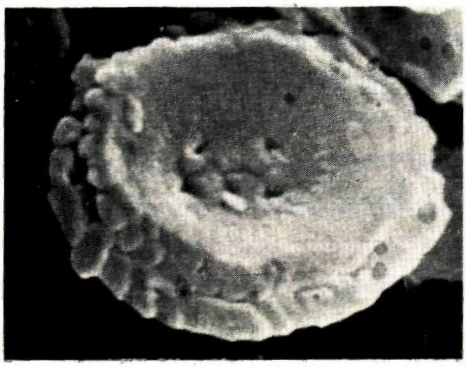

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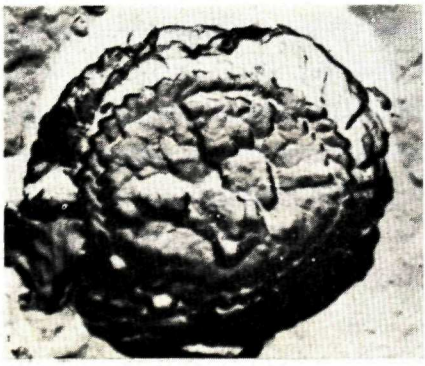

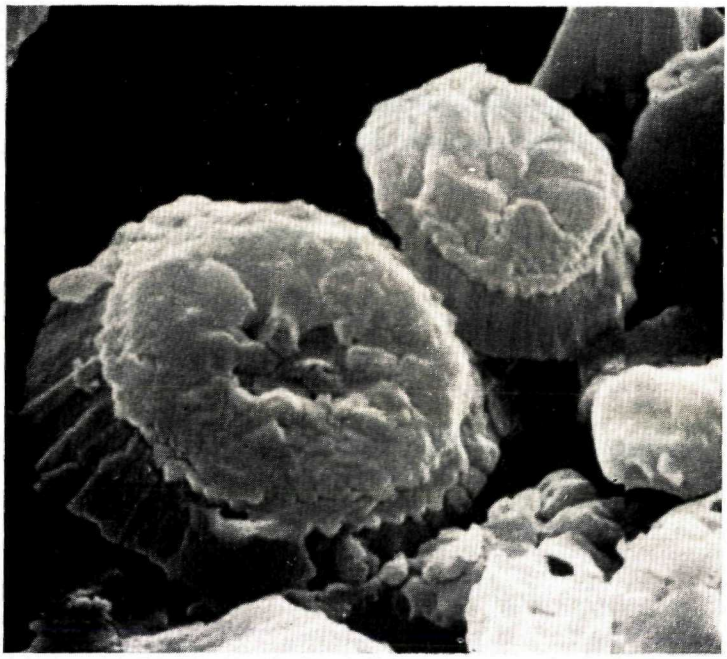

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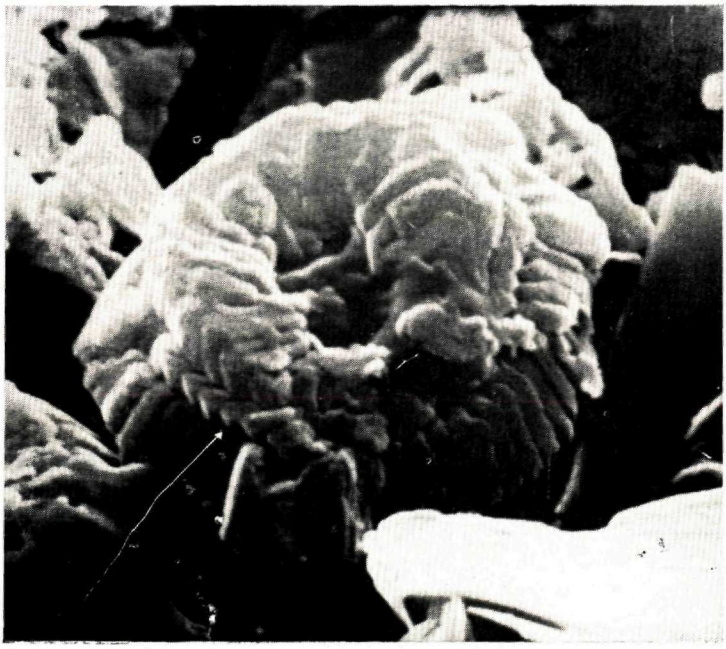

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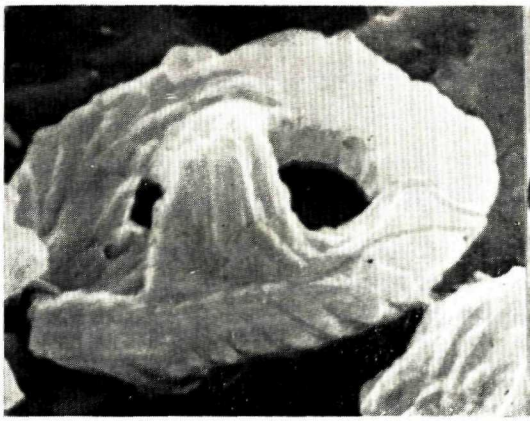

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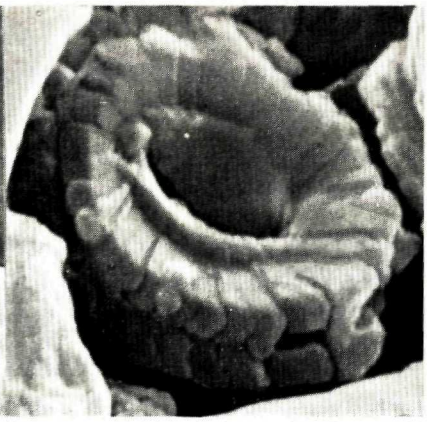

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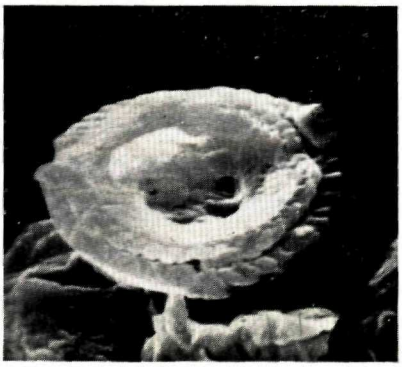

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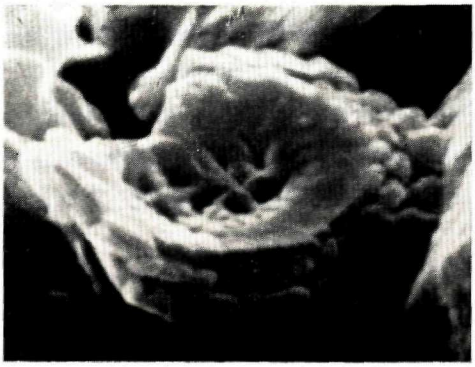

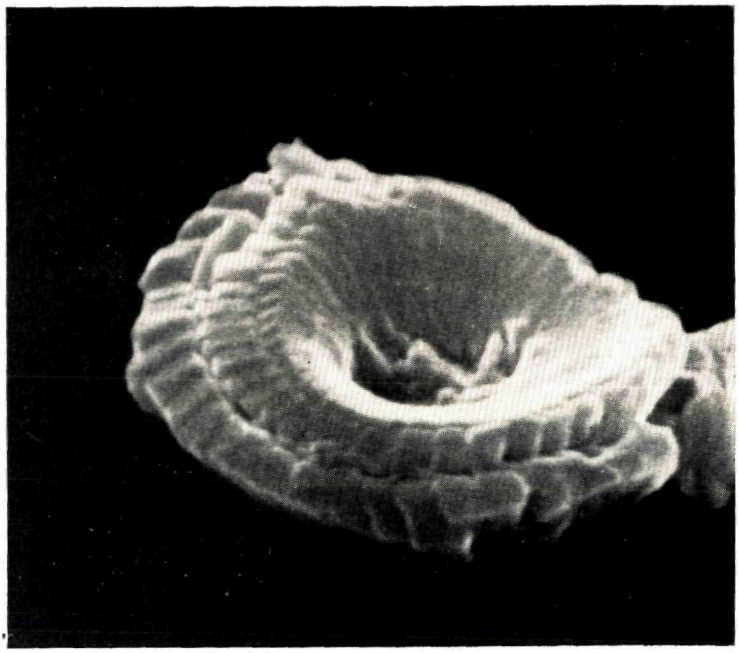

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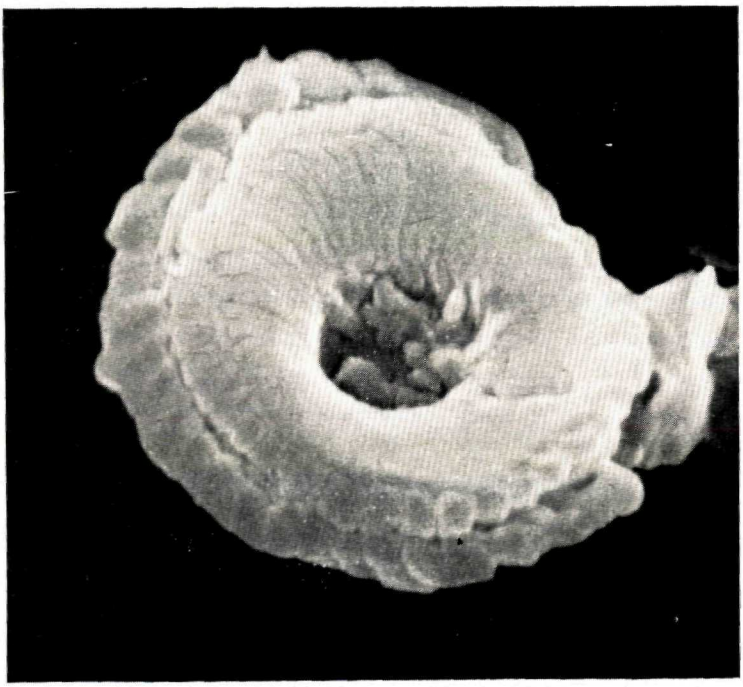

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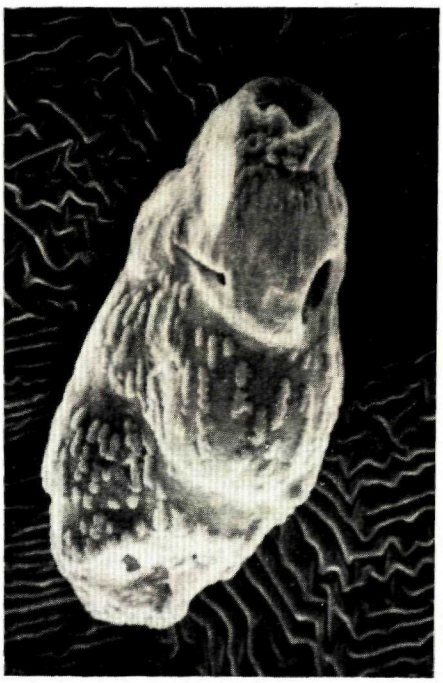

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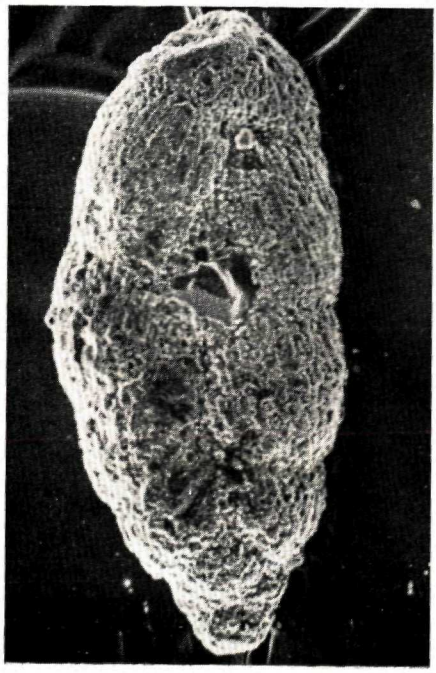

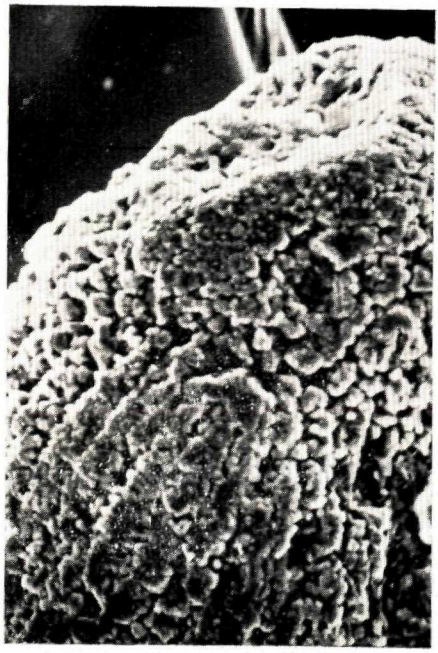

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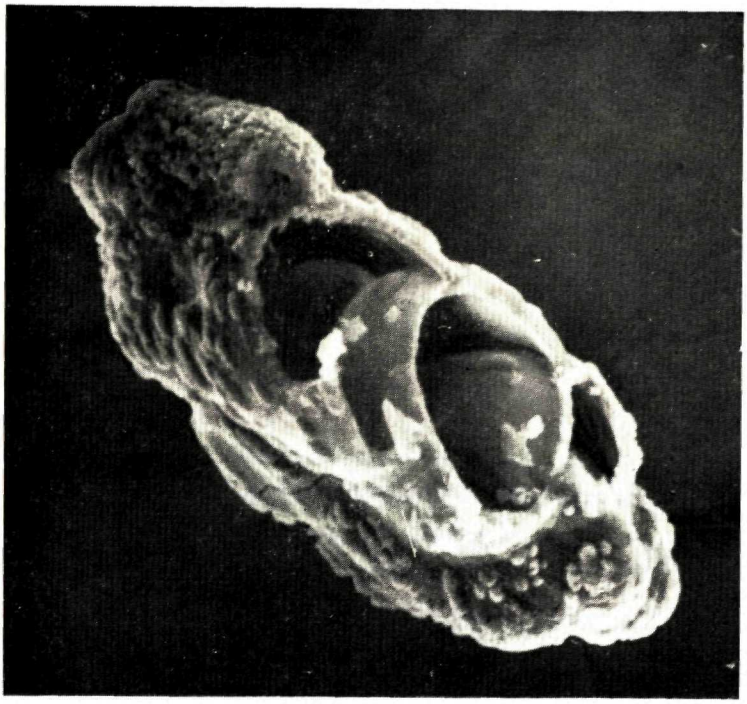

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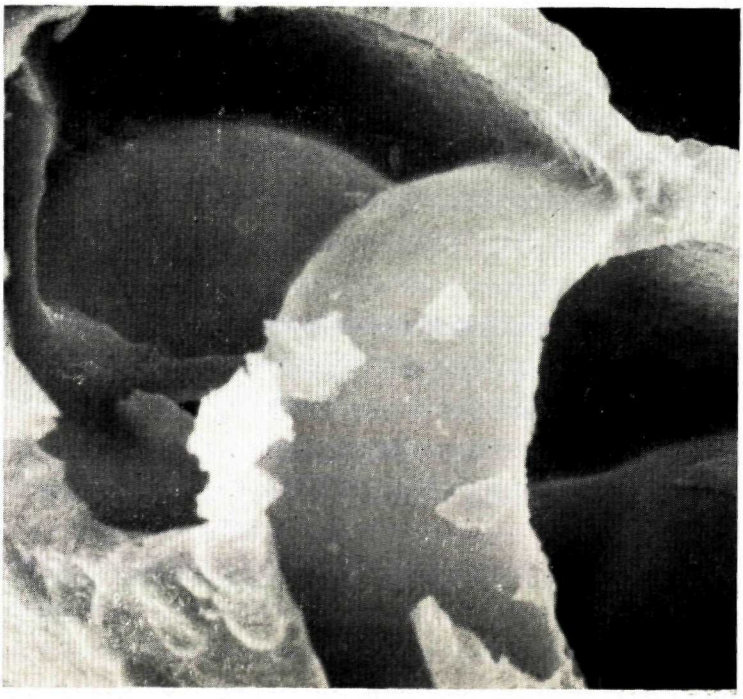

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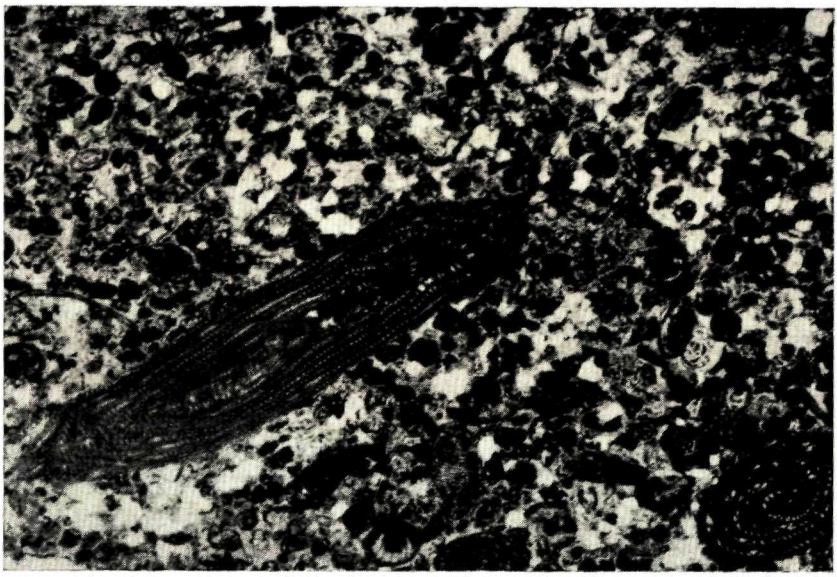

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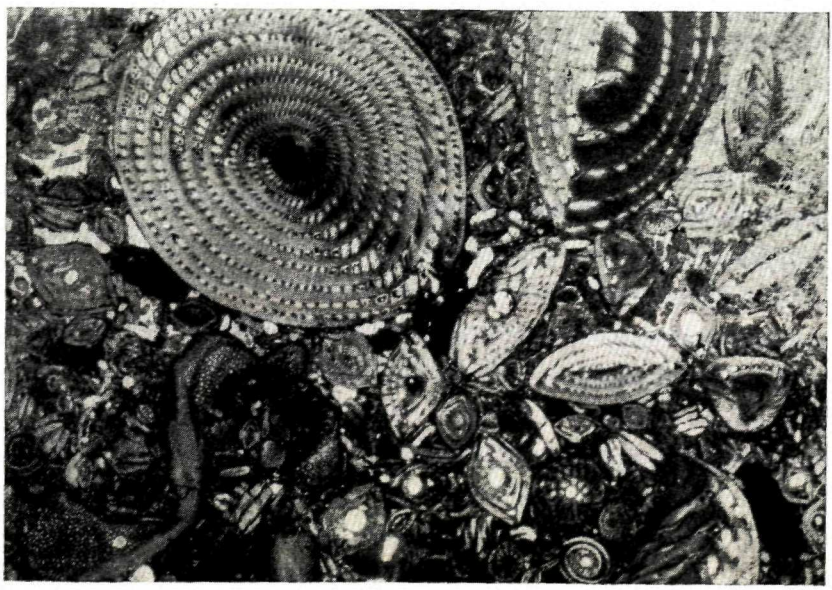

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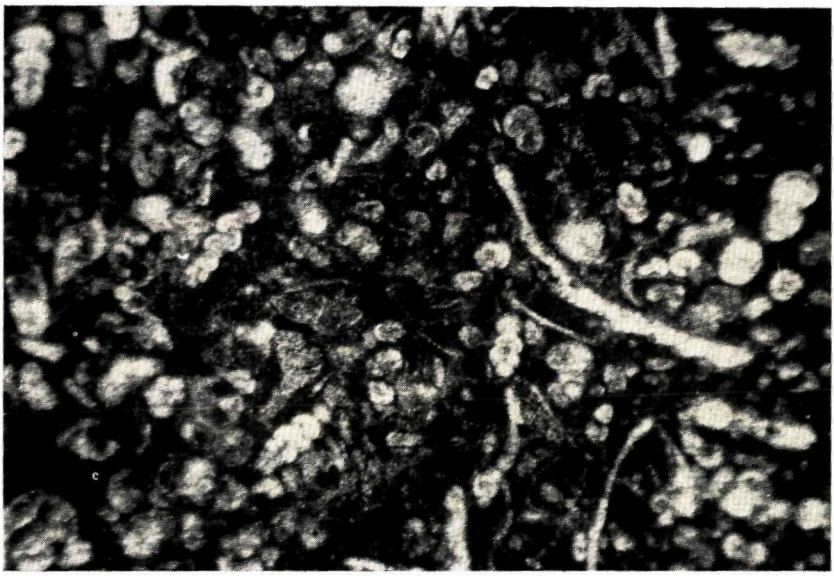

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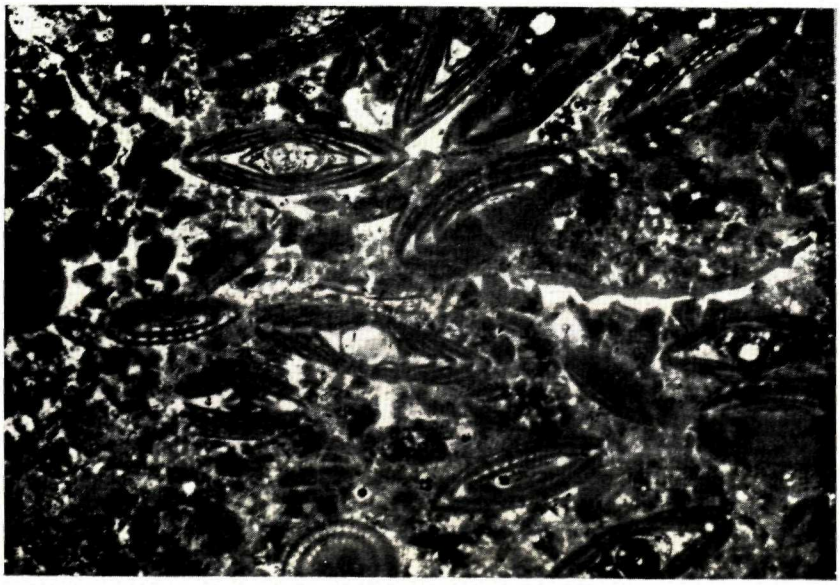

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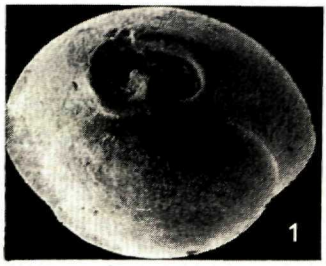
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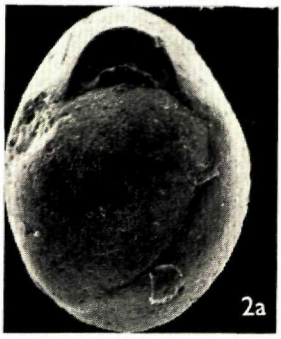
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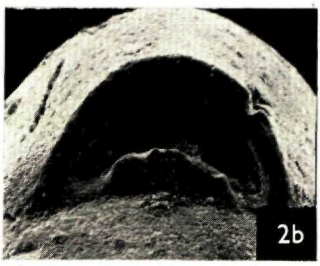
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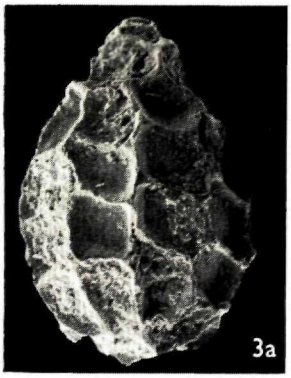
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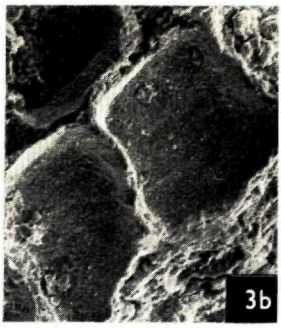
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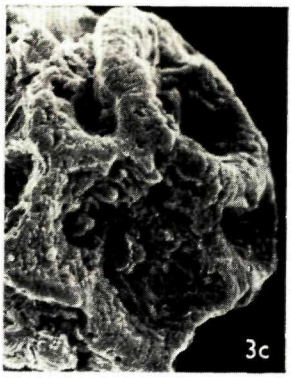
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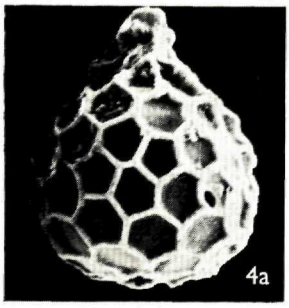
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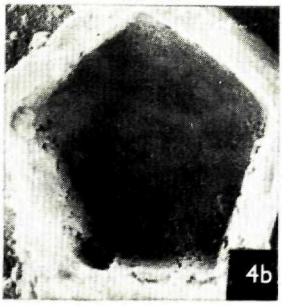
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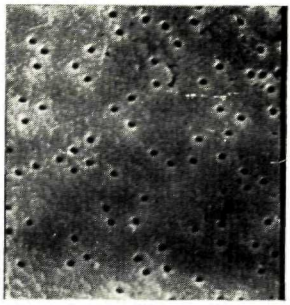

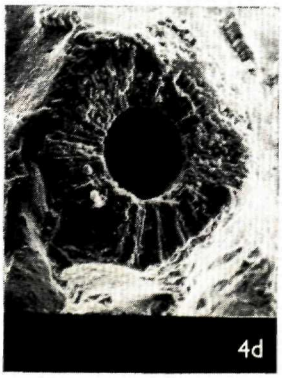
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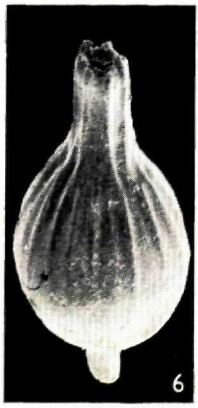
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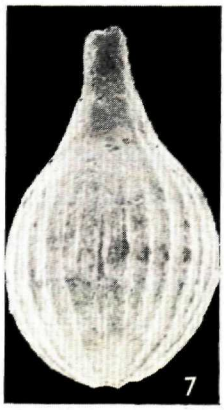
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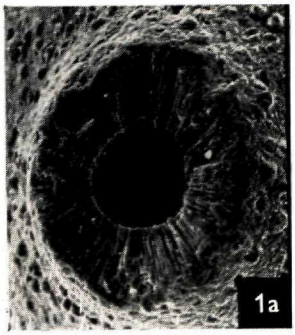
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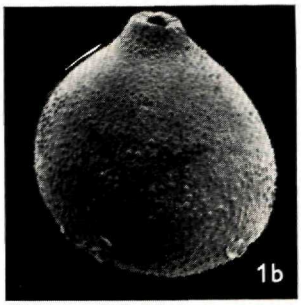
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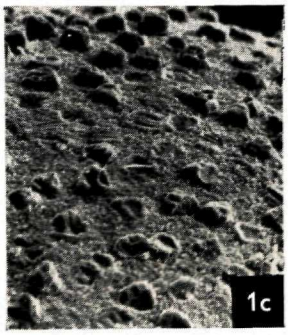
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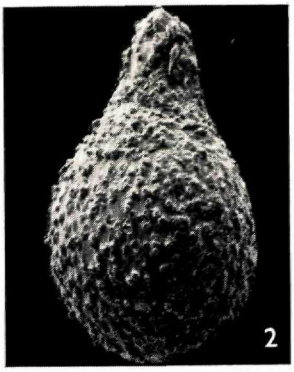
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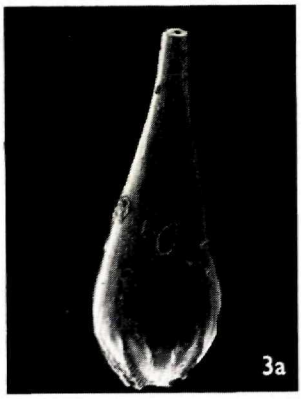
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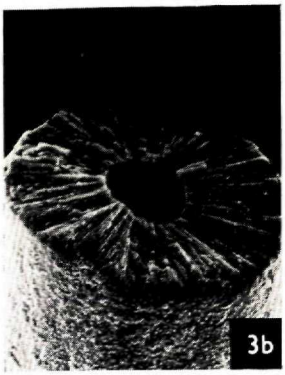
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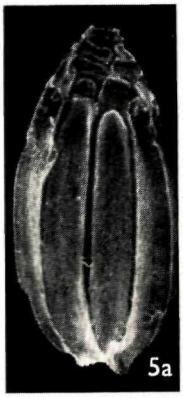
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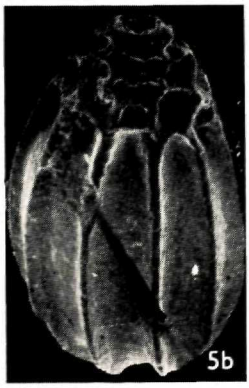
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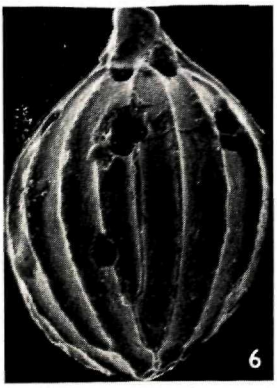
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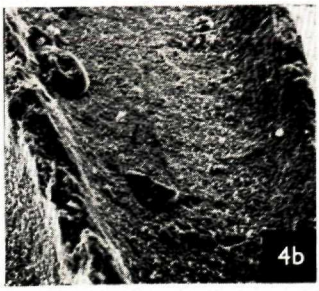
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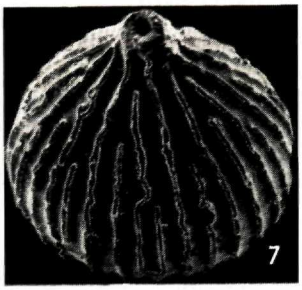
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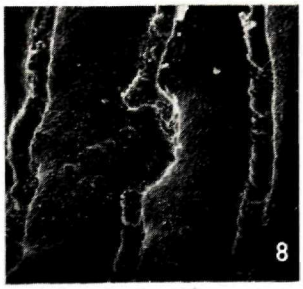
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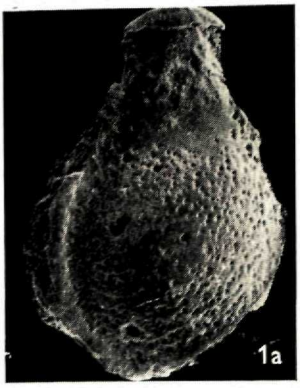
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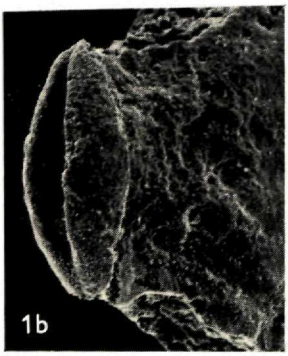
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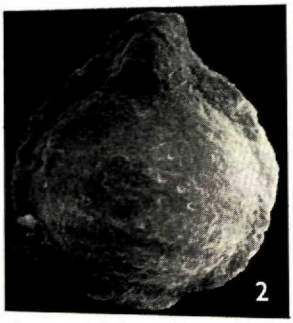
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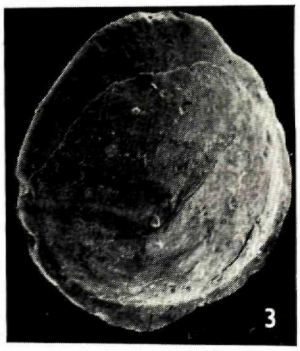
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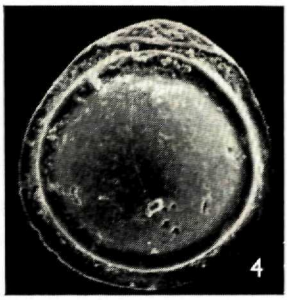
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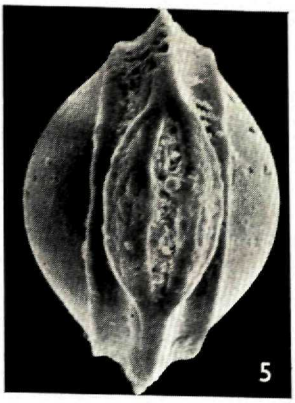
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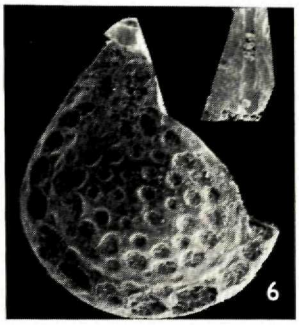
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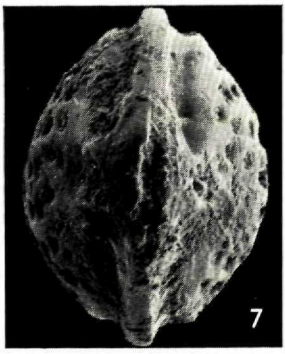
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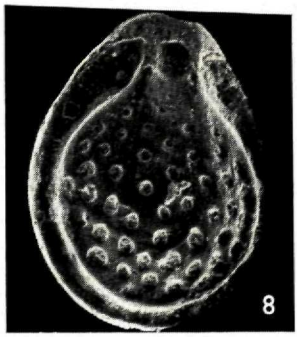
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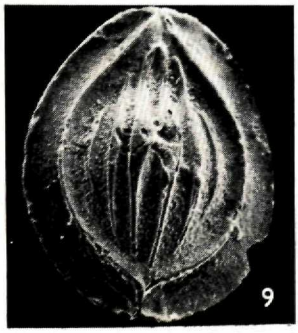
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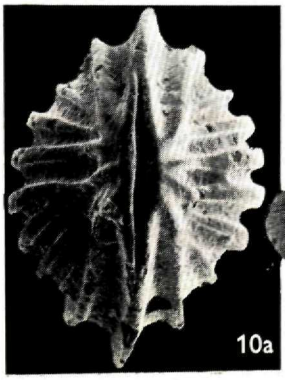
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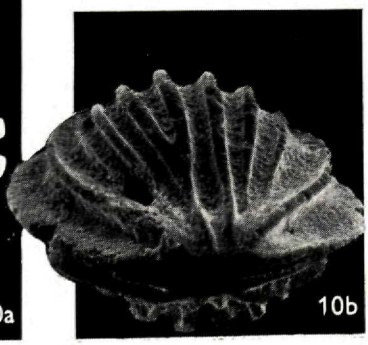
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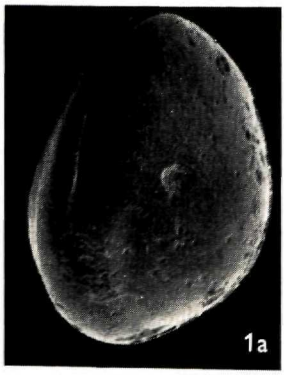
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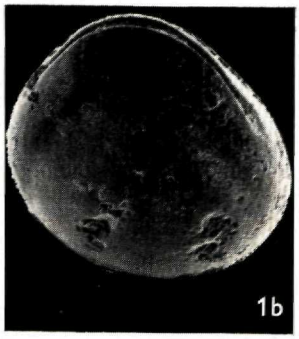
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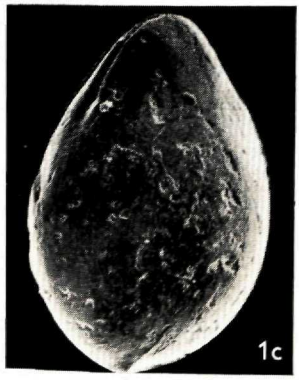
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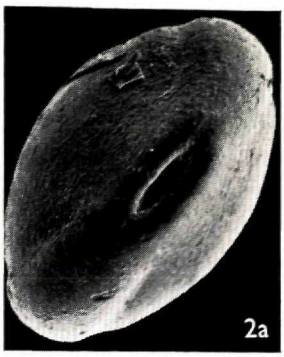
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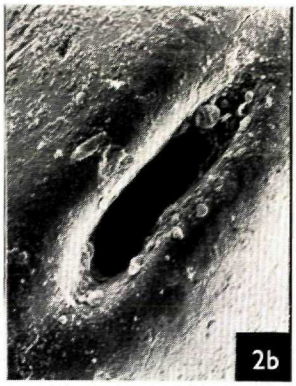
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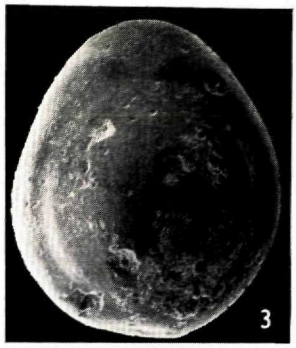
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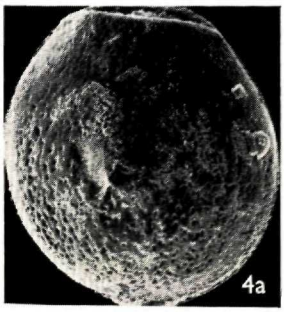
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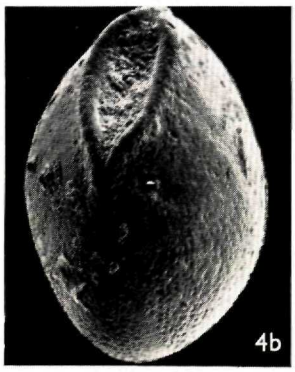
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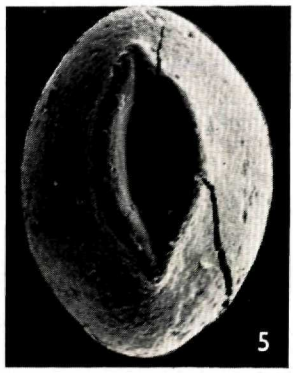
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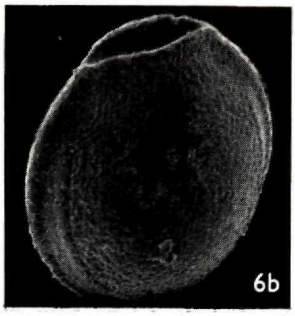
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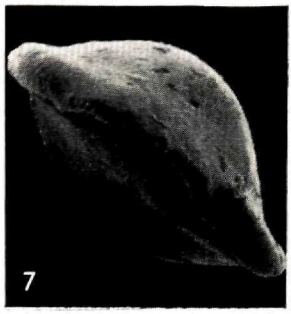
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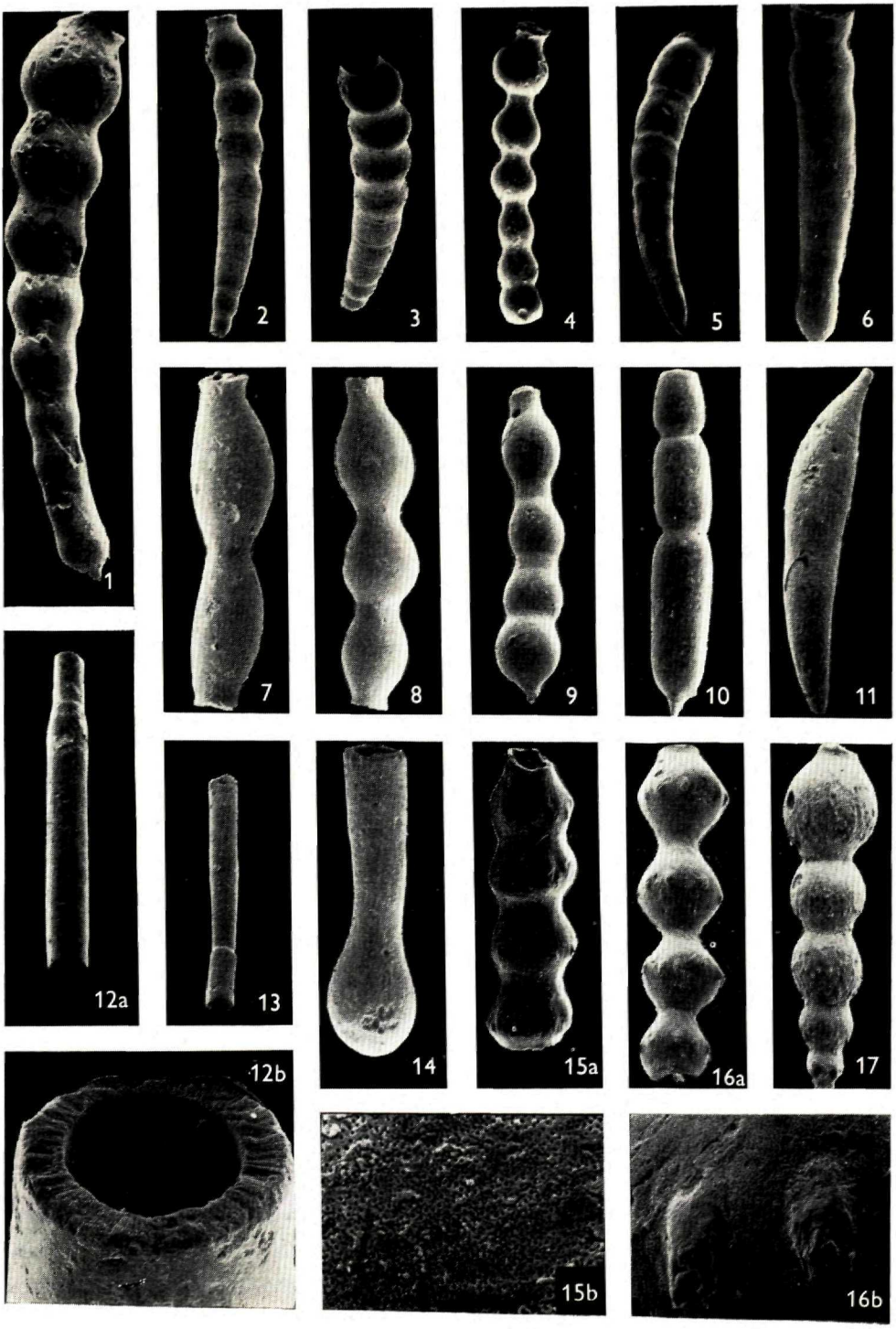
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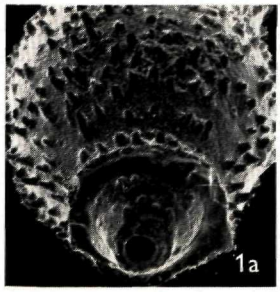
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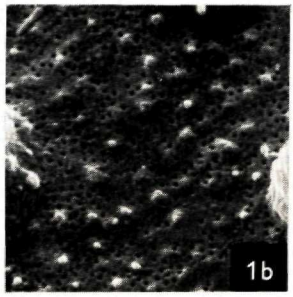
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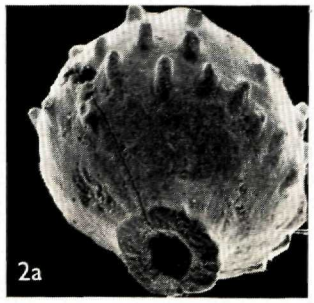
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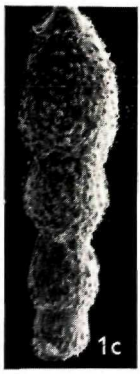
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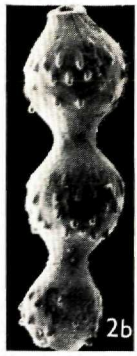
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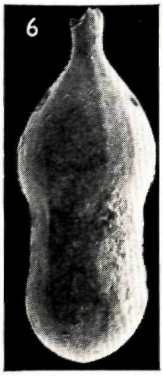
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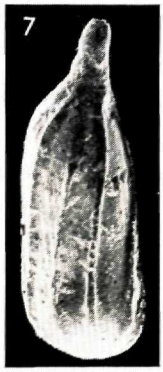
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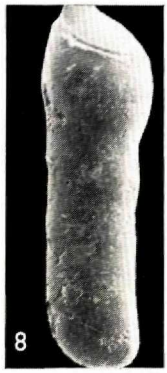
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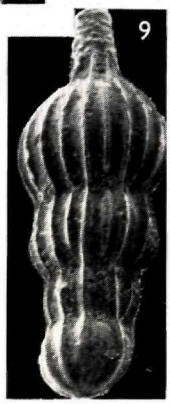
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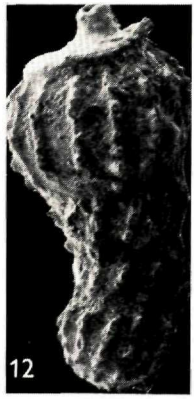
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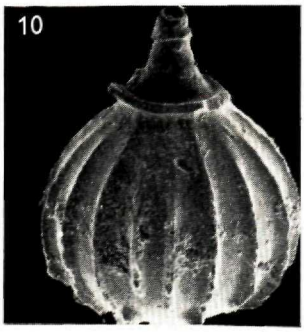
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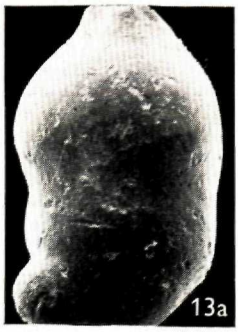
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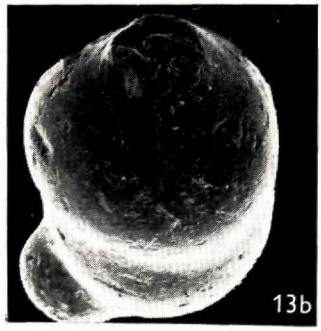
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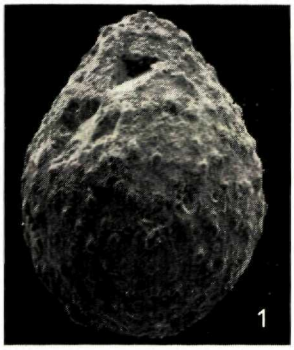
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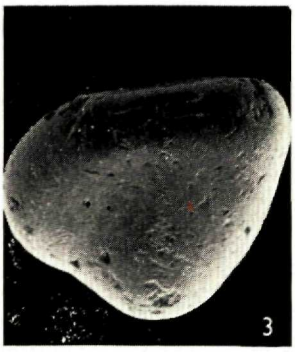
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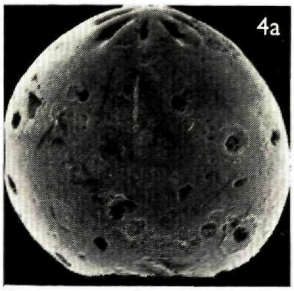
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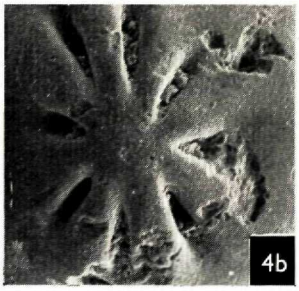
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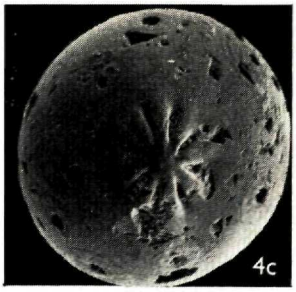
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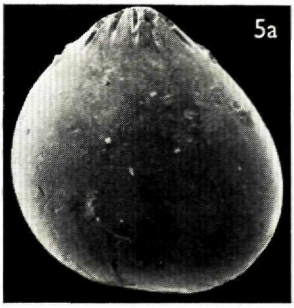
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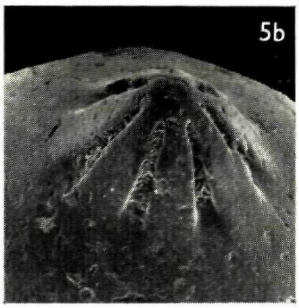
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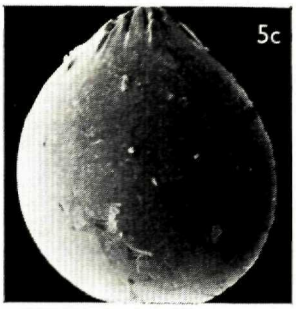
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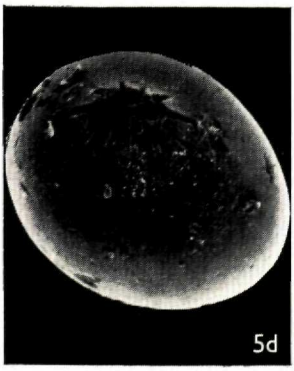
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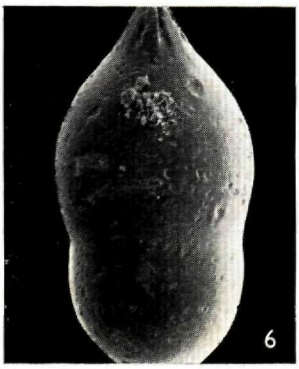
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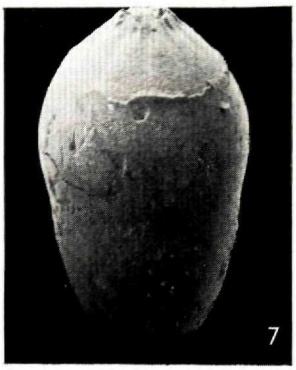
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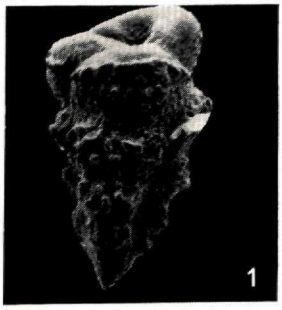
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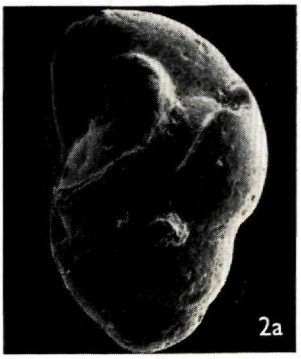
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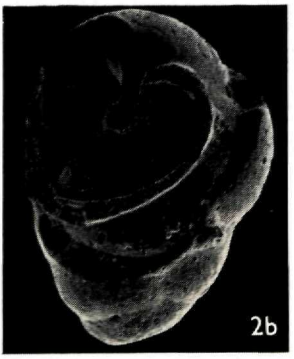
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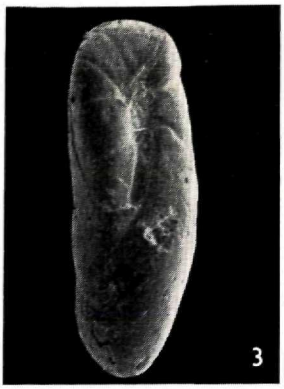
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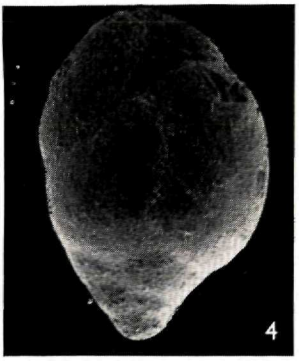
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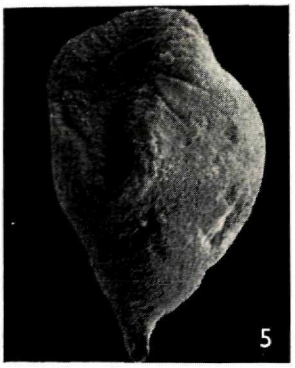
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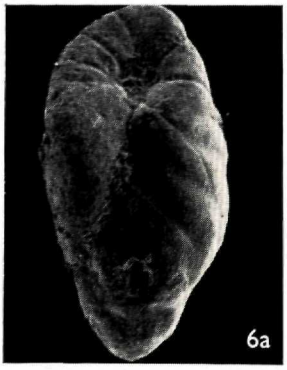
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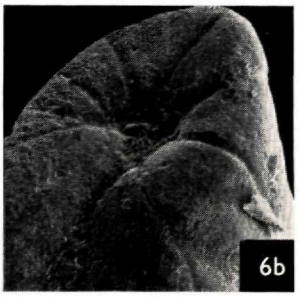
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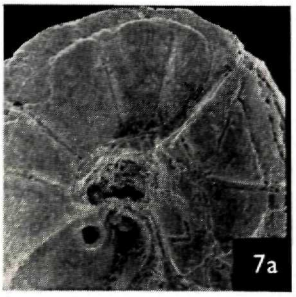
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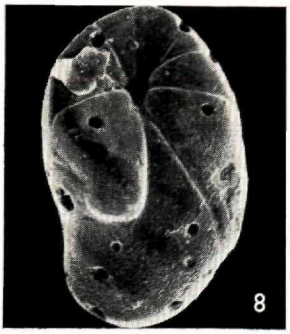
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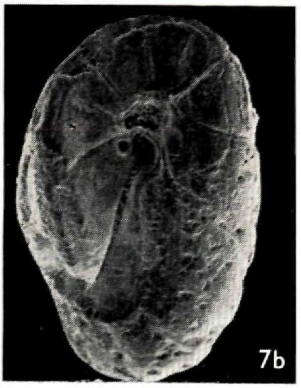
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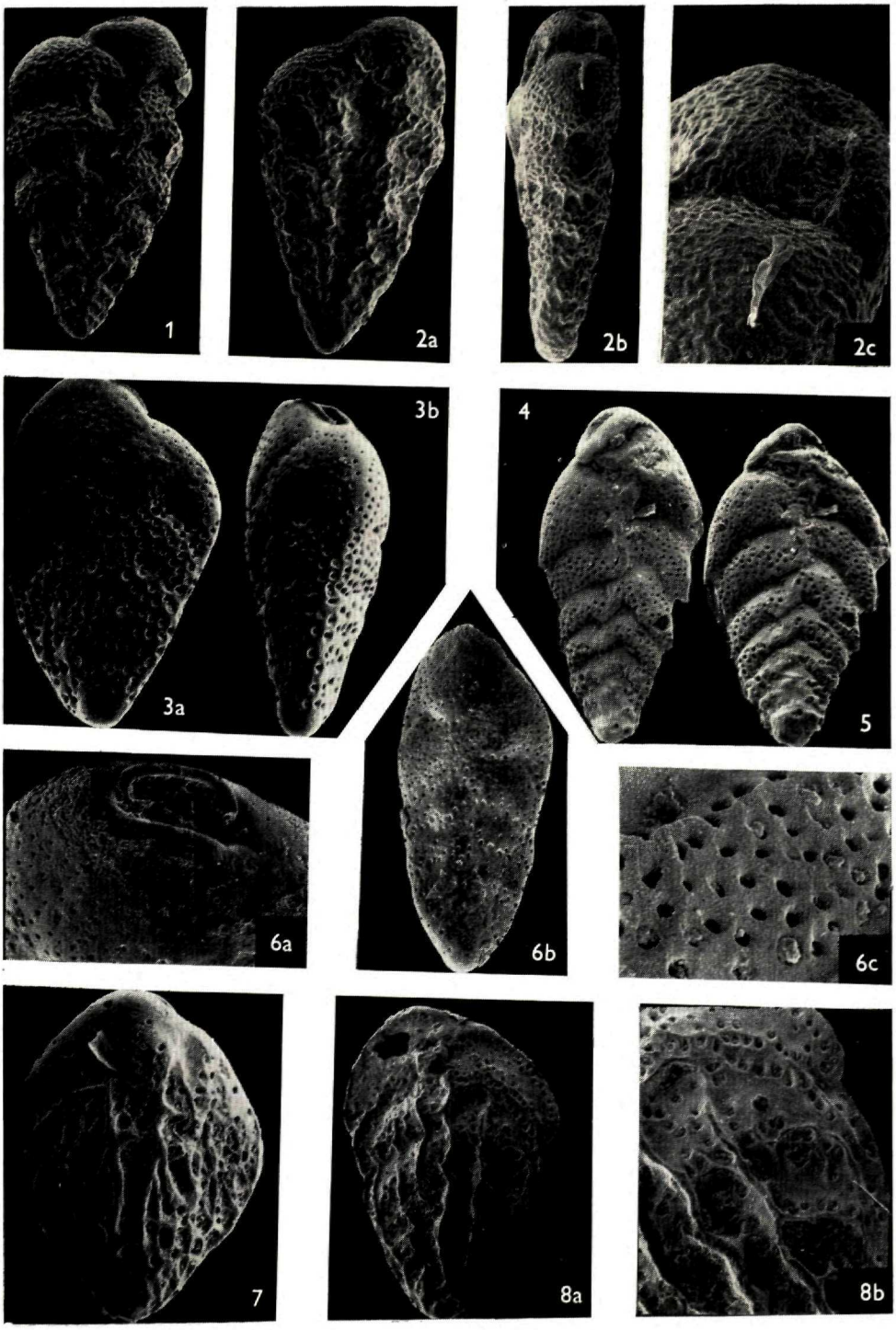
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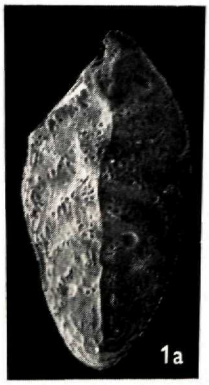
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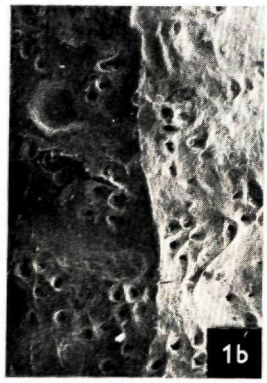
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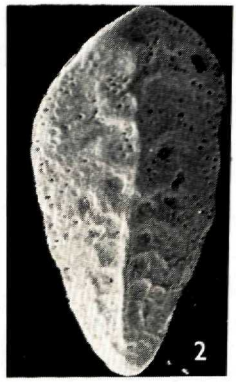
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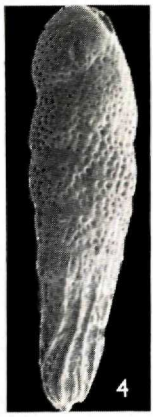
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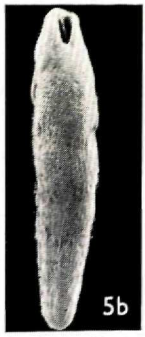
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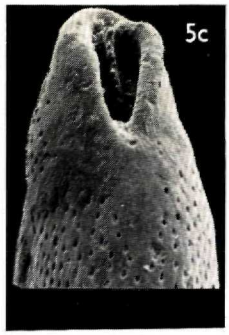
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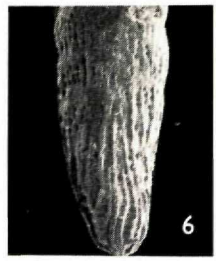
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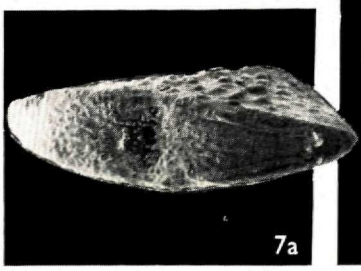
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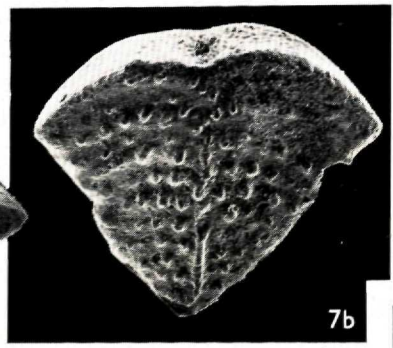
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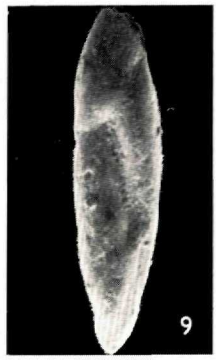
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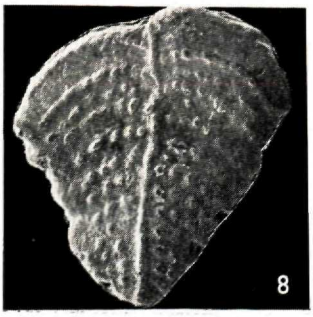
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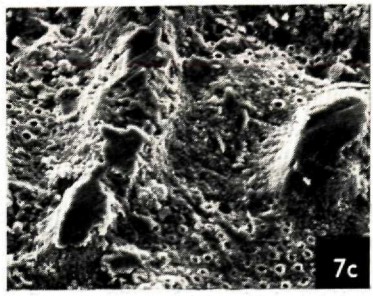
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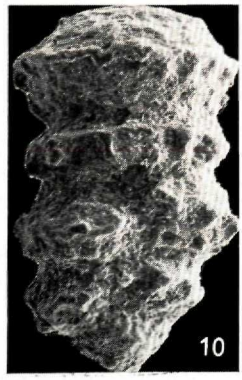
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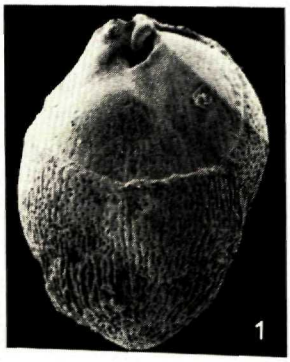
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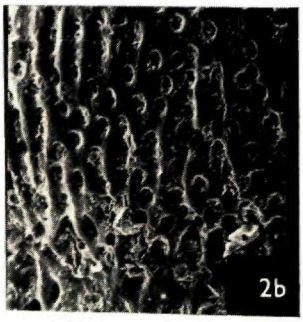
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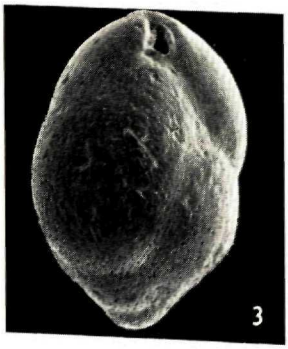
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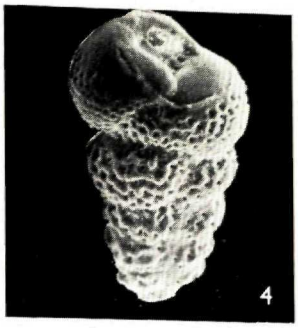
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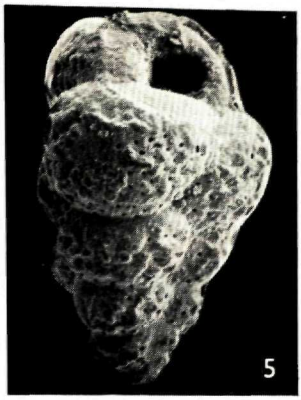
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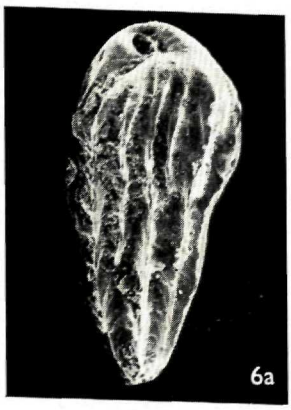
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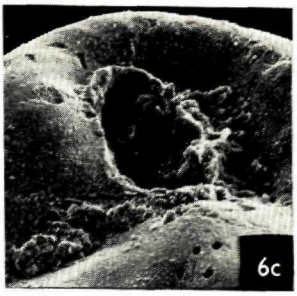
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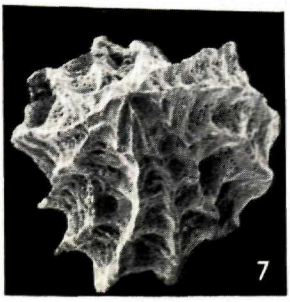
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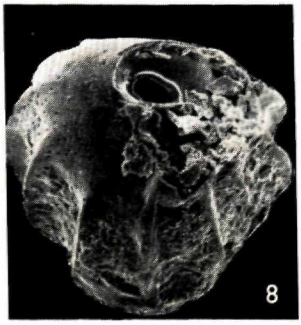
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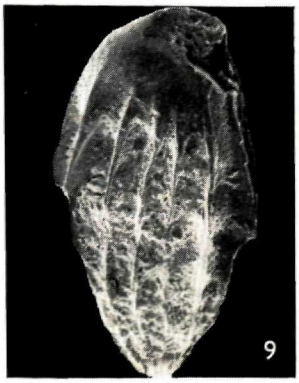
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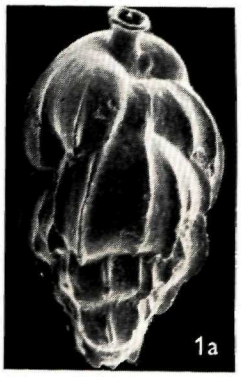
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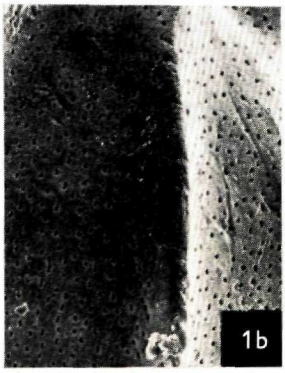
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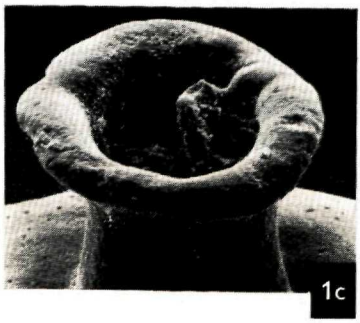
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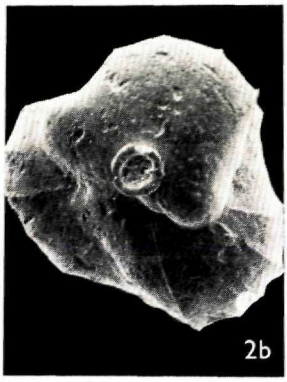
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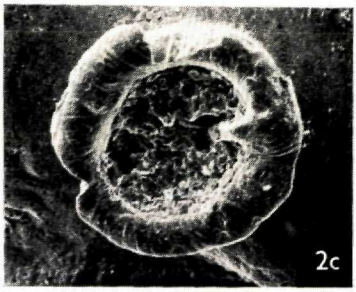
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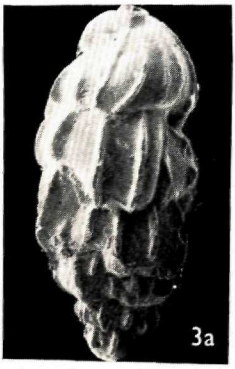
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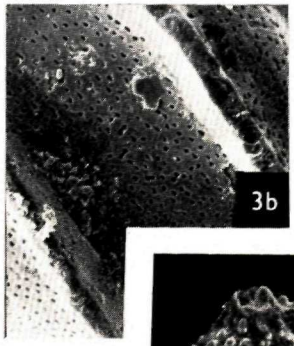
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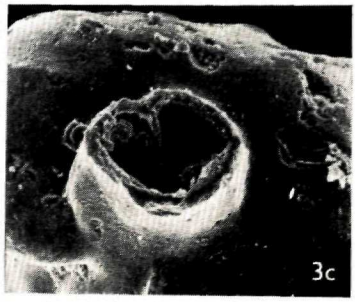
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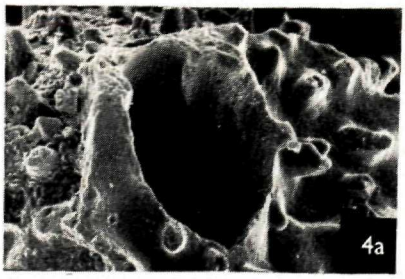
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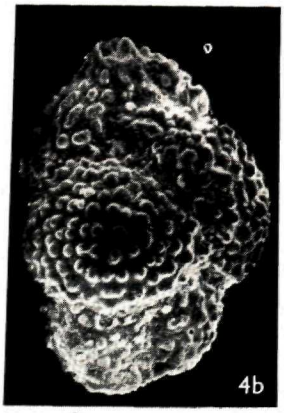
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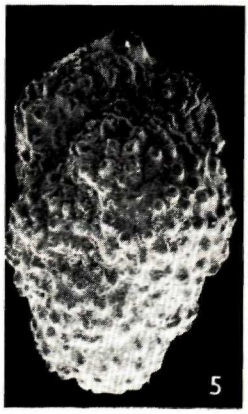
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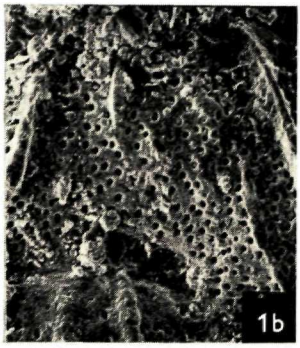
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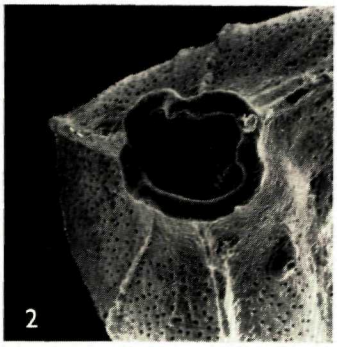
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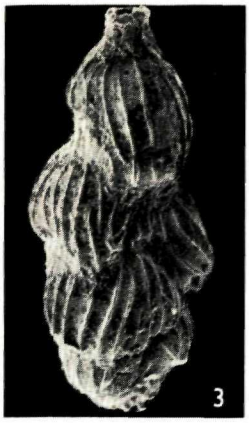
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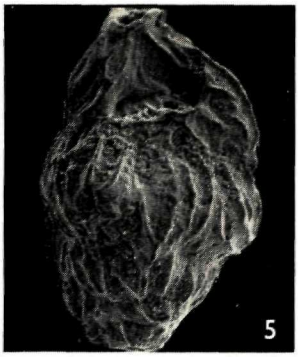
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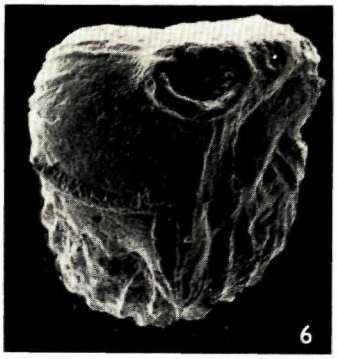
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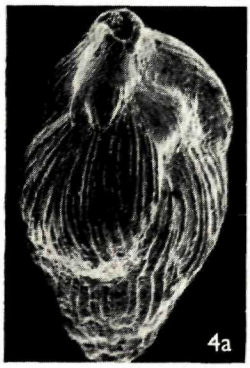
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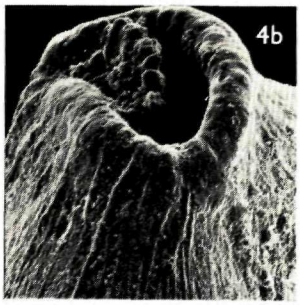
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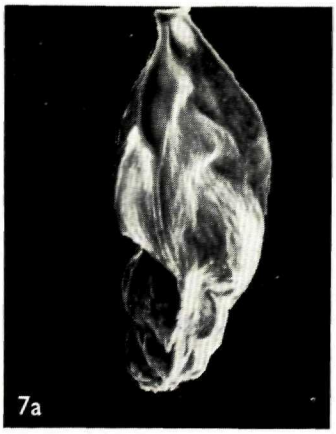
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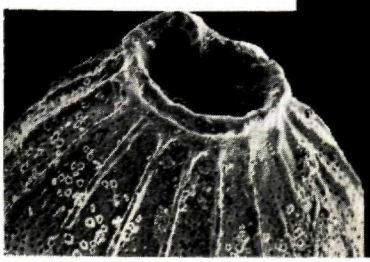
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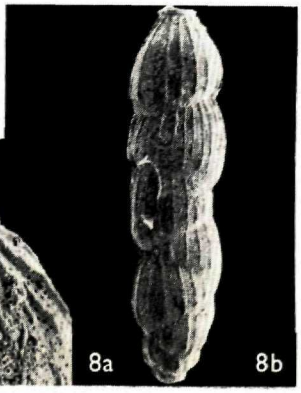
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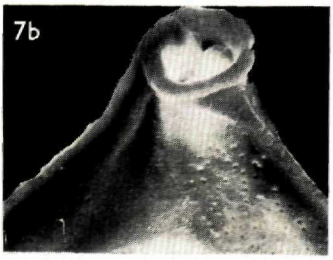
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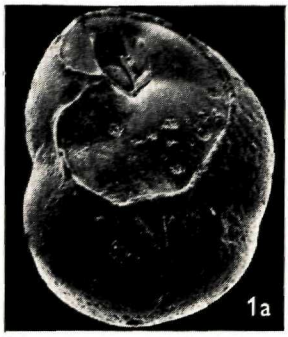
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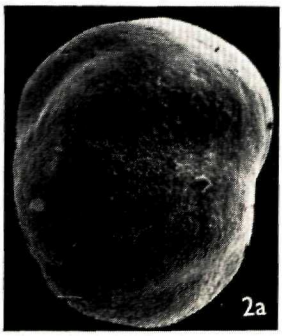
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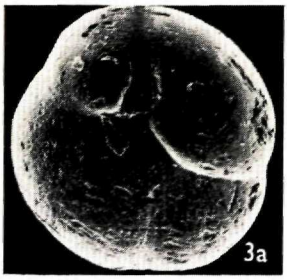
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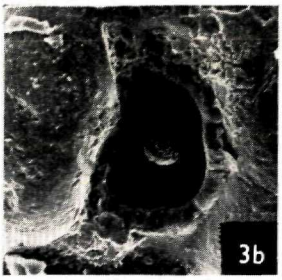
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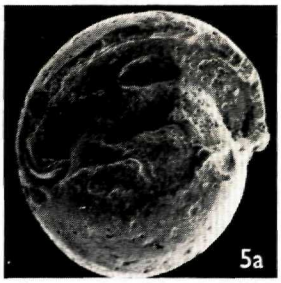
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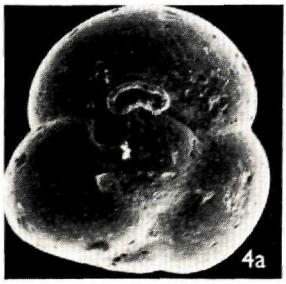
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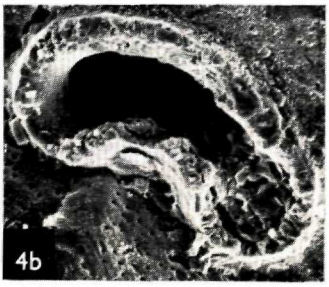
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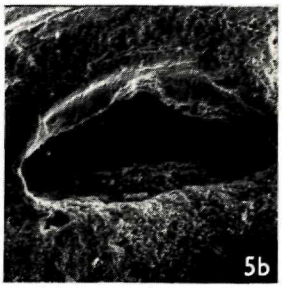
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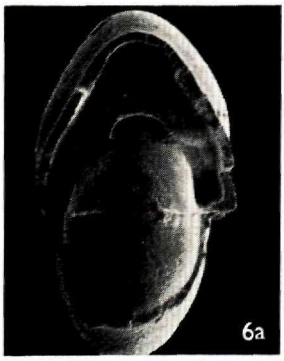
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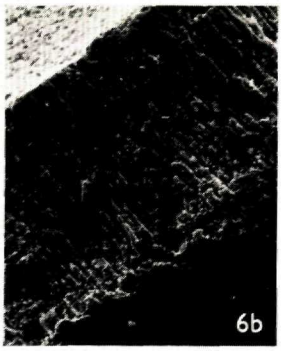
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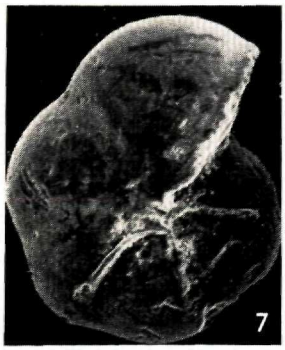
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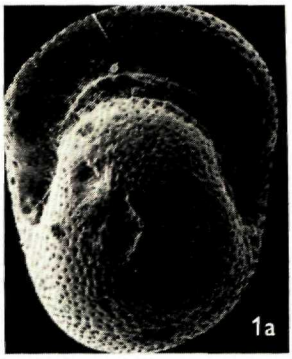
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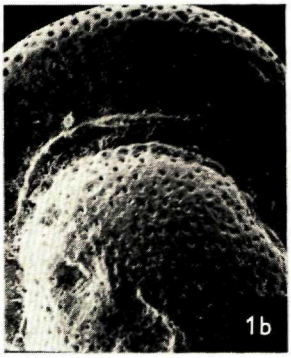
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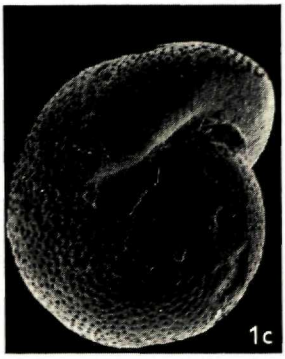
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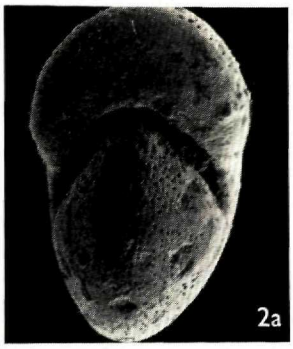
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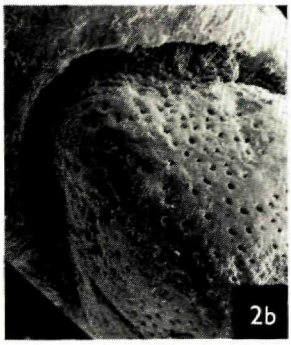
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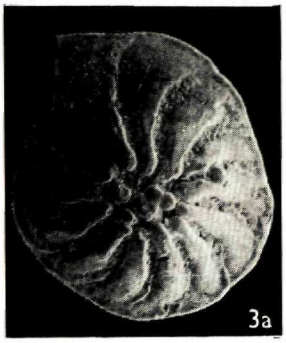
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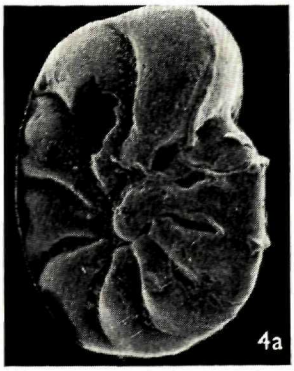
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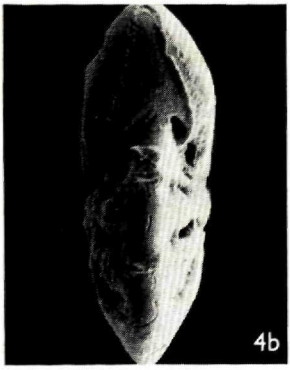
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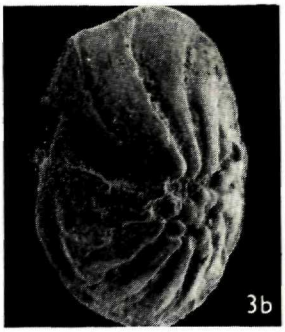
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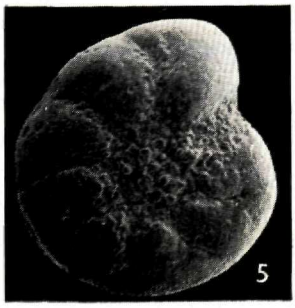
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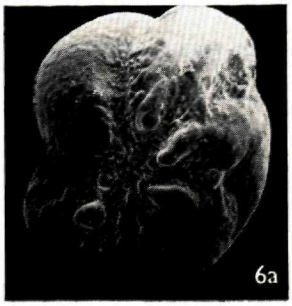
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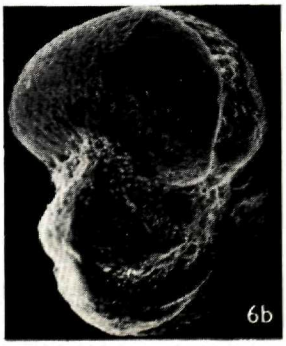
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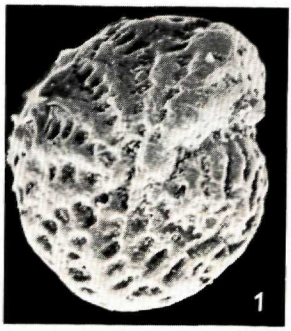
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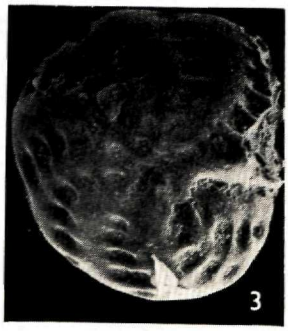
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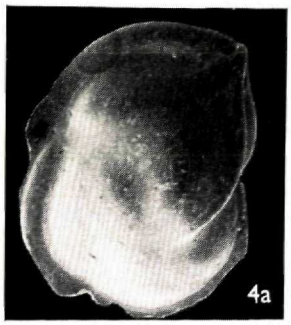
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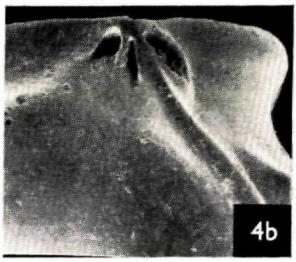
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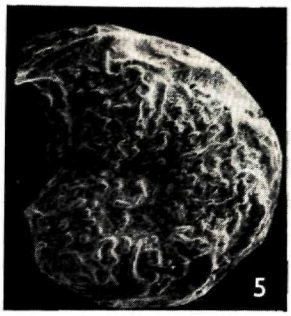
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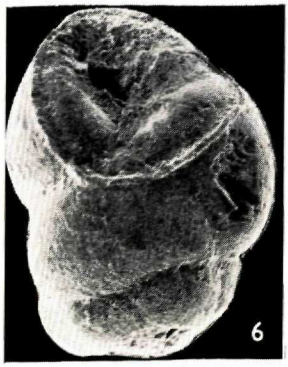
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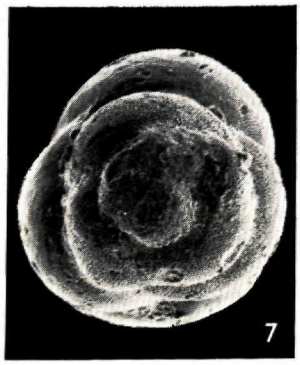
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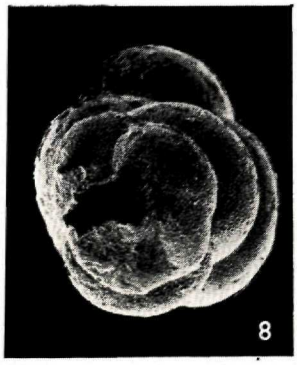
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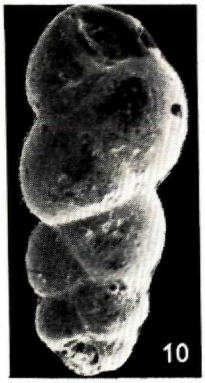
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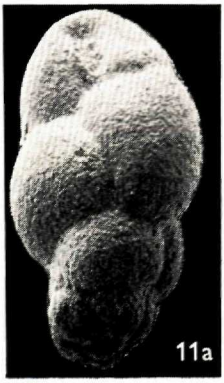
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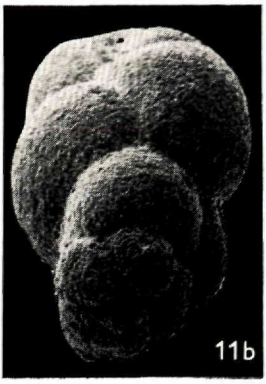
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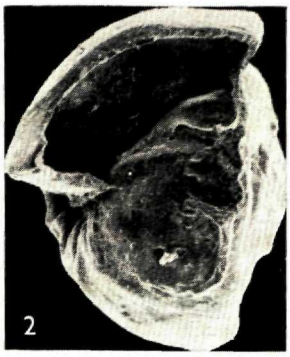
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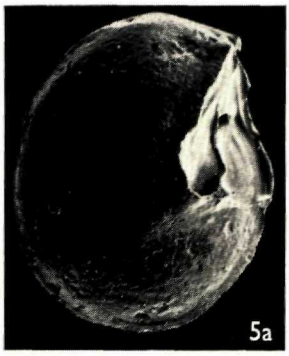
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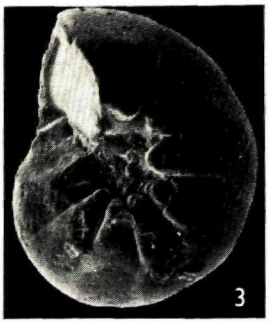
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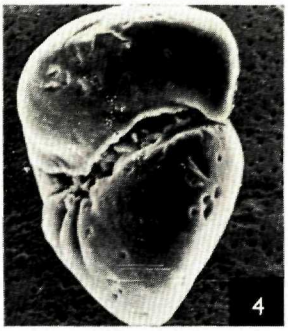
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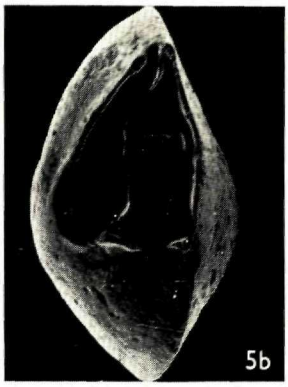
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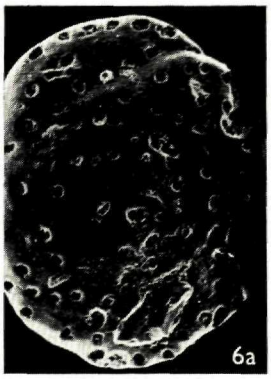
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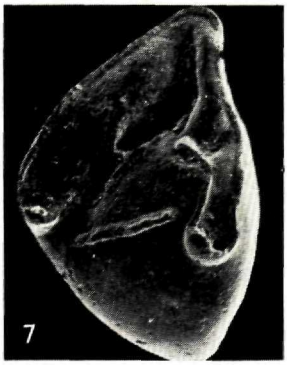
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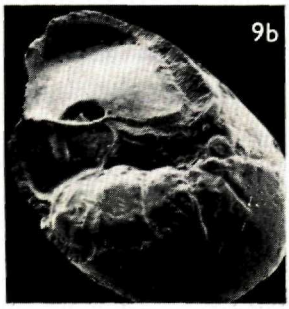
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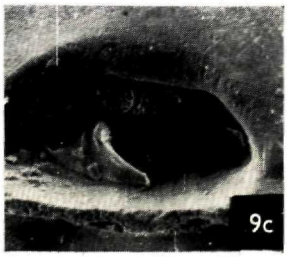
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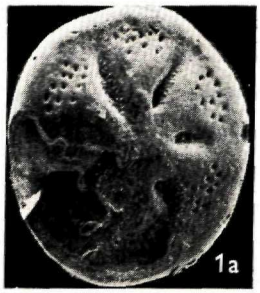
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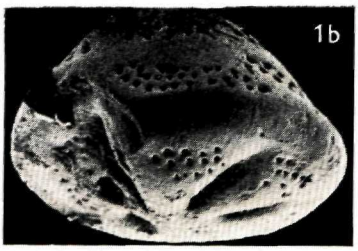
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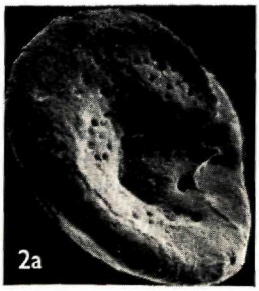
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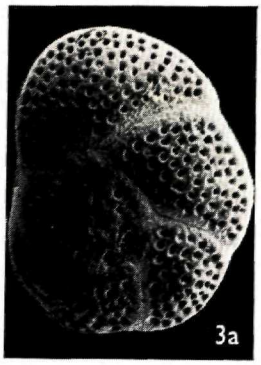
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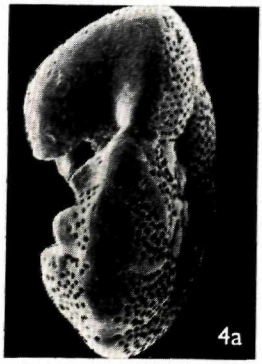
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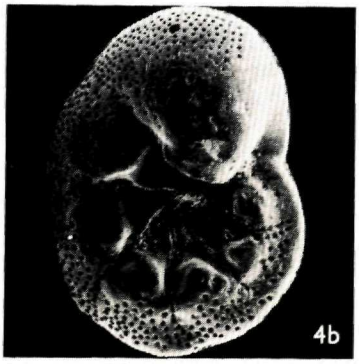
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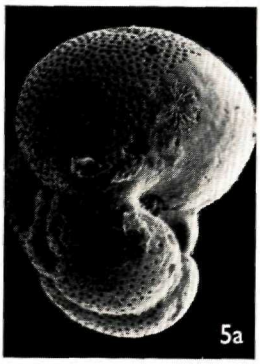
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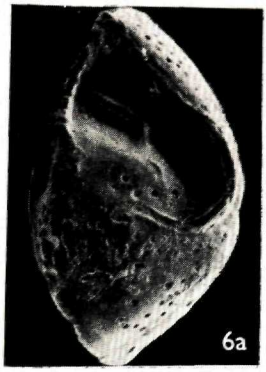
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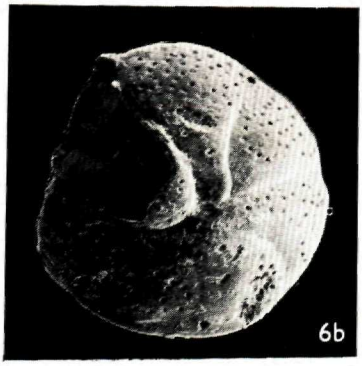
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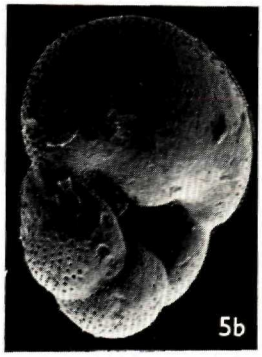
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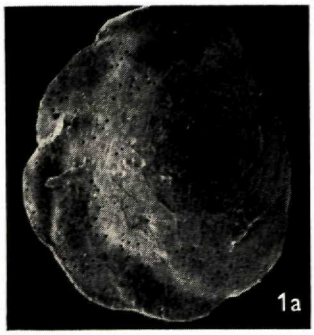
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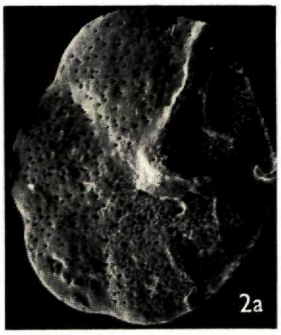
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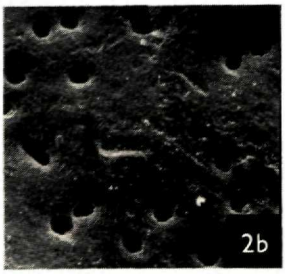
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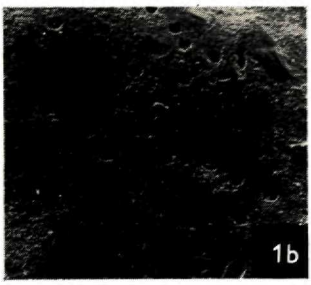
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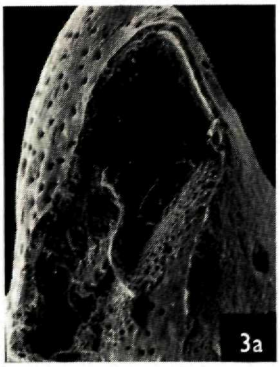
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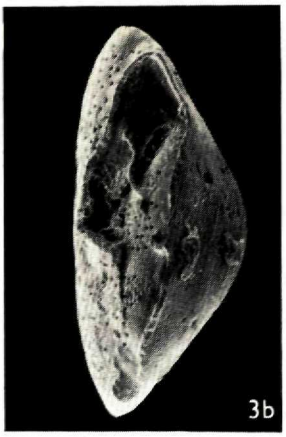
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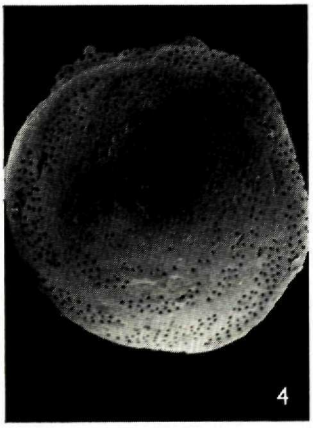
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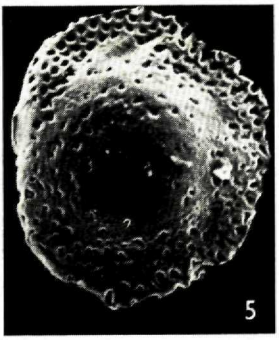
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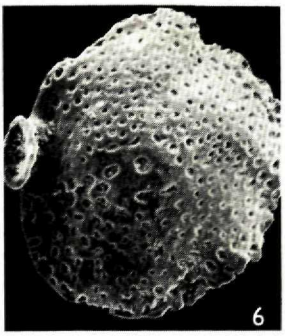
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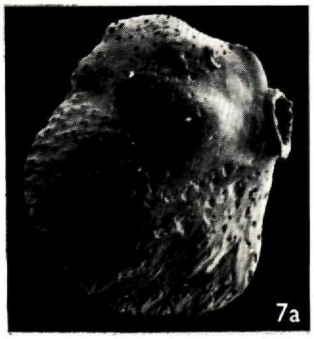
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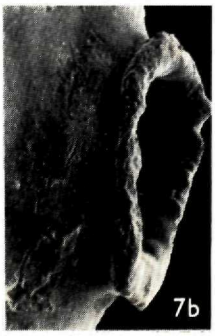
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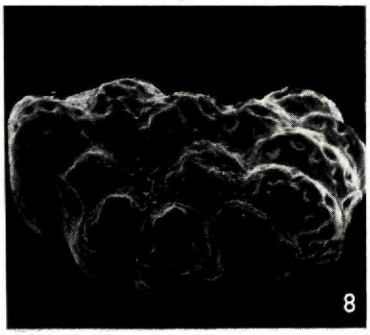
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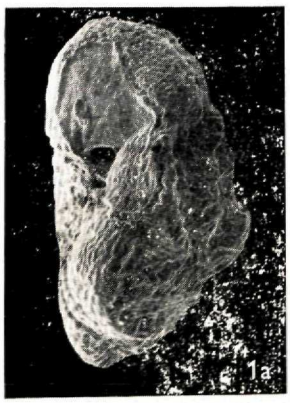
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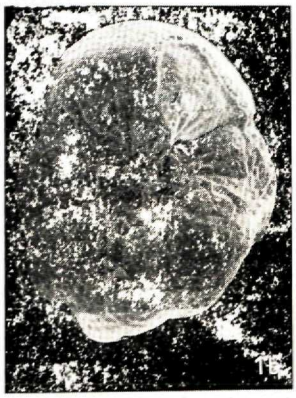
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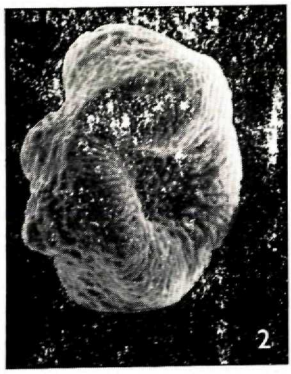
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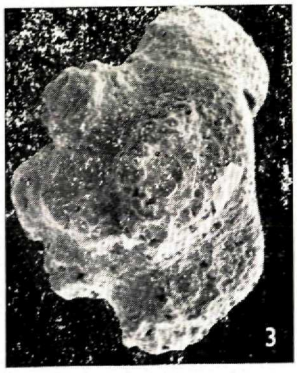
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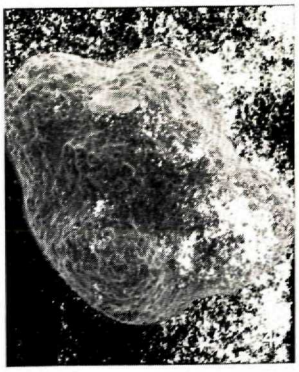

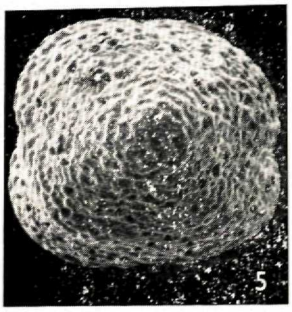
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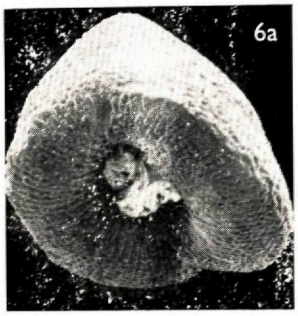
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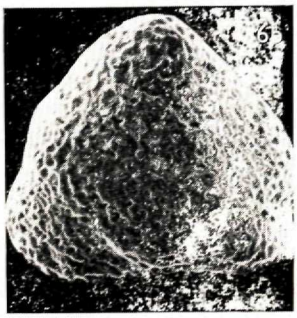
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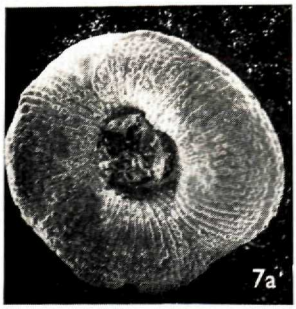
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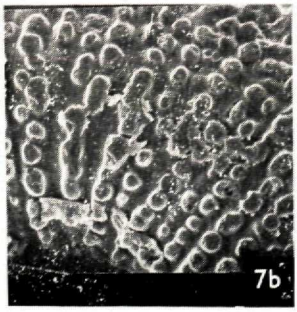
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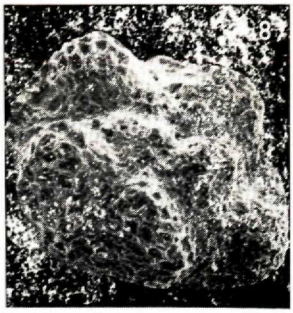
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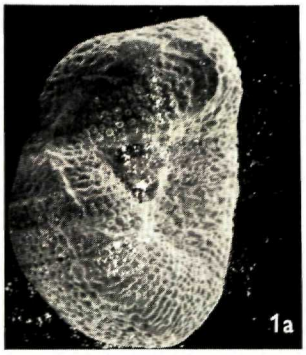
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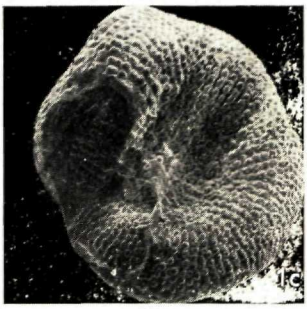
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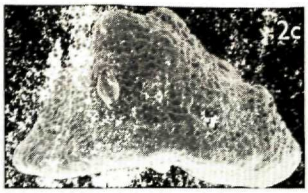
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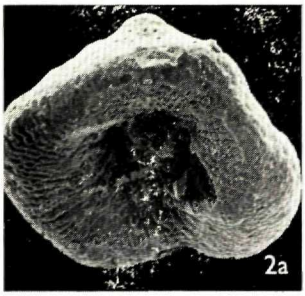
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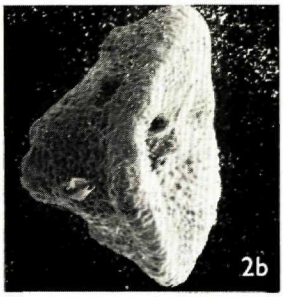
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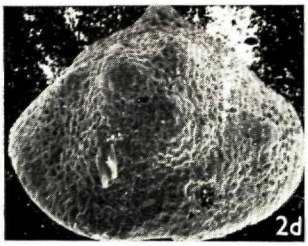
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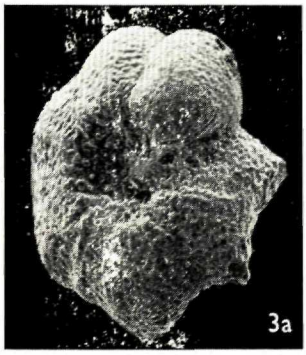
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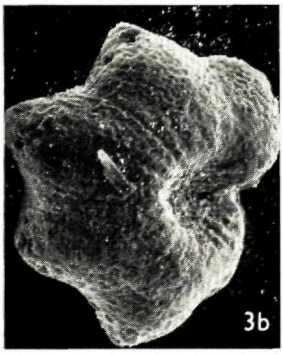
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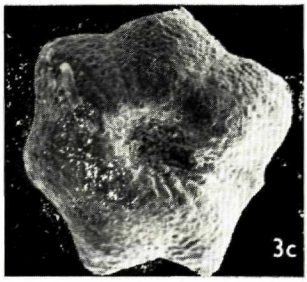
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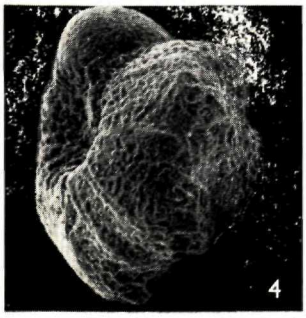
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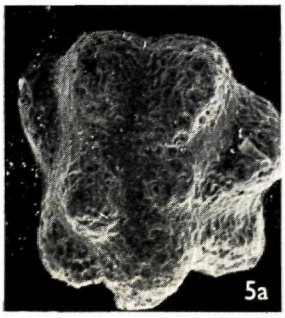
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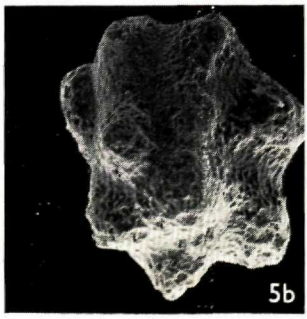
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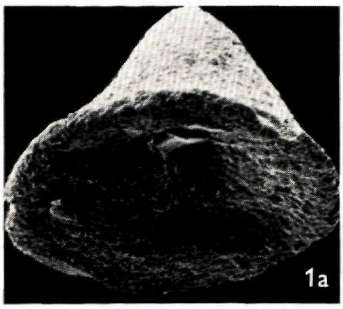
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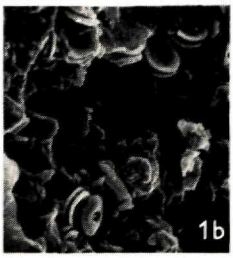
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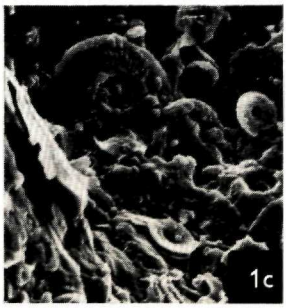
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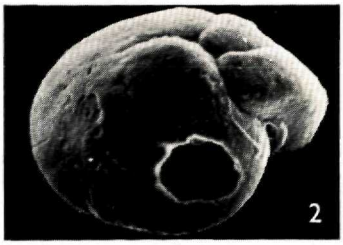
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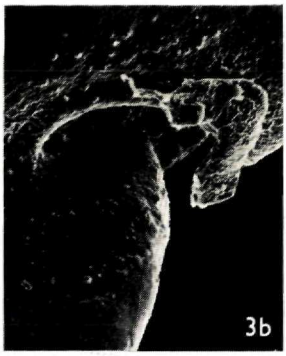
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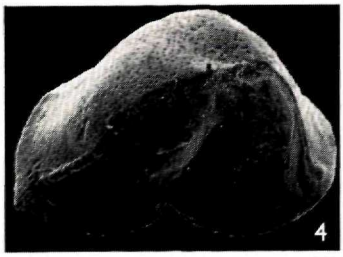
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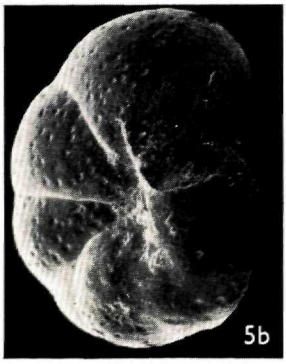
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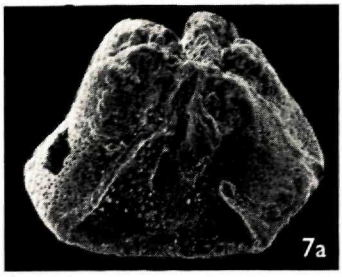
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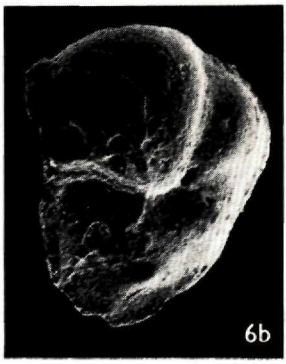
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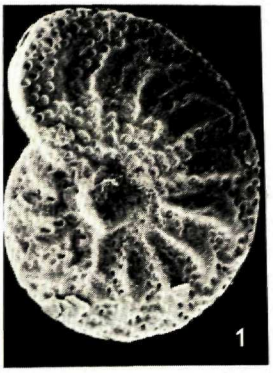
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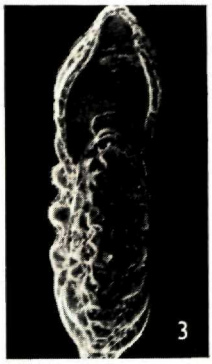
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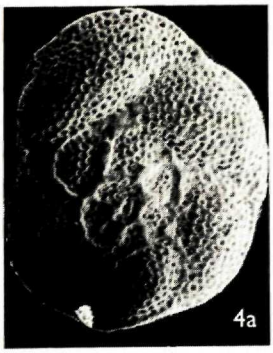
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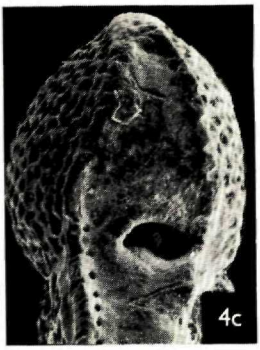
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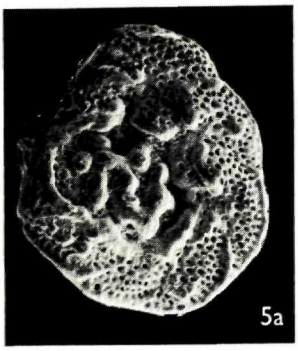
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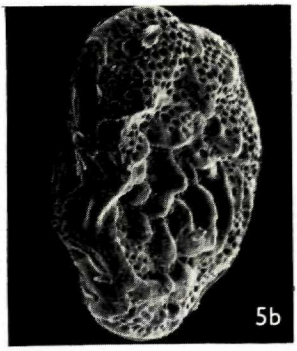
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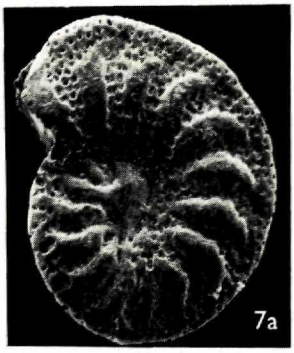
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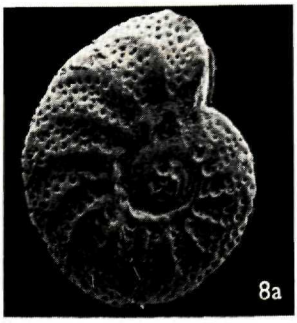
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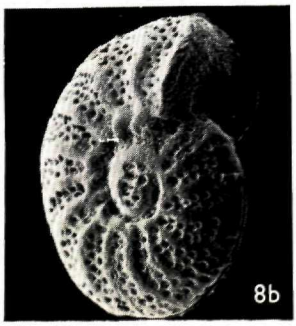
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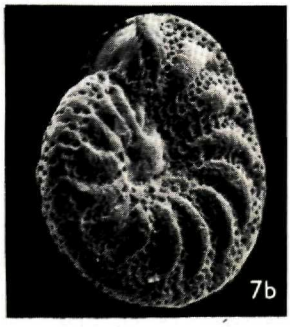
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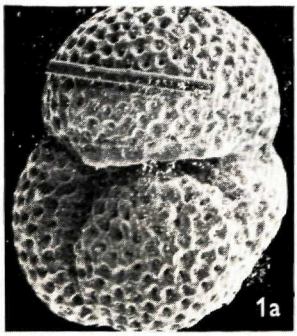
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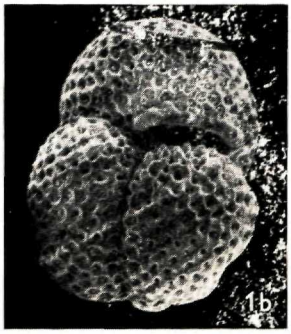
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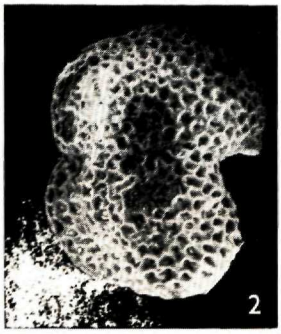
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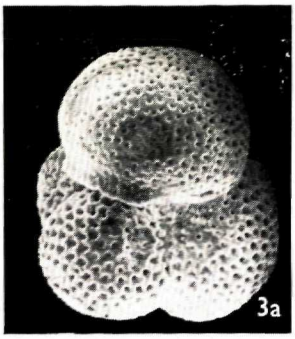
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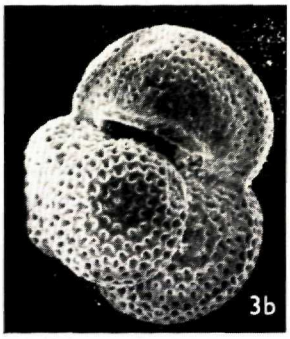
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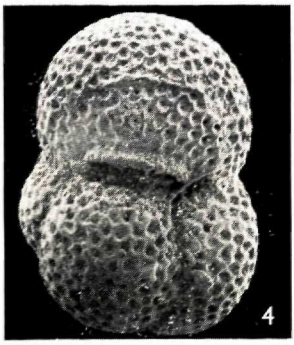
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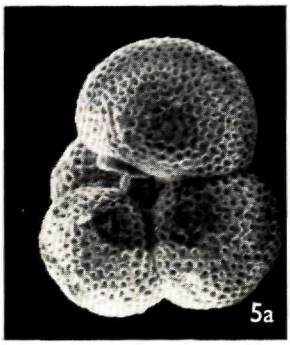
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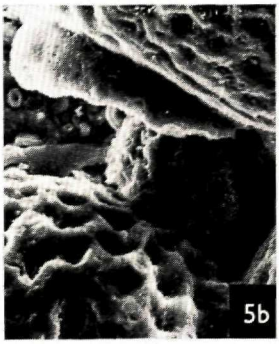
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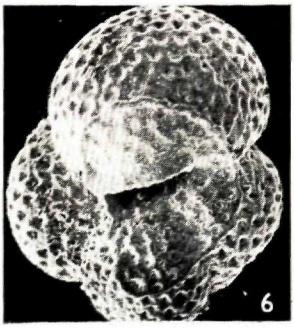
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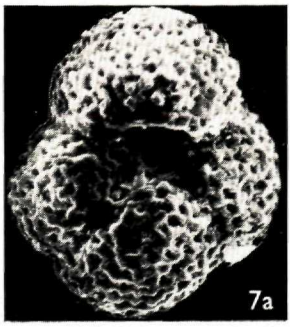
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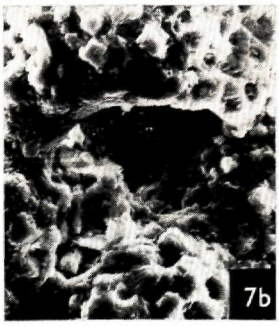
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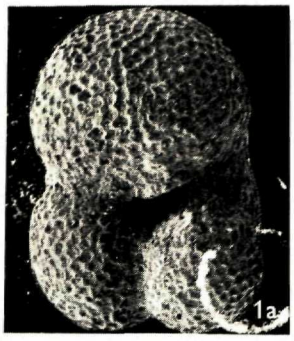
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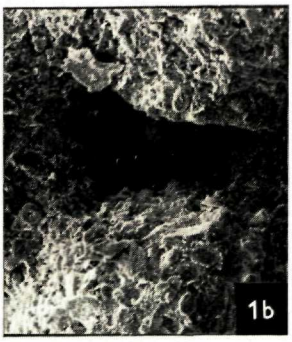
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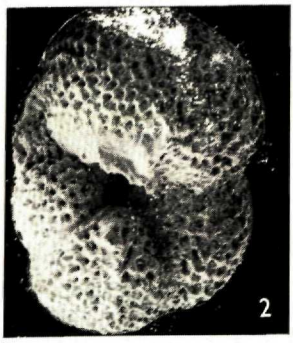
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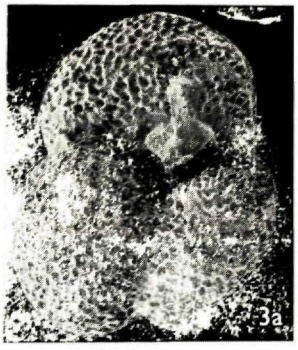
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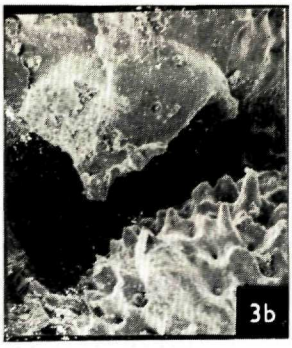
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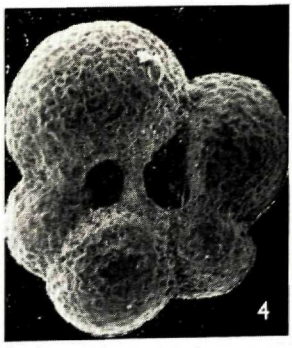
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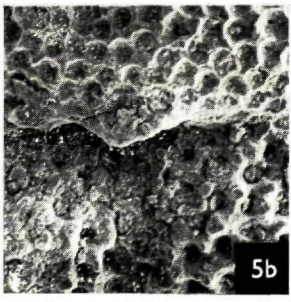
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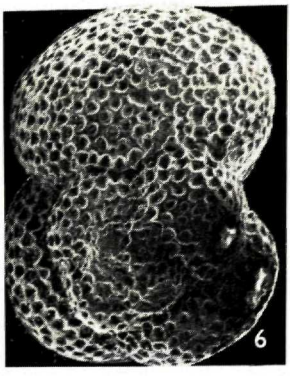
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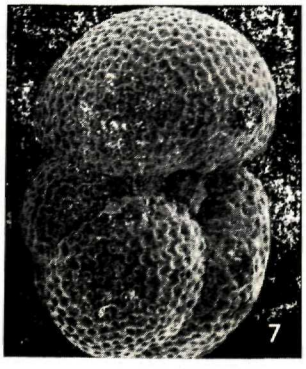
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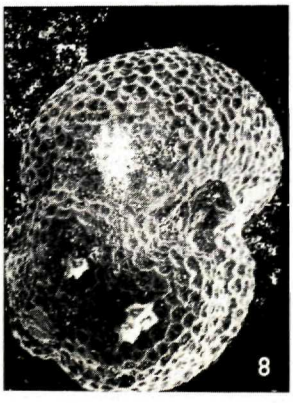
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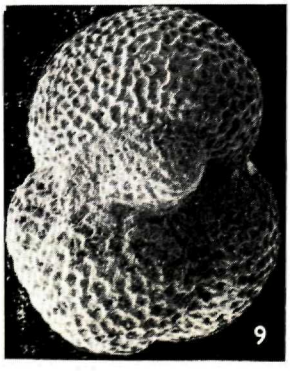
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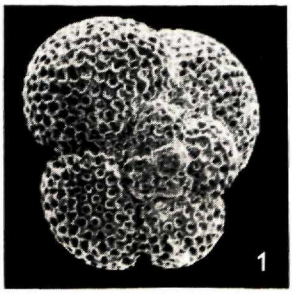
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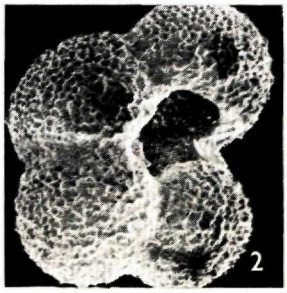
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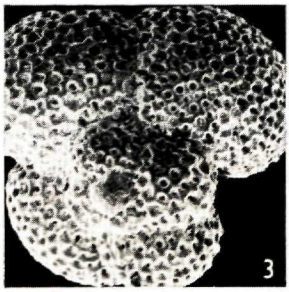
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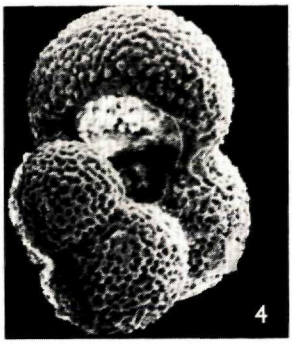
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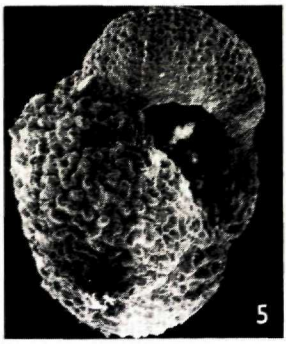
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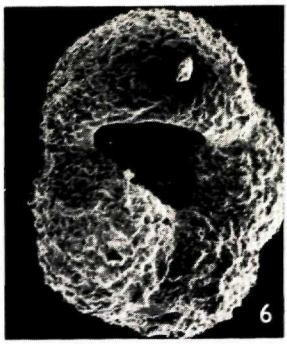
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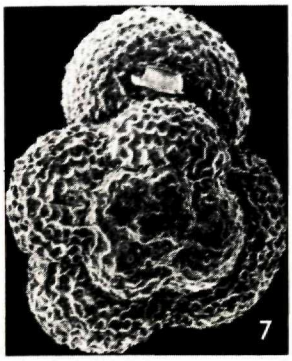
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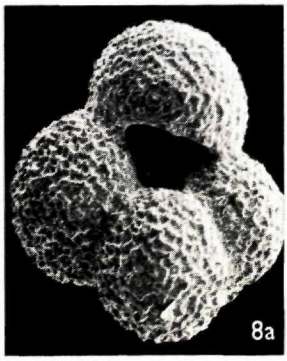
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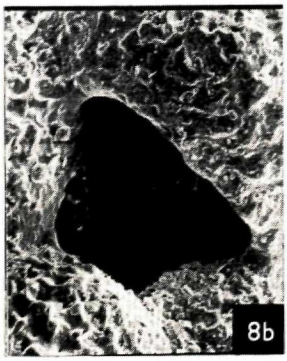
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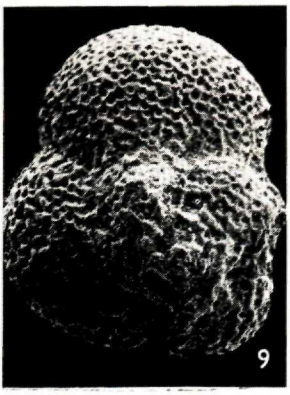
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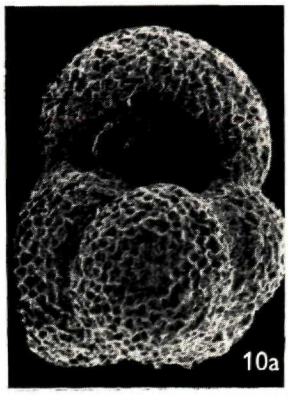
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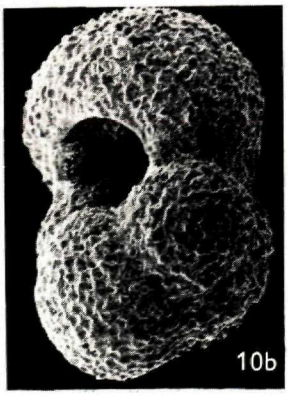
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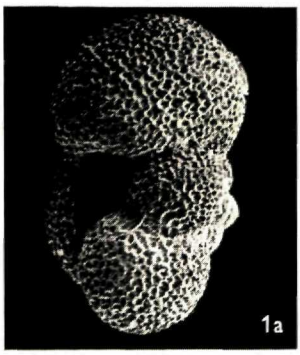
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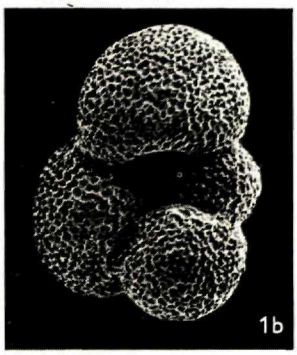
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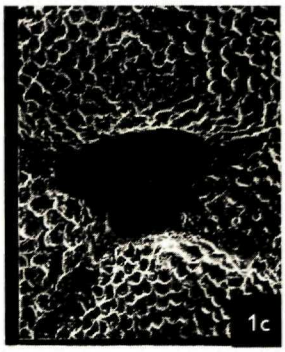
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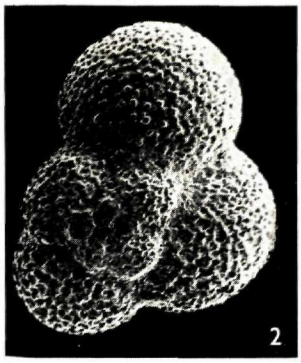
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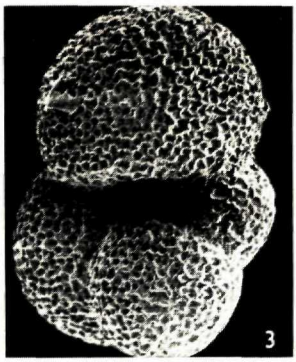
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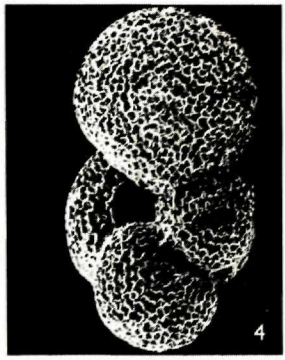
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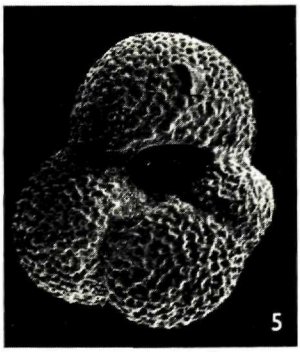
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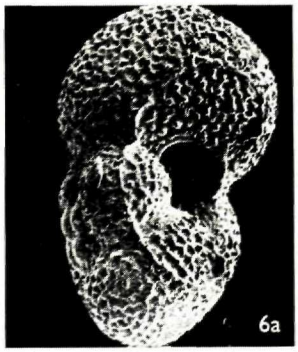
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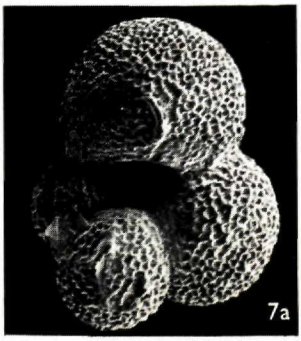
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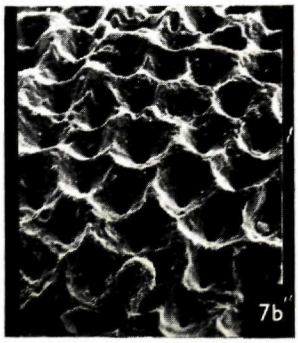
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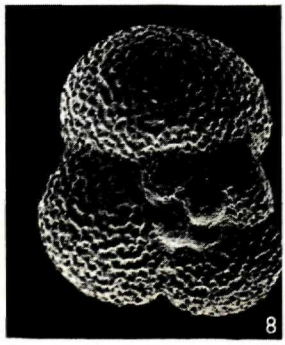
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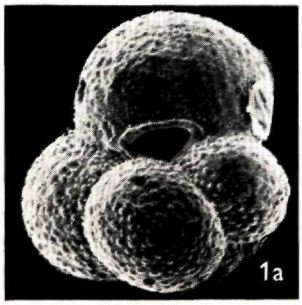
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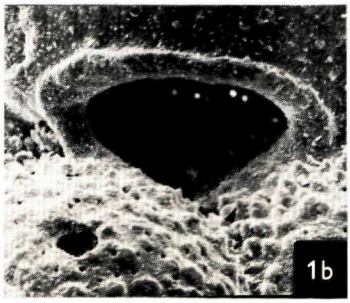
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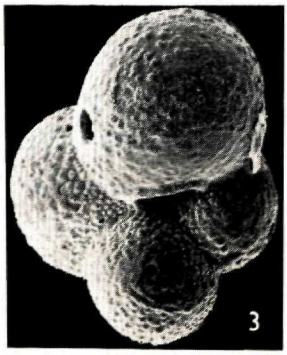
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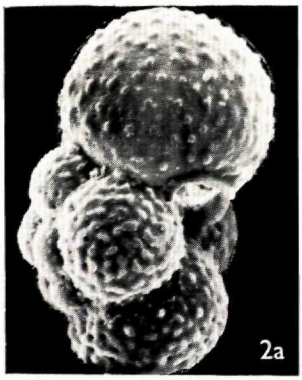
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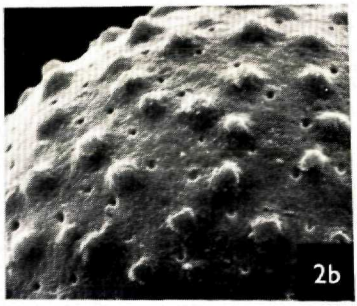
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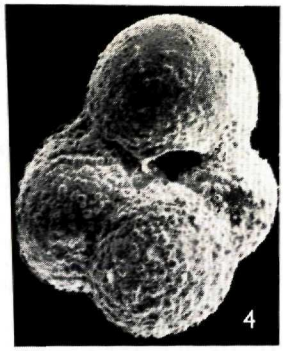
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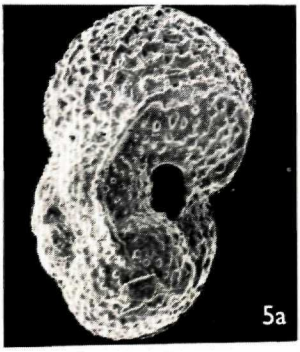
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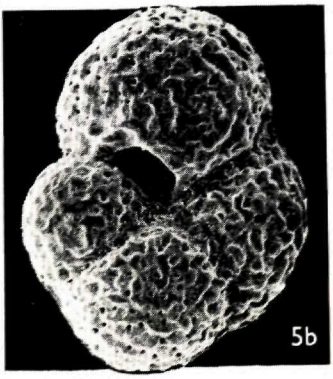
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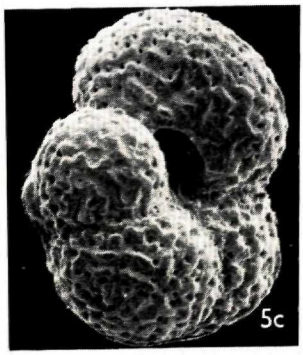
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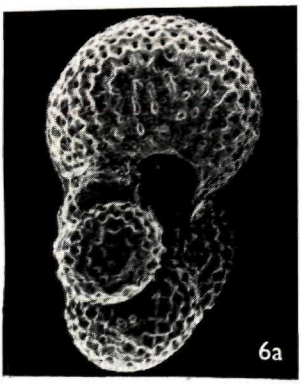
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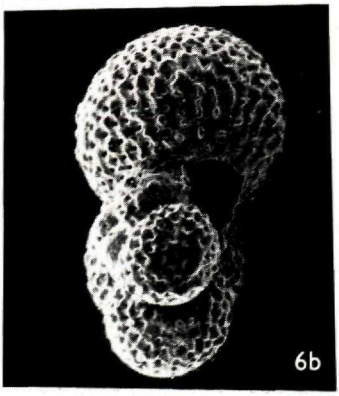
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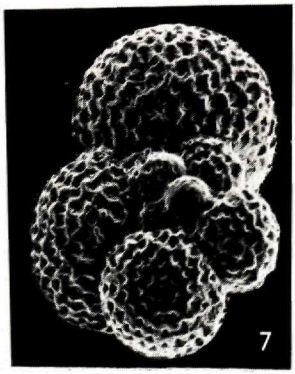
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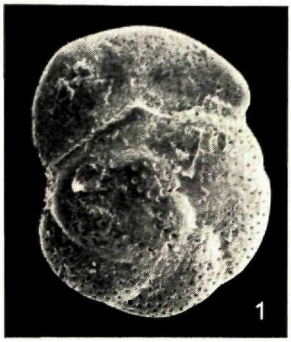
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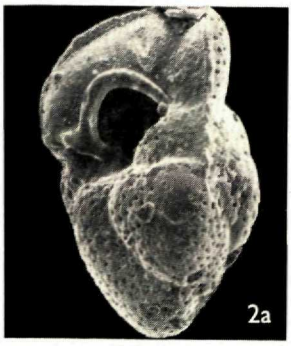
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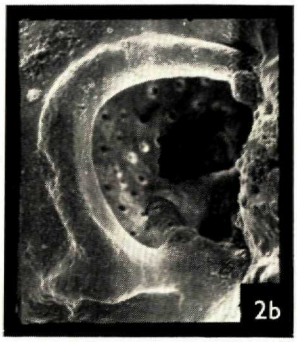
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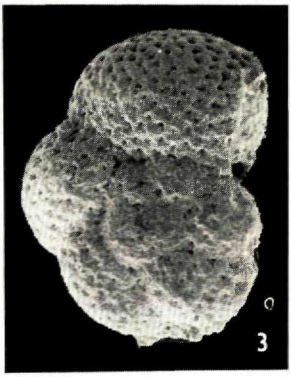
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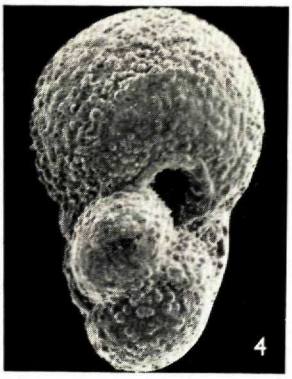
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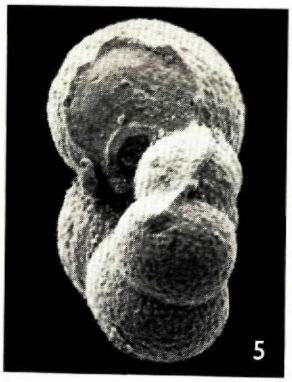
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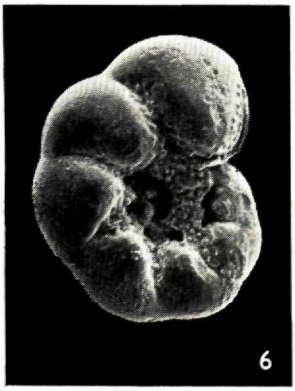
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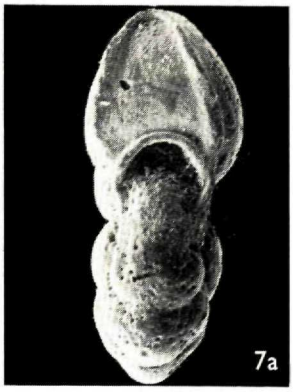
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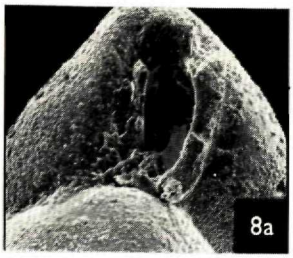
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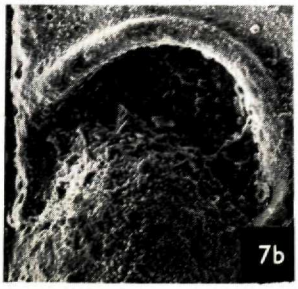
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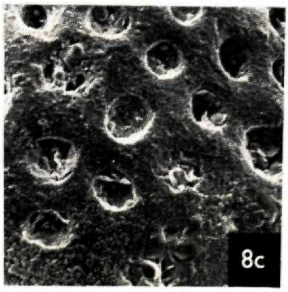
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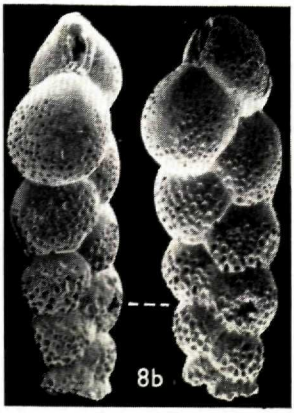
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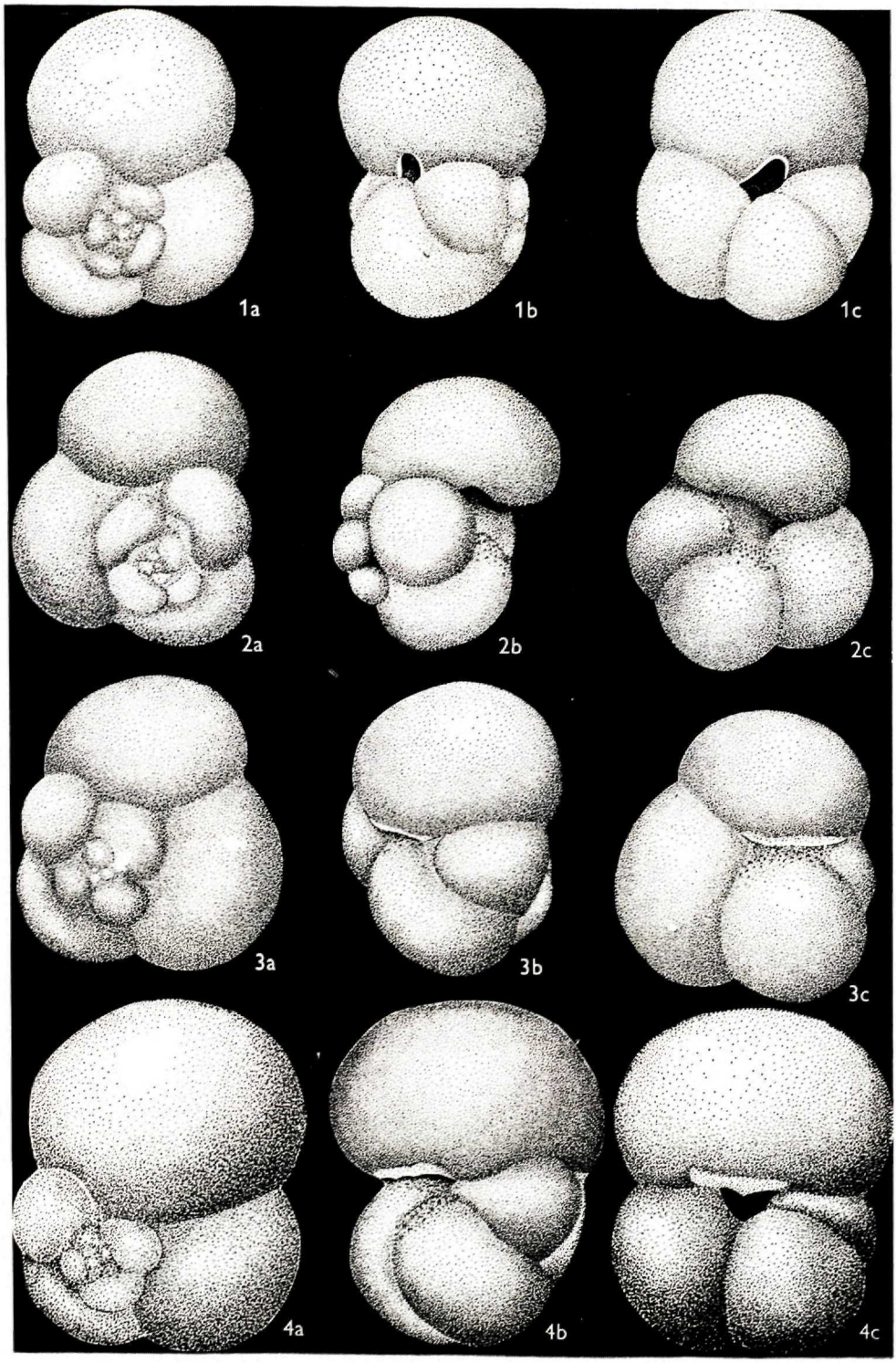
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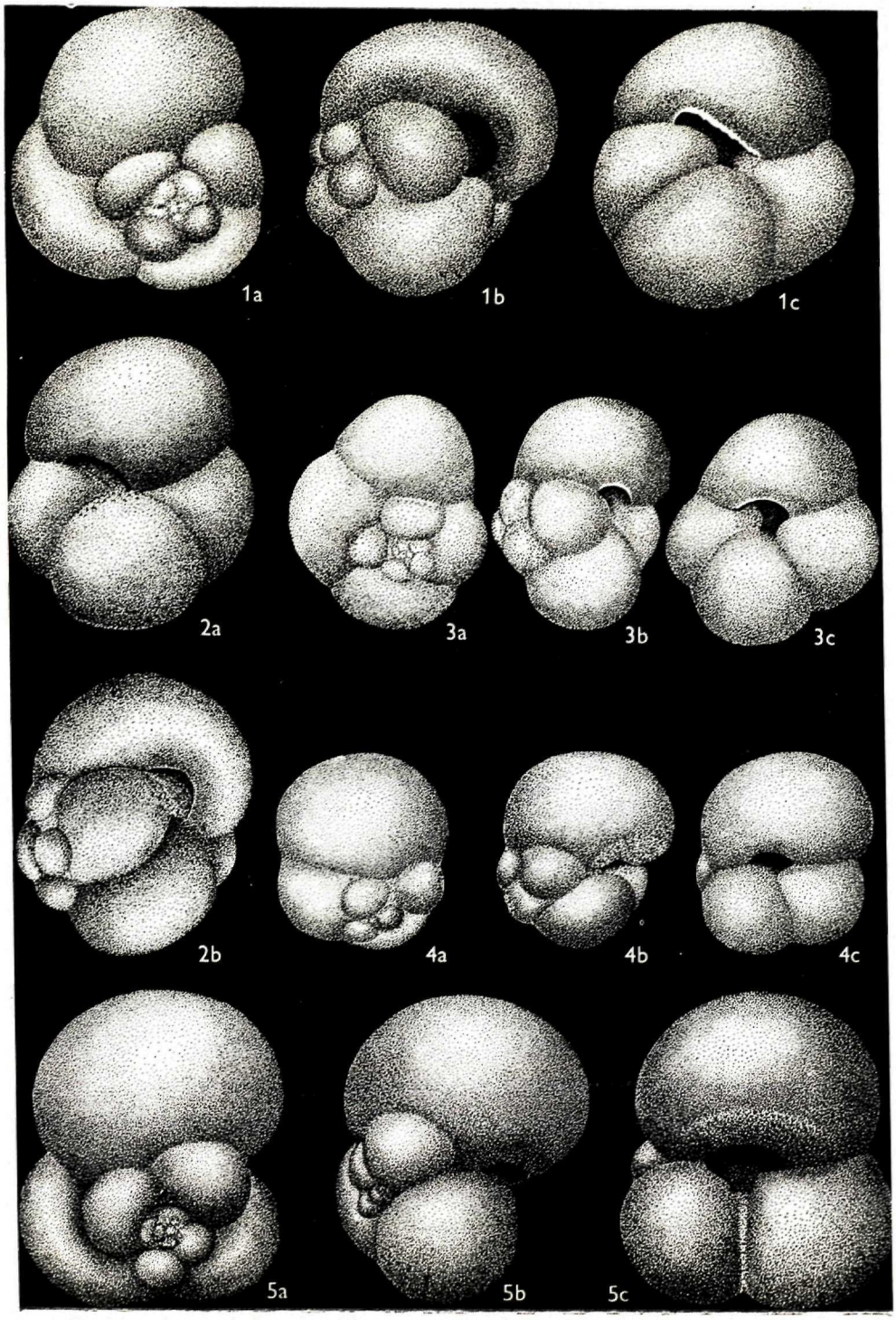
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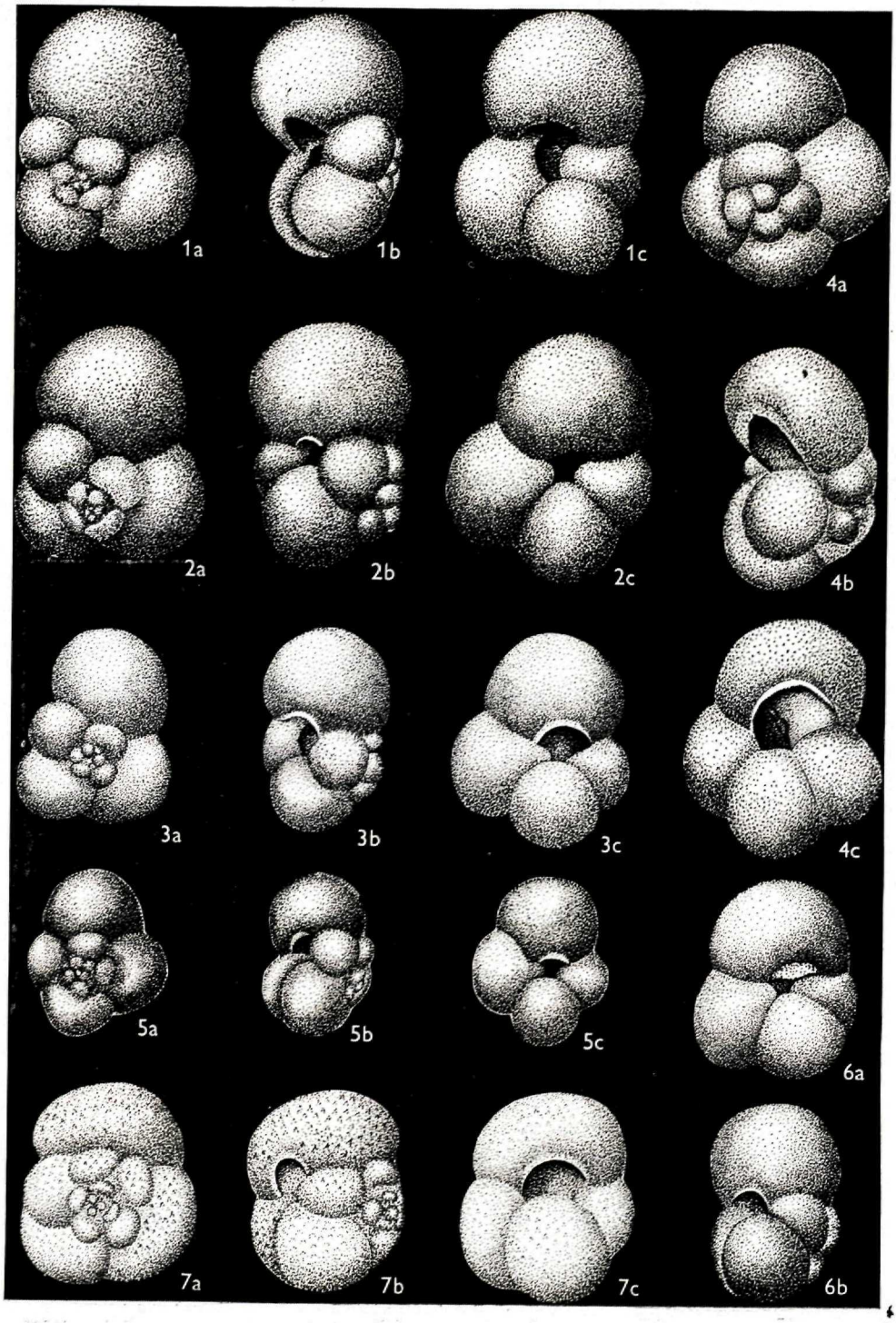
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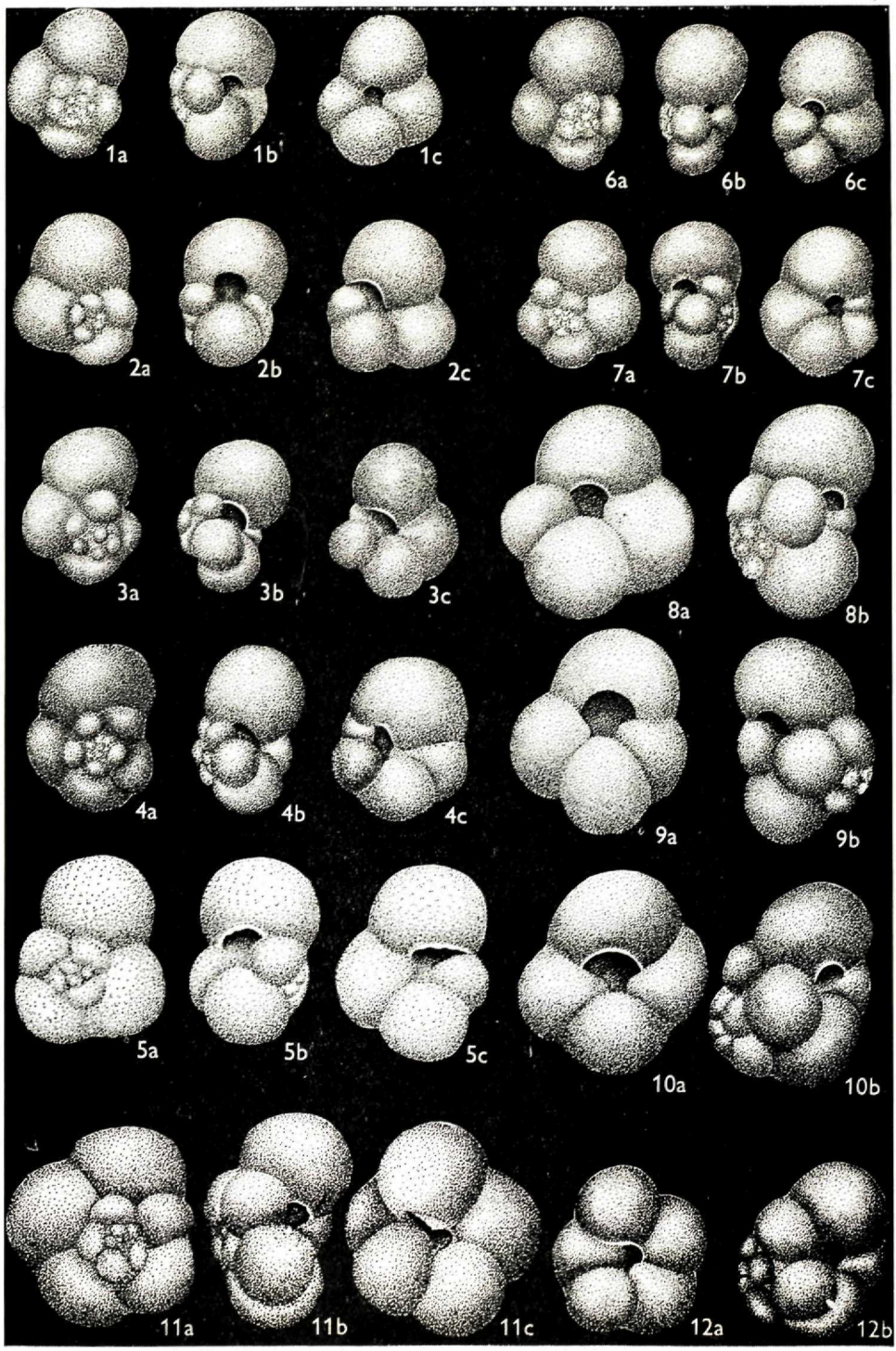
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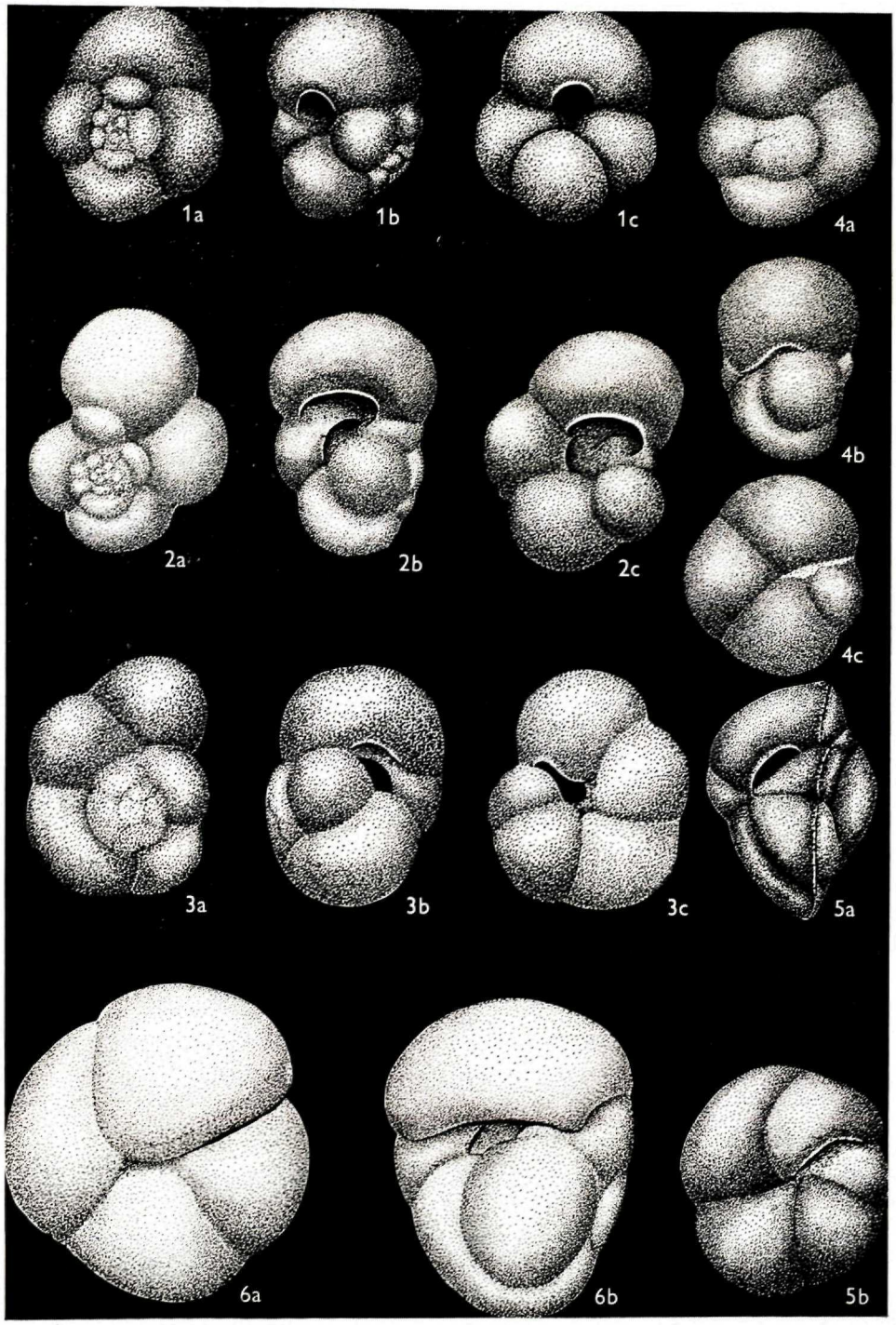
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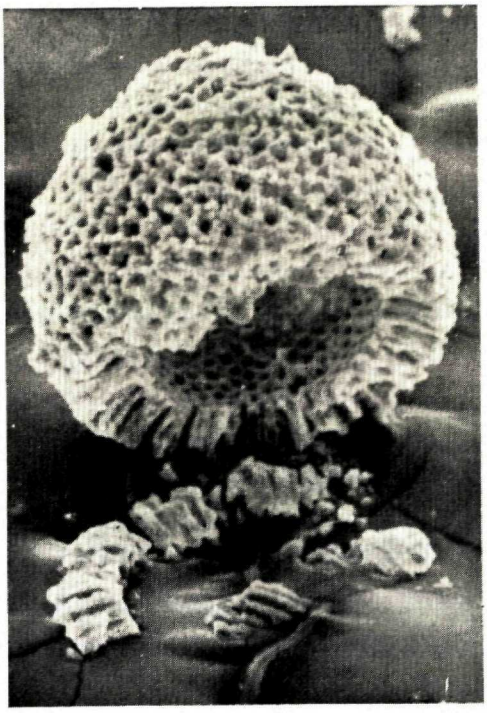

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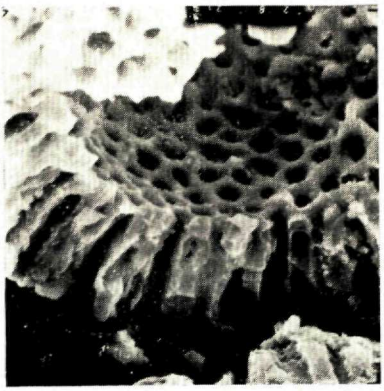

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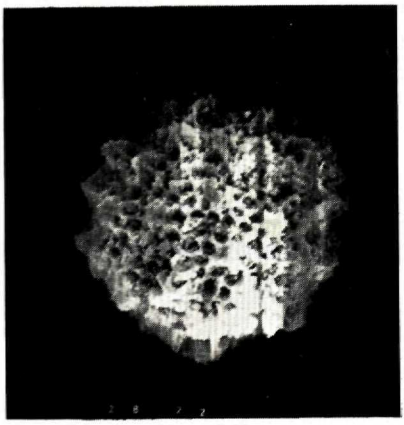

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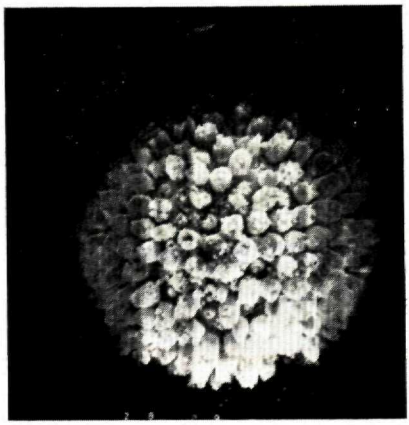

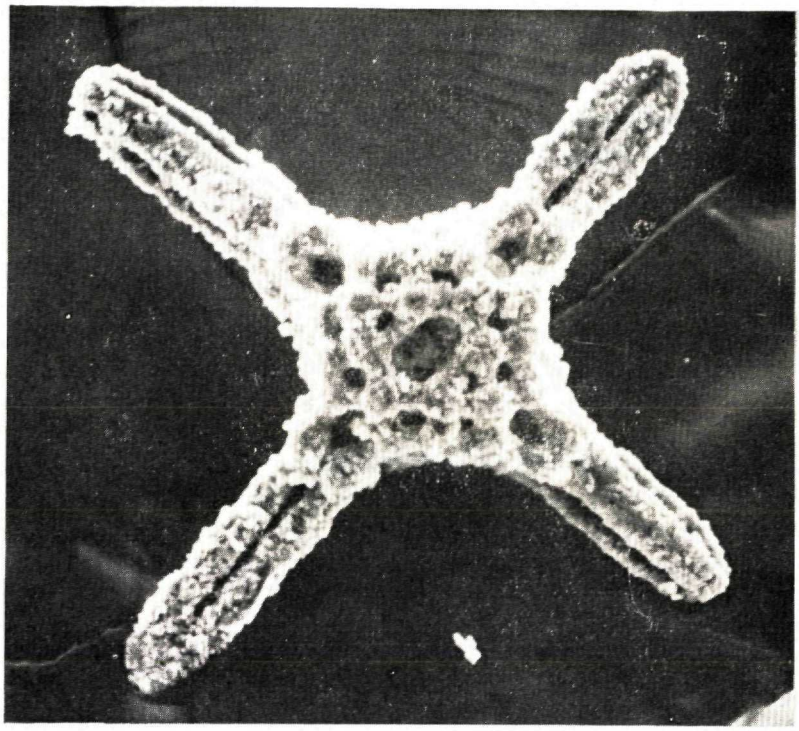

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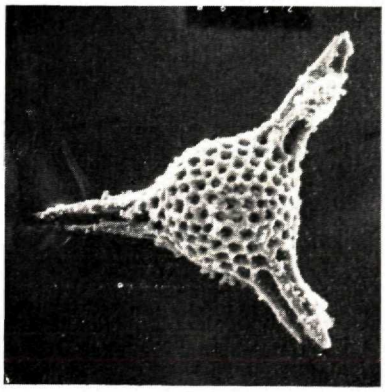

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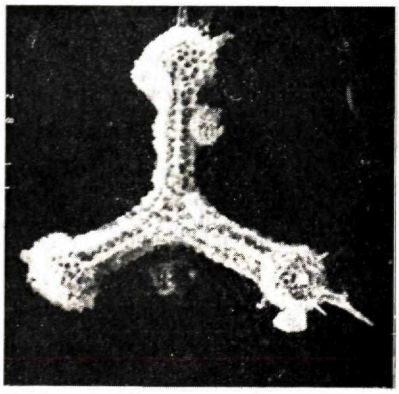

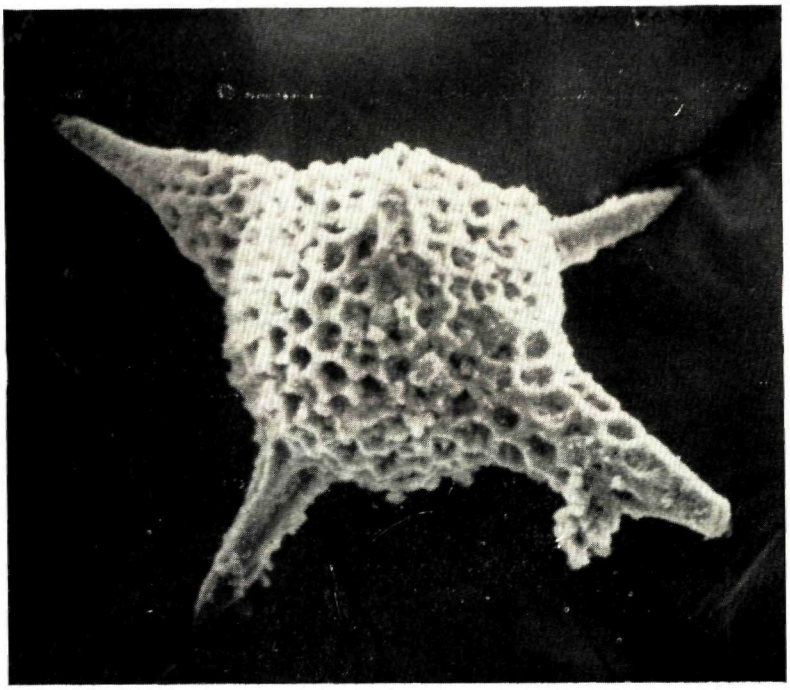

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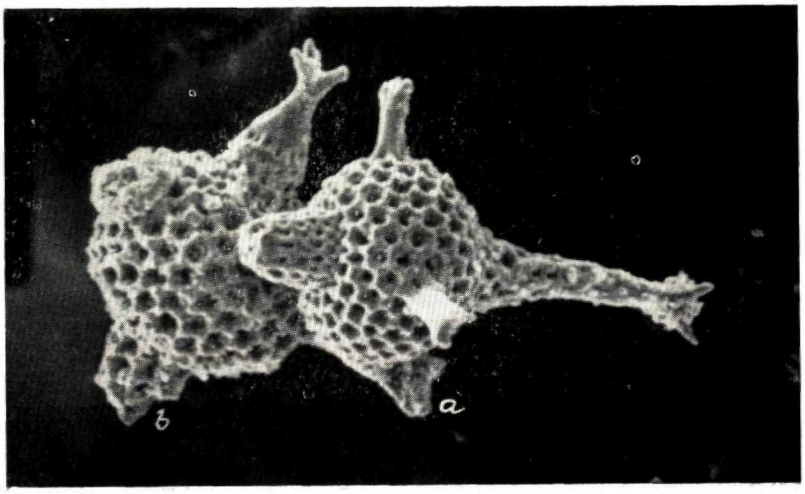

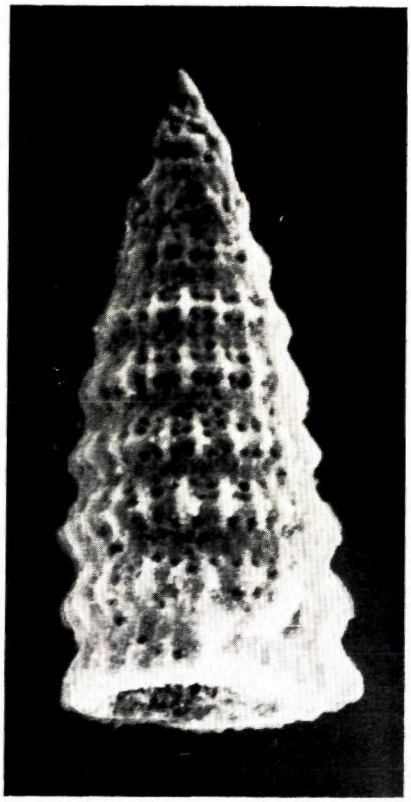

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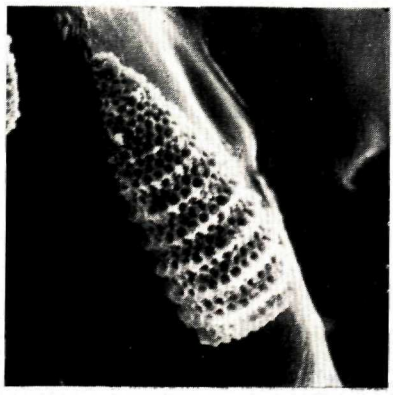

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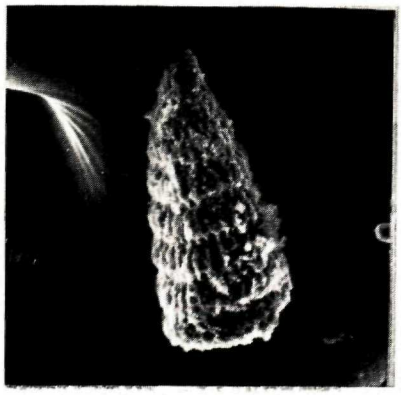

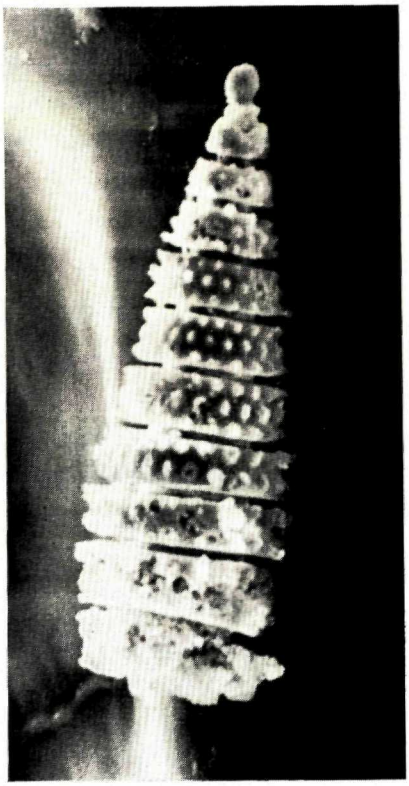

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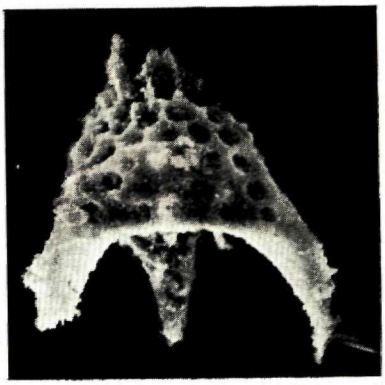

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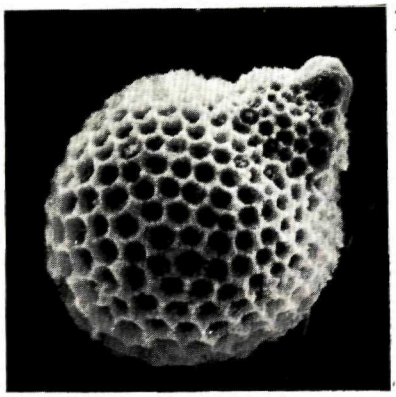

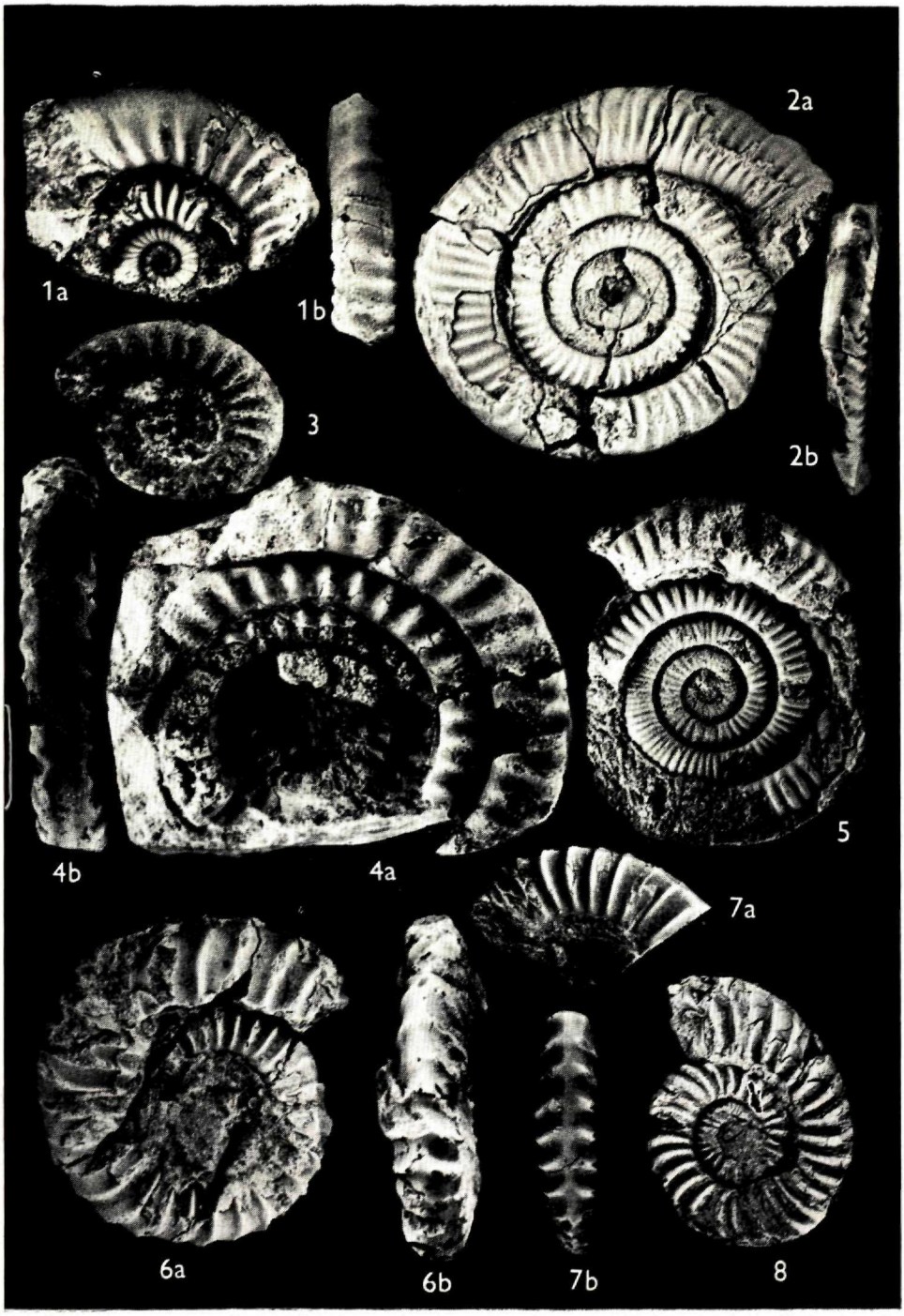
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