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CALCAREOUS NANNOPLANKTON OF THE MIDDLE EOCENE OF THE MALÉ KARPATY MTS.

(Figs. 3, Pls. 6)

A b s t r a c t: The paper is dealing with biostratigraphical evaluation of the calcareous nannoplankton assemblage obtained from Paleogene sediments found at the NW end of the Malé Karpaty Mts. Setting out from species representation of nannoflora we may range the studied sequence to the Middle Eocene. In the sense of M a r t i n i (1971) the studied associations represent biozone NP 16 *Discoaster tani nodifer*, in the sense of B u k r y (1973) the *Discoaster bifax* Subzone (*Reticulofenestra umbilica* zone).

Р е з ю м е: Автор занимается биостратиграфической оценкой сообщества известкового нанопланктона полученного из палеогенных осадков находящихся у северозападного конца Малых Карпат. Исходя из видового состава нанофлоры, исследованную толщу можно отнести к среднему эоцену. В смысле Э. М а р т и н и (1971) исследованные сообщества представляют биозону NP 16 *Discoaster tani nodifer*, в смысле Д. Б у к р ы (1973) субзону *Discoaster bifax* (зона *Reticulofenestra umbilica*).

Introduction

At the NW margin of the Malé Karpaty Mts., in geomorphological sense representing the subunit Pezinok Carpathians, part Plavecké predhorie and Bukovská brázda depression (M a z ú r — L u k n i š, 1978) sediments of Paleogene age are found, which are a subject of study at present. They occur in a strip approximately 20 km long and 2 km wide of NW-SE direction. In the past the geology of the area was studied by M a t ě j k a (1961), who setting out from the system of transversal faults divided the Paleogene into three sections with certain differences in structure: Northern — Buková section, reaching S of Prievaly to the Prievaly transversal faul, middle section between the Prievaly fault and transversal Mikuláš fault and southern section, between Plavecký Mikuláš and the southern closure of the synclinar strip near Sološnica, where at the transversal so called Rohožník elevation the Paleogene sequence terminate. He distinguished facially: the basal conglomerate — limestone sequence and flysch claystone-sandstone sequence.

Biostratigraphical evaluations from the area mentioned are insufficient. Data by V á ň o v á (1962) are known only, who on the basis of larger foraminifers *Nummulites burdigalensis burdigalensis* HARPE assigns the conglomerates at the quarry near Sološnica to the Cuisian, i. e. to the Lower Eocene. B e n e š o v á (1958) on the basis of the foraminifer microassemblage from the so called flysch beds found in close overlier of the basal beds ranged the basal beds to the Lower Lutetian. The same authoress, setting out from the foraminifer

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assemblage, ranges the flysch beds to the Middle to Upper Eocene.

At the present state of investigation we may distinguish two fundamental types of sequences here:

1. conglomerate-limestone sequence, prevailingly formed by sandy limestones with nummulites, bioherm limestones, conglomerates to breccias and sandstones;

2. claystone-sandstone sequence, prevailingly formed by grew to brownishgrey claystones passing into siltstones, variegated redhishbrown calcareous claystones, sandstones are also frequent and intercalations of conglomerates were rarely found.

With geological mapping we also carry out detailed sampling, the samples are subject of detailed paleontological treatment.

We place the foundations of formation of the sedimentation area in the studied territory to the Paleocene or Middle Eocene time when sea transgreded with contemporaneous formation of clastics and limestones of the basal transgressive sequence. The diferent thickness of roocks of this sequence testifies to considerable dissection of the pre-Paleogene substratum.

After deposition of basal Paleogene sediments a distinct subsidence of the sea floor took place. In connection with a different sedimentation regime rocks of different lithology formed, manifested mainly in distinct granulometric step, i. e. rocks of the claystone-sandstone sequence began to be deposited. This facial change is probably a manifestation of the Laramide phase of folding. With deposition of rocks of this sequence, which has no regression features, sedimentation terminates in the studied area.

Whereas rocks of the basal Paleogene deposited in a shallow, well-lit and oxygenated environment, suitable for development of shallow-water animal assemblages, in deepened sedimentation environment other conditions for development of organisms were created.

Biostratigraphy

The calcareous nannoplankton I obtained from rocks (claystones) of the overlying, i. e. claystone-sandstone sequence occurring in the area between Plavecké Podhradie and Plavecký Mikuláš (see Fig. 1).

5 samples with most abundant representation of nannoflora I traced under scanning electron microscope JSM-U_3 (see Fig. 2), where it was possible to identify the folloving speciess:

Coccolithus eopelagicus (BRAMLETTE et RIEDEL) BRAMLETTE et SULLIVAN (Pl. 1, Figs. 1–2)
Coccolithus pelagicus (WALLICH) SCHILLER (Pl. 1, Figs. 2–6)
Cyclicargolithus floridanus (ROTH et HAY) BUKRY (Pl. 3, Figs. 1–2)
Cyclococcolithus formosus KAMPTNER (Pl. 2, Figs. 1–6)
Cyclococcolithus formosus KAMPTNER (Pl. 2, Figs. 1–6)
(Pl. 3, Figs. 3–4)
Markalius inversus (DEFLANDRE) BRAMLETTE et MARTINI (Pl. 3, Fig. 5)
Reticulofenestra umbilica (LEVIN) MARTINI et RITZKOWSKI (Pl. 4, Figs. 1–2)
Transversoponthis pseudopulcher PERCH-NIELSEN (Pl. 3, Fig. 6)
Helicosphera seminulum BRAMLETTE et SULLIVAN (Pl. 4, Fig. 3)

Discoaster barbadiensis TAN SIN HOK (Pl. 4, Figs. 4–6, Pl. 5, Figs. 1–2)
Discoaster bifax BUKRY (Pl. 5, Figs. 4–5)
Discoaster deflandrei BRAMLETTE et RIEDEL (Pl. 6, Fig. 1)
Discoaster distinctus MARTINI (Pl. 6, Fig. 2)
Discoaster binodosus MARTINI (Pl. 5, Fig. 3)
Discoaster saipanensis BRAMLETTE et RIEDEL (Pl. 6, Fig. 5)
Discoaster tani BRAMLETTE et RIEDEL (Pl. 6, Fig. 5)
Nannotetrina cristata (MARTIN) ACHUTHAN et STRADNER (Pl. 6, Fig. 6)

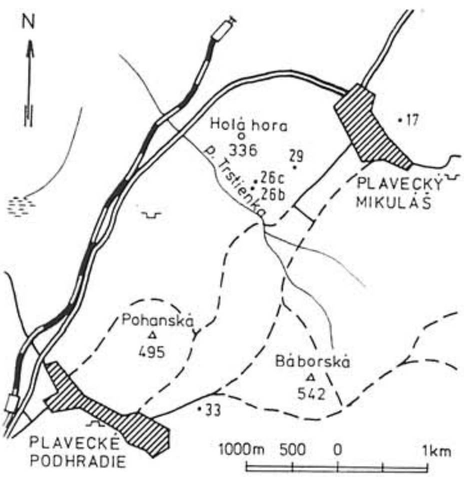

Fig. 1. Sketch-map of sampling sites

SAMPLE NUMBER	17	26b	26c	29	33
Coccolithus eopelagicus	o	o	o	o	
Coccolithus pelagicus	o	o	o	o	o
Cyclicargolithus floridanus	o	o			
Cyclococcolithus formosus		o	o	o	o
Chiasmolithus grandis			o		
Markaluis inversus		o			
Reticulofenestra umbilica		o	o	o	
Transversopontis pseudopulcher		o			
Helicosphaera seminulum		o			
Discoaster barbadiensis	o	o			o
Discoaster bifax		o			
Discoaster deflandrei	o				
Discoaster distinctus		o		o	
Discoaster binodosus		o			
Discoaster saipanensis		o			
Discoaster tani		o			
Nanotetrina cristata		o			

Fig. 2. Representation of calcareous nannoplankton in the studied samples

Qualitative and mainly quantitative representation of nannoflora was possible to observe mostly in sample 26b. In the studied Thanatocoenosis I determined the following species of coccolites: *Coccolithus eopelagicus*, *Cocccolithus pelagicus*, *Cyclicargolithus floridanus*, *Cyclococcolithus formosus*, *Markalius inversus*, *Reticulofenestra umbilica*, *Transversoponthis pseudopulcher*, *Helicosphaera seminulum*. In relative prevalence (quantitative) to Coccolites is here the occurrence of discoasters: *Discoaster barbadiensis*, *Discoaster bifax*, *Discoaster distinctus*, *Discoaster binodosus*, *Discoaster saipanensis*, *Discoaster tani*. Several forms of uncertain systematic position were also recorded- the species *Nannotetrina cristata* (? *Nannotetrina fulgens*).

In sample 26c was quantitative prevalence of the species *Coccolithus eopelagicus*, *Coccolithus pelagicus* and *Cyclococcolithus formosus*. Rare were the occurrence of the species *Chiasmolithus grandis* and *Reticulofenestra umbilica*.

Sample 29 is characterized by the occurrence of the species *Discoaster dis-*

tinctus. The species *Coccolithus eopelagicus, Coccolithus pelagicus, Cyclococcolithus formosus* and *Reticulofenestra umbilica*, were also established.

In sample 17 I found the species *Coccolithus eopelagicus, Coccolithus pelagicus, Cyclicargolithus floridanus, Discoaster deflandrei* and abundant occurrence of the species *Discoaster barbadiensis*.

Qualitatively and quantitatively poorest was sample 33, in which the species *Coccolithus pelagicus, Cyclococcolithus formosus* and *Discoaster barbadiensis* are found only.

On the basis of qualitative species analysis it was possible to range the assemblages of calcareous nannoplankton from the area between Plavecké Podhradie and Plavecký Mikuláš in the sense of Bukry (1973) to the *Discoaster bifax* Subzone (*Reticulofenestra umbilica* Zone), or to the uppermost part of the *Coccolithus staurion* Subzone (*Nannotetrina quadrata* Zone), in which the mentioned author quotes the first occurrence of the species *Reticulofenestra umbilica* and *Discoaster bifax* (see Fig. 3).

In the sense of Martini (1971) we may range the studied associations to biozone NP–16 – *Discoaster tani nodifer*, in which the author mentions the first occurrence of the species *Discoaster saipanensis* and the last occurrence of the species *Discoaster distinctus*.

The stratigraphic diapason of the mentioned zones is essentially understood

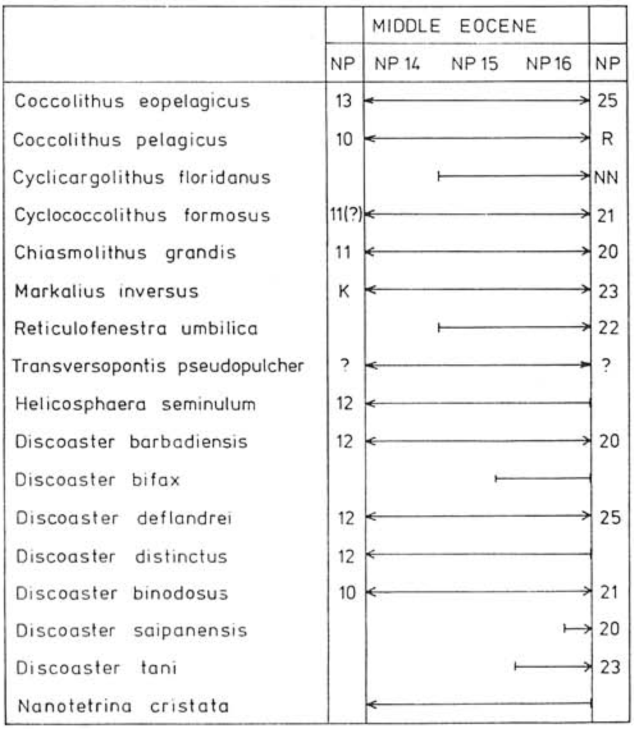

Fig. 3. Stratigraphic range of the determined species of calcareous nannoplankton

equally in both authors, also when we cannot correlate their lower boundary (both, however, place it to the middle part of the Middle Eocene). They understand the upper boundary equally, i. e. as the boundary between the Middle and Upper Eocene.

Thus we may state that the obtained nannoplankton proves the Middle Eocene age of the claystone — sandstone sequence found at NW termination of the Malé Karpaty Mts.

Conclusion

From rocks (claystones) of the claystone — sandstone sequence found at NW termination of the Malé Karpaty Mts. I obtained 5 assemblages of calcareous nannoplankton. From the degree of their disturbing we may conclude on depth of the sedimentation basin by application of knowledge obtained by observation in present — day oceans.

Schneidermann (1977), studying selective dissolution of recent coccolites in the Atlantic Ocean on the basis of the state of test preservation divides the compensation zone, i. e. the zone in which dissolution of $CaCO_3$ is taking place, into 5 subzones: alytic, eolytic, oligolytic, mesolytic and hololytic.

Applying his knowledge on the way of preservation and qualitative and quantitative species composition to the assemblage of nannoflora, which we obtained from the Paleogene of the Malé Karpaty Mts. we may conclude that the sedimentation area in the sense of Schneidermann represented the eolytic subzone (situated 3000 m above the CCCD).

Qualitative and quantitative representation of the present species as well as the way of preservation points to relatively warm waters of the epicontinental sea, which formed the sedimentation area at the NW margin of the present-day Malé Karpaty Mts. in the time of the Middle Eocene.

The studied association may be assigned to biozone NP 16—*Discoaster tani nodifer* in the sense of Martini or to the *Discoaster bifax* Subzone (*Reticulofenestra umbilica* Zone) in the sense of Bukry, i. e. to the Middle Eocene.

Translated by J. Pevný

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Plate 1

Fig. 1. *Coccolithus eopelagicus* (BRAMLETTE et RIEDEL) BRAMLETTE et SULLIVAN, distal view, ×3500
Fig. 2. *Coccolithus eopelagicus* (BRAMLETTE et RIEDEL) BRAMLETTE et SULLIVAN, proxinal view, ×3500
Figs. 3, 6. *Coccolithus pelagicus* (WALLICH) SCHILLER, distal view, ×5000
Fig. 4. *Coccolithus pelagicus* (WALLICH) SCHILLER, distal view, ×4500
Fig. 5. *Coccolithus pelagicus* (WALLICH) SCHILLER, distal view, ×4000

Plate 2

Figs. 1, 5, 6. *Cyclococcolithus formosus* KAMPTNER, distal view, ×4500
Fig. 2. *Cyclococcolithus formosus* KAMPTNER, distal view, ×5000
Fig. 3. *Cyclococcolithus formosus* KAMPTNER, proximal view, ×5000
Fig. 4. *Cyclococcolithus formosus* KAMPTNER, distal view, ×4000

Plate 3

Figs. 1, 2. *Cyclicargolithus floridanus* (ROTO et HAY) BUKRY, proximal view, ×5000
Figs. 3, 4. *Chiasmolithus grandis* (BRAMLETTE et RIEDEL) HAY, MOHLER et WADE, proximal view, ×2500
Fig. 5. *Markalius inversus* (DEFLANDRE) BRAMLETTE et MARTINI, distal view, ×5000
Fig. 6. *Transversopontis pseudopulcher* PERCH-NIELSEN, ×4000

Plate 4

Fig. 1. *Reticulofenestra umbilica* (LEVIN) MARTINI et RITZKOWSKI, proximal view, ×4000
Fig. 2. *Reticulofenestra umbilica* (LEVIN) MARTINI et RITZKOWSKI, distal view, ×4000
Fig. 3. *Helicosphaera seminulum* BRAMLETTE et SULLIVAN, proximal view, ×4000
Fig. 4. *Discoaster barbadiensis* TAN SIN HOK, ×5000
Fig. 5. *Discoaster barbadiensis* TAN SIN HOK, ×4500
Fig. 6. *Discoaster barbadiensis* TAN SIN HOK, ×4000

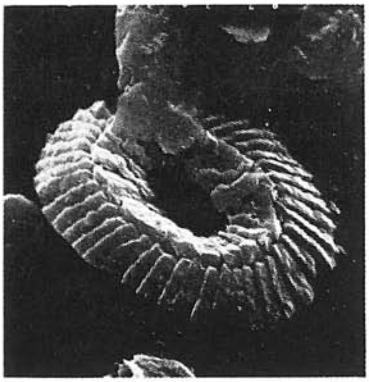
Plate 5

Figs. 1, 2. *Discoaster barbadiensis* TAN SIN HOK, ×4500
Fig. 3. *Discoaster binodosus* MARTINI, ×3500
Fig. 4. *Discoaster bifax* BUKRY, ×10000
Fig. 5. *Discoaster bifax* BUKRY, ×9000

Plate 6

Fig. 1. *Discoaster deflandrei* BRAMLETTE et RIEDEL, ×3000
Fig. 2. *Discoaster distinctus* MARTINI, ×4500
Fig. 3. *Discoaster saipanensis* BRAMLETTE et RIEDEL, ×4500
Fig. 4. *Discoaster saipanensis* BRAMLETTE et RIEDEL, ×4500
Fig. 5. *Discoaster tani* BRAMLETTE et SULLIVAN, ×5000
Fig. 6. *Nannotetrina cristata* (MARTINI) ACHUTHAN et STRADNER, ×3000

Plate 1



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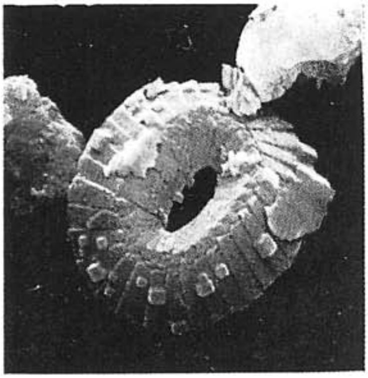

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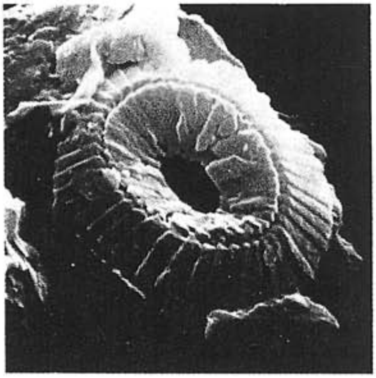

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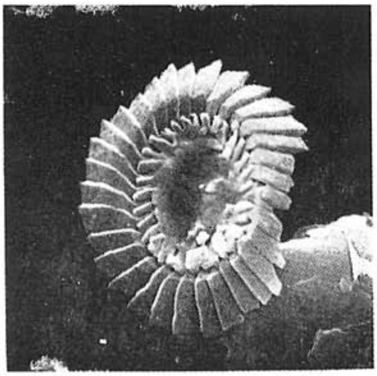

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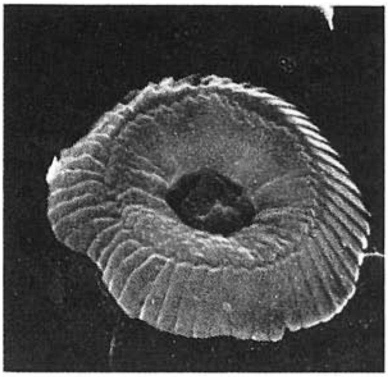

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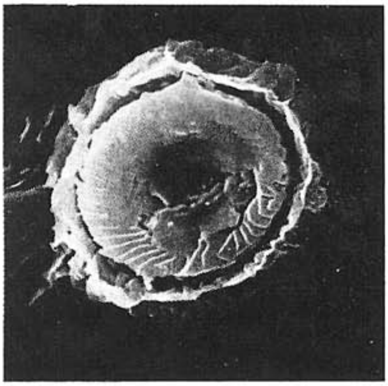

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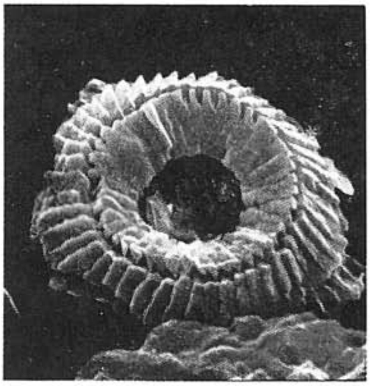

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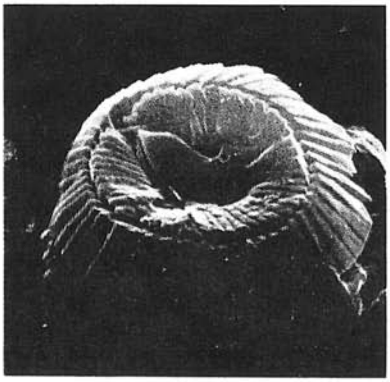

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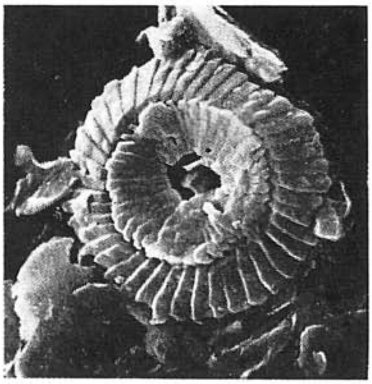

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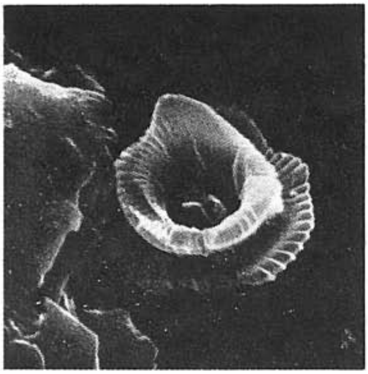

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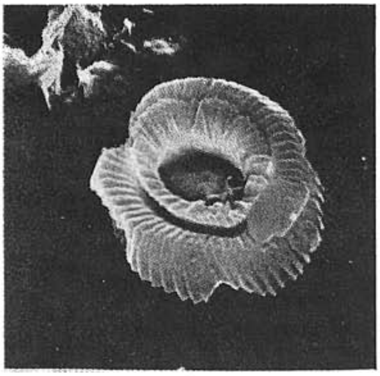

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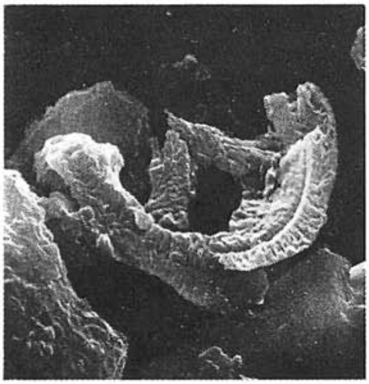

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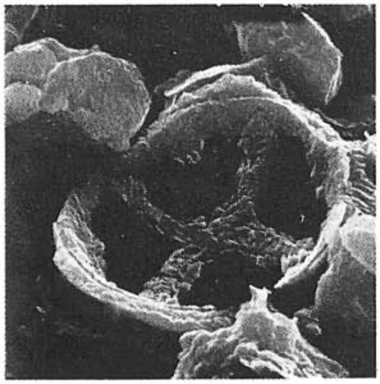

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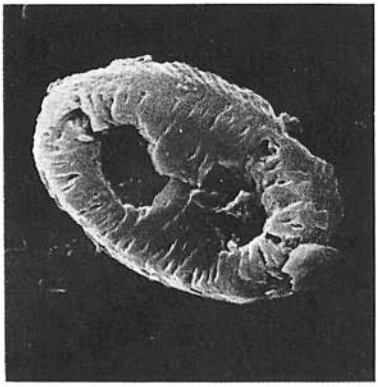

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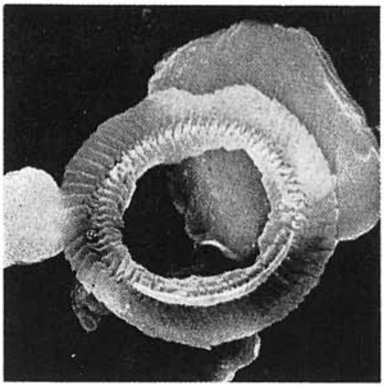

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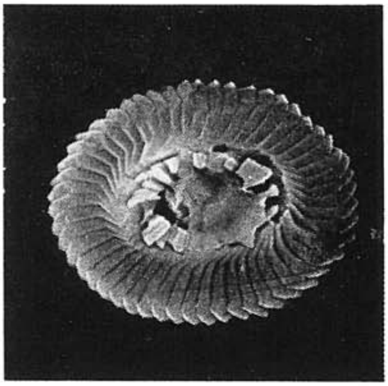

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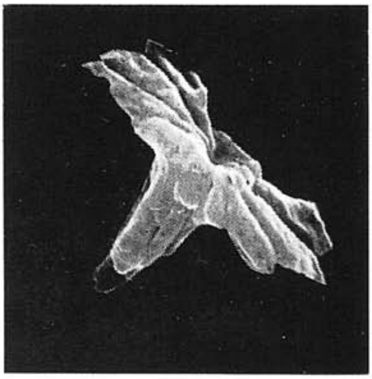

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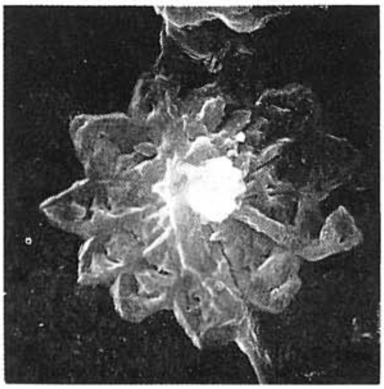

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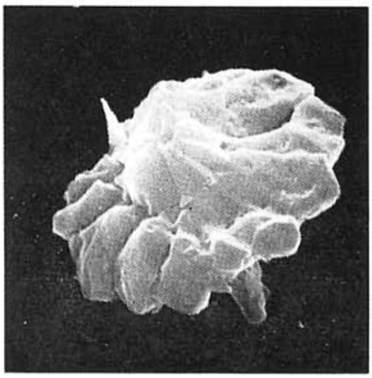

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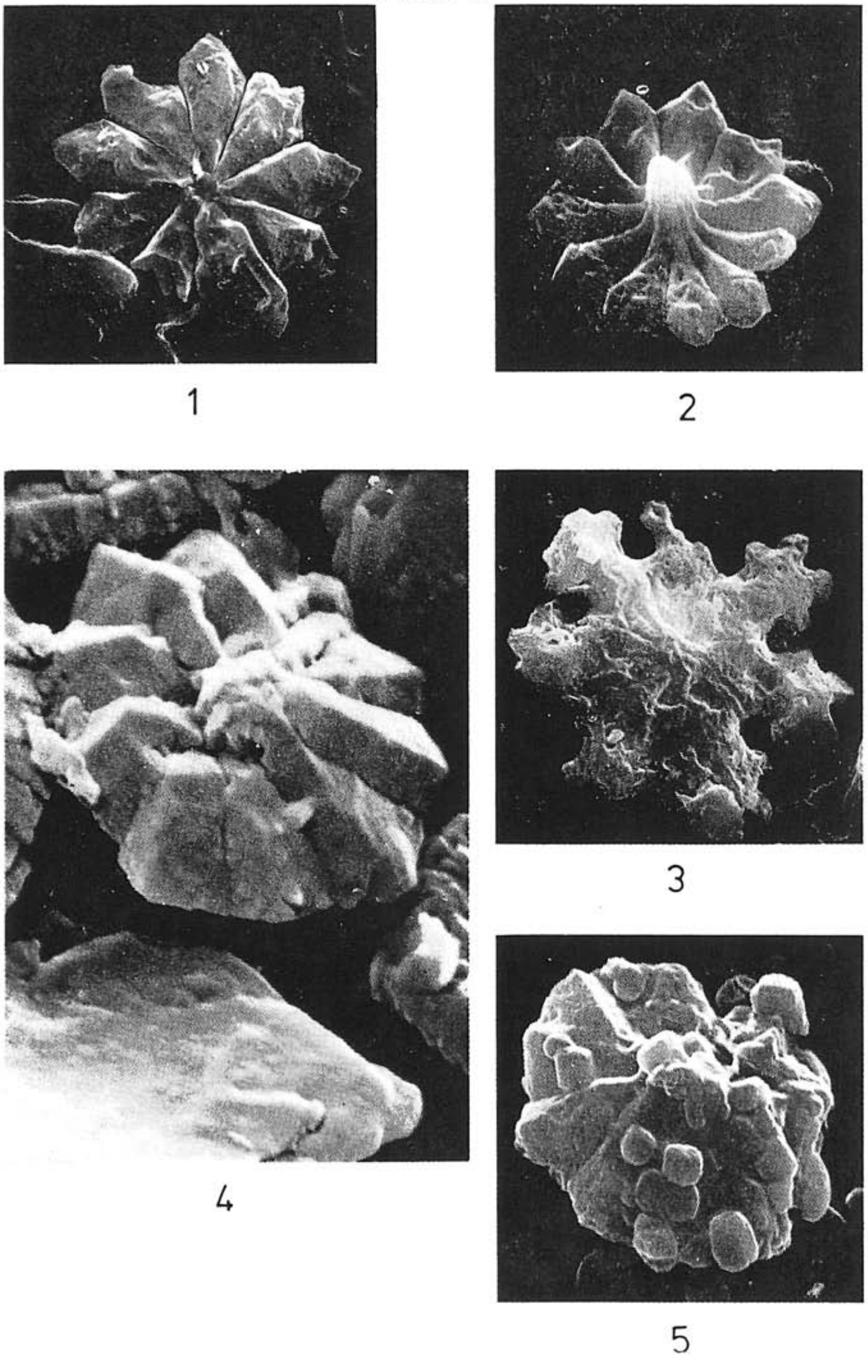

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