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HAUTERIVIAN RADIOLARIAN ASSOCIATION FROM THE LÚČKOVSKÁ FORMATION, MANÍN UNIT (MT. BUTKOV, WESTERN CARPATHIANS)

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Abstract: The paper deals with the occurrence of a rich radiolarian microfauna in the limestones of the Lúčkovská Formation of the Manín Unit (Mt. Butkov, Strážovské vrchy Mts., Central Western Carpathians). 36 taxa of radiolarians and four new species - *? Acaeniotyle florea* n. sp., *Cyclastrum decorum* n. sp., *Orbiculiforma trispinosa* n. sp. and *Paronaella trifoliacea* n. sp. have been identified in prospecting gallery Št-02-38 *m*. The associations found represent the stratigraphical range of Uppermost Valanginian - Hauterivian. Findings of tintinnids and ammonites (Vašíček & Michalík 1986; Borza et al. 1987; Michalík et al. 1990) in this formation prove Barremian age. However, the calcareous microfauna and calcareous nannoplankton found in prospecting gallery Št-02-38 *m* does not determine the exact age. The older age of radiolarian associations can be explained here either by intraclasts of underlying rocks (Michalík et al. 1990) or by the assignation of the part of the Lúčkovská Formation to Hauterivian in this prospecting gallery.

Key words: Western Carpathians, Hauterivian, Barremian, Radiolaria.

Introduction

Mt. Butkov is situated in the western foot of the Strážovské vrchy Mts. (Fig. 1). In 1889 a factory producing portland cement was established here (the first one in the area of present day Slovakia). Up to the present time an exploitation of the Butkov deposit for cement purposes has discovered a continuous succession of Oxfordian to Lower Albian carbonate formations which have been a subject of complex lithological - paleontological studies (Borza et al. 1987; Borza & Michalík 1987; Michalík & Vašíček 1987; Michalík et al. 1990; Rakús 1977, Vašíček et al. 1983; Vašíček & Michalík 1986; Žítt & Michalík 1988).

A detailed lithostratigraphy was worked out, on the basis of biostratigraphical research of tintinnids, stomiospheras, cadosinas and calcispherulas. The attention was mainly directed to ammonites, aptychi and belemnites (Michalík et al. 1990). The other groups of organisms - calcareous nannoplankton (Halásová & Gašparíková in Michalík et al. 1990), crinoids (Žítt in Michalík et al. 1990), sea urchins, brachiopodes, teeth of fish, etc.) have not been studied in detail yet (ibidem) (Fig. 2).

Radiolarian microfauna was gained from ŕbananaf radiolarites of the Czajakowa Formation (Michalík et al. 1990). The composition of associations with species *Andromeda podbielensis, Archaeospongoprunum imlayi, Emiluvia chica, Emiluvia orea, Homoeoparonanella* sp., *Hsuum brevicostatum, Hsuum maxwelli, Obesacapsula morroensis, Orbiculiforma* sp., *Pantanellium lanceola, Paronaella kotura, ?Paronaella* sp., *Perispyridium tamanense, Tetraditryma corralitosensis, Tetraditryma pseudoplena, Tetratrabs zealis, Thanarla* sp., *Triactoma blakei, Tritrabs casmaliaensis, Tritrabs hayi* indicates a stratigraphical range from the upper part of the Lower Oxfordian to the Upper Oxfordian (Baumgartner 1984, 1987 - U.A.7-U.A.8).

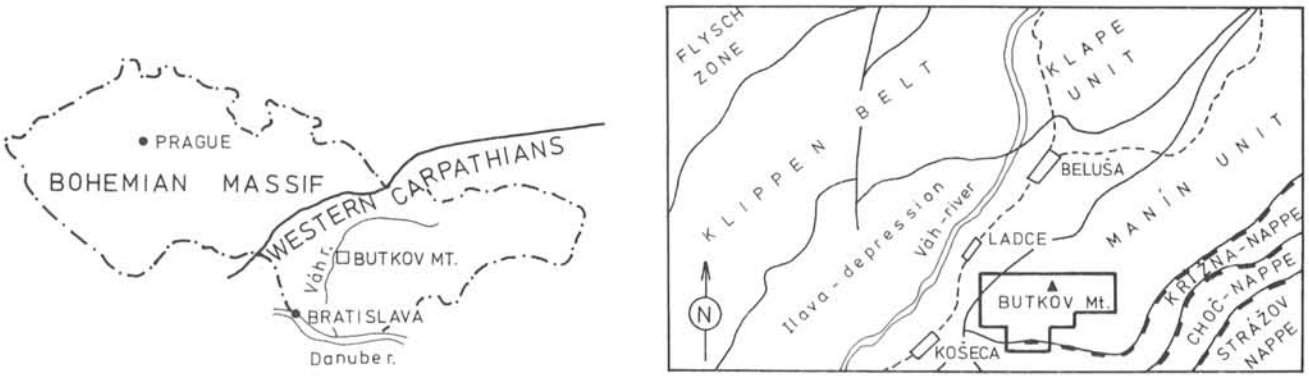


Fig. 1. Situation map of the studied area and geological scheme of Mt. Butkov.

Radiolarians were also gained from cherts of the Kališčo Formation (Peterčáková 1990). The following genera and species have been identified in the associations: *Acanthocircus dicranacanthos, Alievium helenae, Alievium* sp., *Archaeodictyomitra pseudoscalaris, Archaeodictyomitra rigida, Archaeodictyomitra puga, Archaeodictyomitra* sp., *Cecrops septemporatus, Crucella* sp., *Cyclastrum* sp., *Ditrabs sansalvadorensis, Mirifusus* sp., *Sethocapsa uterculus, Sphaerostylus hastatus, Thanarla conica, Thanarla* sp., *Triactoma echiodes, Triactoma* sp., *Tritrabs worzeli*. They represent *Cecrops septemporatus* Zone of Hauterivian age (Schaaf 1984).

A section sampling in prospecting gallery Št-02 also enables biostratigraphical correlation of the Lúčkovská Formation on the basis of occurrence of radiolarian microfauna.

The Lúčkovská Formation is generally composed of bedded massive limestones with dark grey to black cherts. Radiolarians were separated from the calcareous part of the rock, the cherts did not contain a separable radiolarian microfauna. The limestones are intercalated with marls. The Lúčkovská Formation contain an abundance of fossils - belemnites, ammonites, brachiopodes, sea urchins, gastropodes, corals, crinoids, teeth of fish, placed in family *Hexacanthidae*, foraminifers and tintinnids. A research of calcareous microplankton as well as macrofauna indicates Barremian age (Michalík 1990) (Fig. 3).

Fig. 2. Lithostratigraphical scheme of the Jurassic and Lower Cretaceous sequence exposed in the Butkov quarry.

Evaluation of radiolarian microfauna

Prospecting gallery Št-02

The limestones contain a very rich, diverse and well preserved radiolarian microfauna. The following genera and species have been identified: *Acaeniotyle diaphorogona, Acaeniotyle umbilicata, Acanthocircus dicranacanthos, Acanthocircus carinatus, Acanthocircus* sp. A., *Acanthocircus* sp. B, *Alievium helenae, ?Angulobracchia crassa, Archaeodictyomitra pseudoscalaris, Archaeodictyomitra* sp., *Cecrops septemporatus, Crucella* sp., *Cyrtocapsa grutterinki, Holocryptocanium barbui, Mesosaturnalis hueyi, Mesosaturnalis aculeatus, Microsciadiocapsa monticelloensis, Mirifusus chenodes, Obesacapsula rotunda, Orbiculiforma coronata, Orbiculiforma tecta, Orbiculiforma* sp. A, *Orbiculiforma* sp. B, *Pantanellium lanceola, Parvicingula boesii, Parvicingula* cf. *dhimenaensis, Podobursa triacantha, Pseudodictyomitra carpatica, Pseudodictyomitra* cf. *lilyae, Sethocapsa leiostraca, Sethocapsa trachyostraca, Syringocapsa agolarium Thanarla conica, Triactoma echiodes, Ultranapora praespinifera, Xitus spicularius, Gen. et* sp. *indet*. Four new species were described in these associations.

The dominant species of the associations are *C. septemporatus* and *A. dicranacanthos*. The former appears together with *A. carinatus* in the Uppermost Valanginian. On the other hand the species *A. dicranacanthos* and *O. rotunda*, according to available data finish their occurrence in Hauterivian. The composition of associations prove Uppermost Valanginian to Hauterivian age.

This fact is in contradiction to the age of the Lúčkovská Formation (Barremian), established on the basis of macrofauna and calcareous microplankton. However, intraclasts of underlying rocks with *Tintinopsella carpathica*, which evidently arose from the older strata during their erosion were found in the bedded limestones (Michalík et al. 1990). This matter of fact made for explanation of the older age of radiolarians associations (ibidem). In the upper part of the underlying Kališčo Formation, however, radiolarians were not found. In view of that fact, that the composition of calcareous microfauna and calcareous nannoplankton in the Lučkovská Formation in prospecting gallery Št-02 does not enable the clear stratigraphical assignation, we incline to the opinion, that the part of the Lúčkovská Formation in this prospecting gallery belongs to Hauterivian.

Systematical part

The chapter deals only with those specimens, whose specific assignation was problematic or which did not quite well correspond to the diagnosis of the species.

Genus *Aceaniotyle* Foreman 1973
Type species: *Xiphosphaera umbilicata* Rüst 1898.

?Acaeniotyle florea Ožvoldová n. sp.
Pl. 5, Figs. 6 - 8

Holotype: No. 7183, 7185, Pl. 5, Figs. 7, 8. Deposited in the Slovak National Museum in Bratislava.

Type locality: Mt. Butkov, Strážovské vrchy Mts., Central Western Carpathians.

Stratotype: Limestones of the Lúčkovská Formation, Hauterivian.

D e n o m i n a t i o n: Lat. floreus - flower: after the test, resembling the perianth.

D e s c r i p t i o n: Test is of drum-like shape, with slightly bulged top and bottom and with four massive spines, arranged in the shape of a cross. Spines are composed of three longitudinal ridges separated by deep grooves. On the periphery of the top and the bottom sides there are protruding 10 - 12 subspherical nodes with coarse meshwork arranged like a garland. In the inner part the nodes are smaller and their arrangement is indistinct. Between nodes there is fine meshwork. Pores on the lateral side of the test are of medium to large size.

Measurements:	holotype	min.	max.
Diameter of the top and the bottom of the test	0.156	0.135	0.158
Max. thickness of the test	0.136	0.131	0.140
Length of spines	0.125	0.093	0.125
Diameter of nodes	0.025	0.021	0.025

Genus *Acanthocircus* Squinabol 1903; sensu Donofrio et Mostler 1978
Type species: *Acanthocircus irregularis* Squinabol 1903

Acanthocircus sp. A
Pl. 1, Fig. 4

1981 *Acanthocircus* sp. - A. Schaaf, p. 531, Pl. 7, Fig. 7

D e s c r i p t i o n: Elliptical ring with one flat spine of oval shape on each pole.

R e m a r k: Our specimens resemble speciman *Acanthocircus* sp. in Schaaf (1984, p. 431, Pl. 7, Fig. 7) which occurs in Lower Cretaceous associations in Middle Pacific (DSDP, leg. 62).

Acanthocircus sp. B
Pl. 1, Fig. 3

D e s c r i p t i o n: Eliptical ring, with a small flat unsplitted spine on one pole, and a flat spine with a moderately lobate splitted on the other.

R e m a r k: The forms have a transitional signs between the species *Acanthocircus trizonalis* (Rüst) and *Acanthocircus dicranacanthos* (Squinabol).

Genus *Angulobracchia* Baumgartner 1980
Type species: *Paronaella*(?) *purisimaensis* Pessagno 1977

?*Angulobracchia crassa* (Ožvoldová 1979) nov. comb. emend.
Pl. 2, Figs. 3, 4

1979 *Dictyastrum crassum* n. sp. - L. Ožvoldová, p. 10, Pl. 2,Figs. 1, 3

R e m a r k: The assignation to the species *Angulobracchia* is controversial because of raised central area and lacking tubular extensions at the end of the rays. On some specimens we can notice four small lateral spines on the expanded part of rays.

Genus *Crucella* Pessagno 1971; emend. Baumgartner 1980
Type species: *Crucella messinae* Pessagno 1971

Crucella sp.
Pl. 2, Fig. 9

R e m a r k: The specimens resemble the species *?Haliodictya hojnosi* Riedel et Sanfilippo. They differ from the holotype in the spongy meshwork of the test and in irregularly rectangular shape of the test.

Genus *Cyclastrum* Rüst 1898
Type species: *Cyclastrum infundibuliforme* Rüst 1898

Cyclastrum decorum Peterčáková n. sp.
Pl. 5, Fig. 9

H o l o t y p e: No. 7479, Pl. 5, Fig. 9. Deposited in the Slovak National Museum in Bratislava.

T y p e l o c a l i t y: Mt.Butkov, Strážovské vrchy Mts., Central Western Carpathians.

S t r a t o t y p e: limestones, Lúčkovská Formation, Hauterivian.

D e n o m i n a t i o n: Lat. decorus - decorative.

D e s c r i p t i o n: Three rayed test with small central area, consists of concentrically arranged fine porous meshwork. Rays are narrow in the proximal part. Towards the end they become wider, and wedge-shaped. At the ray tips there are one central and two lateral spines. The spines are short and thick. Meshwork of the rays consists of one longitudinal prominent row of large tetragonal pore frames, which has on both sides 1 - 2 rows of smaller pore frames, as well with linear arrangement. Rays are connected in their middle part by a round garland with spongy meshwork.

Measurements:	holotype	min.	max.
Length of rays	0.150	0.144	0.170
Width of rays in the proximal part	0.025	0.018	0.032
Width of rays in the termination	0.043	0.030	0.052
Length of spines	0.024	0.016	0.030
Width of garland	0.075	0.054	0.096

Genus *Orbiculiforma* Pessagno 1973
Type species: *Orbiculiforma quadrata* Pessagno 1973

Orbiculiforma trispinosa Peterčáková n. sp.
Pl. 5, Fig. 10

H o l o t y p e: No. 7445, Pl. 5, Fig. 10. Deposited in the Slovak National Museum in Bratislava.

T y p e l o c a l i t y: Mt.Butkov, Strážovské vrchy Mts., Central Western Carpathians.

S t r a t o t y p e: Limestones, Lúčkovská Formation, Hauterivian.

D e n o m i n a t i o n: Lat. trispinosus - threerayed.

D e s c r i p t i o n: The test is of oval shape with narrow raised margin and extensive central depression. Three short regularly arranged spines protrude on the periphery of the test. Meshwork of the test consists of tetragonal to polygonal pore frames.

Measurements:	holotype	min.	max.
Diameter of the test in the widest part	0.247	0.241	0.260
Width of the rim	0.042	0.040	0.044
Length of spines	0.036	0.031	0.040

Orbiculiforma sp. A
Pl. 2, Figs. 6, 8

Description: Discoidal test is of wide-oval shape. A central cavity is wide, a raised margin around the cavity has a sharp contour, and towards to a circumference is flat lowerd. It occupies about 1/8 of the test diameter only.

Orbiculiforma sp. B
Pl.3 , Fig. 1

Description: Discoidal test is of wide-oval shape. A central cavity is wide, a raised margin around the cavity makes up about 1/8 of the test diameter only. The short, thin regularly arranged spines run on the circumference of the test. Meshwork of the raised margin consists of tetragonal to polygonal pore frames. Meshwork of the central cavity has an indistinct structure.

Genus *Paronaella* Pessagno 1971; emend. Baugartner 1980
Type species: *Paronaella solanoensis* Pessagno 1971

Paronaella trifoliacea Ožvoldová n. sp.
Pl. 5, Figs. 1 - 5

Holotype: No. 6467, 6468, Pl. 5, Figs. 1 - 5. Deposited in the Slovak National Museum in Bratislava.

Type locality: Mt.Butkov, Strážovské vrchy Mts., Central Western Carpathians.

Stratotype: Limestones, Lúčkovská Formation, Hauterivian.

Denomination: Lat. trifoliaceus - trefoil-like shape; course meshwork of trefoil shape in the central area.

Description: The test is formed by three rays with slightly rised central area. The rays are short, in the proximal part broad, at the ending they become gradually narrower. The cross section of the rays is elliptical. On the lateral side of the rays and on their top there are short thin spines. The meshwork of the rays is irregular, with coarser pores, and with indication of sublinear arrangement in the distal part. Central area is large, in the periphery with raised coarse, porous margin, perpendicular to the rays. The inner part of central area has a fine meshwork. In the centre there is a coarse porous protuberance of trefoil-shape.

Measurements:	holotype	min.	max.
Length of rays AX	broken	0.156	0.186
BX 0.165			
CX 0.156			
Width of the widest part of rays 0.071	0.071	0.106	
Diameter of central area	0.095	0.095	0.150

Genus *Parvicingula* Pessagno 1977
Type species: *Parvicingula santabarbaraensis* Pessagno 1977

Parvicingula cf. *dhimenaensis* Baumgartner 1984
Pl. 4, Fig. 2

1984 *Parvicingula dhimenaensis* Baumgartner n. sp. - P.O. Baumgartner, p. 778, Pl. 7, Figs. 2 - 4

Remark: Our specimens correspond with the diagnosis of the species *Parvicingula dhimenaensis* with the exception of the test shape, which is wide-conical and lacking of the tubular extension behind the last segment.

Genus *Pseudodictyomitra* Pessago 1977
Type species: *Pseudodictyomitra pentacolaensis* Pessagno 1977

Pseudodictyomitra cf. *lilyae* (Tan Sin Hok 1927)
Pl. 4, Fig. 3

1927 *Dictyomitra lilyae* sp. n. - Tan Sin Hok, p. 55, Pl. 10, Fig. 83
1981 *Pseudodictyomitra lilyae* (Tan Sin Hok) - A. Schaaf, p. 437, Pl. 3, Fig. 8, Pl. 18, Figs. 5a,b

Remark: The first 3 - 4 postabdominal segments of our specimens have not noticeably raised longitudinal tubercules.

Gen. et. sp. *indet.*
Pl. 2, Fig. 10

Description: Triangular spongy test with an indication of spines on the apexes.

Conclusion

The study of radiolarian microfauna in the Lúčkovská Formation is the part of the complex research of this formation within the biostratigraphical research of the Upper Jurassic and Lower Cretaceous formations in the Manín unit Mt. Butkov section (Michalík et al. 1990).

Thirty six taxa were identified and four new species were described from associations in prospecting gallery Št-02 - 38 *m*. The evaluation of the associations prove Uppermost Valanginian - Hauterivian age.

The Lúčkovská Formation can be assigned to Barremian according to the evaluation of macrofauna and calcareous microfauna. However, the composition of the calcareous microfauna and calcareous nannoplankton in this formation in prospecting gallery Št-02 - 38 *m* does not enable the clear stratigraphical assignation.

The older age of radiolarian associations can be explained here either by intraclasts of underlying rocks (Michalík et al. 1990), or it necessary to accept that the part of Lúčkovská Formation still belongs to Hauterivian in this prospecting gallery.

Fig. 3. Occurrences of the microfossils in the gallery Št-02 (Butkov quarry).

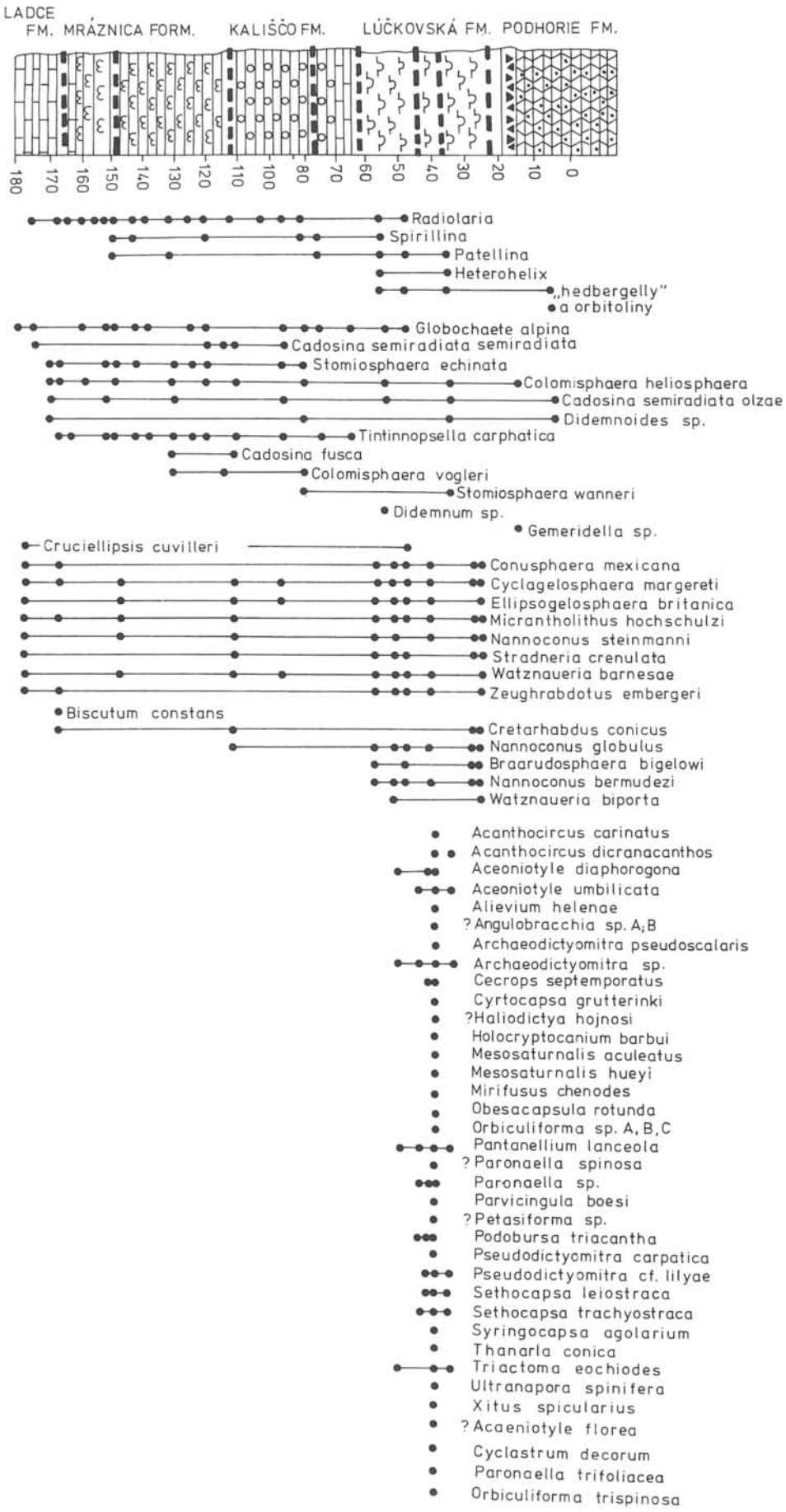

LADCE
FM. MRÁZNICA FORM.
KALIŠČO FM.
LÚČKOVSKÁ FM.
PODHORIE FM.
180
170
160
150
140
130
120
110
100
80
70
60
50
40
30
20
10
0
Radiolaria
Spirillina
Patellina
Heterohelix
„hedbergelly"
a orbitoliny
Globochaete alpina
Cadosina semiradiata semiradiata
Stomiosphaera echinata
Colomisphaera heliosphaera
Cadosina semiradiata olzae
Didemnoides sp.
Tintinnopsella carphatica
Cadosina fusca
Colomisphaera vogleri
Stomiosphaera wanneri
Didemnum sp.
Gemeridella sp.
Cruciellipsis cuvilleri
Conusphaera mexicana
Cyclagelosphaera margereti
Ellipsogelosphaera britanica
Micrantholithus hochschulzi
Nannoconus steinmanni
Stradneria crenulata
Watznaueria barnesae
Zeughrabdotus embergeri
Biscutum constans
Cretarhabdus conicus
Nannoconus globulus
Braarudosphaera bigelowi
Nannoconus bermudezi
Watznaueria biporta
Acanthocircus carinatus
Acanthocircus dicranacanthos
Aceoniotyle diaphorogona
Aceoniotyle umbilicata
Alievium helenae
?Angulobracchia sp. A;B
Archaeodictyomitra pseudoscalaris
Archaeodictyomitra sp.
Cecrops septemporatus
Cyrtocapsa grutterinki
?Haliodictya hojnosi
Holocryptocanium barbui
Mesosaturnalis aculeatus
Mesosaturnalis hueyi
Mirifusus chenodes
Obesacapsula rotunda
Orbiculiforma sp. A, B, C
Pantanellium lanceola
?Paronaella spinosa
Paronaella sp.
Parvicingula boesi
?Petasiforma sp.
Podobursa triacantha
Pseudodictyomitra carpatica
Pseudodictyomitra cf. lilyae
Sethocapsa leiostraca
Sethocapsa trachyostraca
Syringocapsa agolarium
Thanarla conica
Triactoma eochiodes
Ultranapora spinifera
Xitus spicularius
?Acaeniotyle florea
Cyclastrum decorum
Paronaella trifoliacea
Orbiculiforma trispinosa
VALANGINIAN
HAUTERIVIAN-BARREMIAN
APTIAN

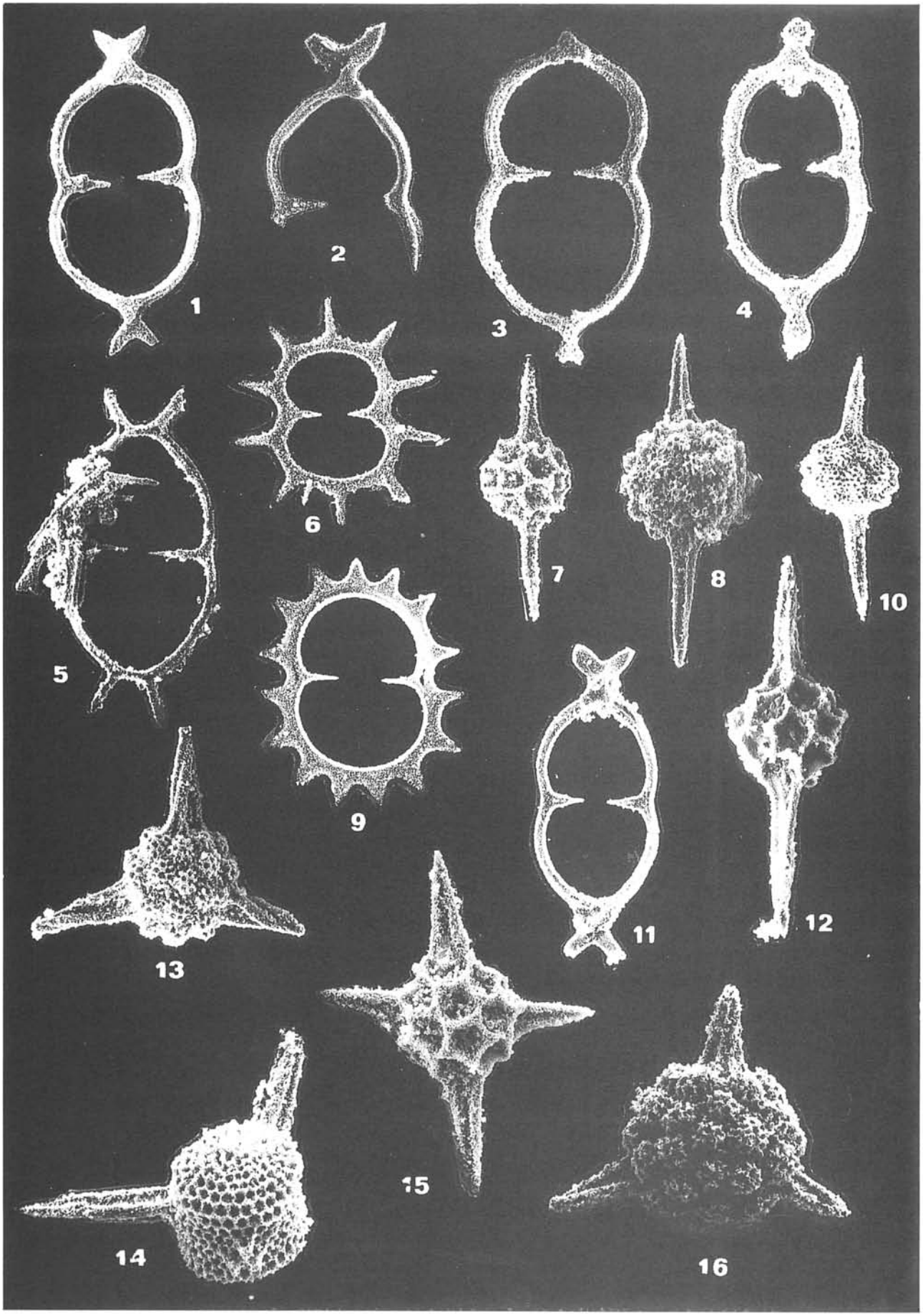
Plate 1: Fig. 1 - *Acanthocircus dicranacanthos* (Squinabol), 7519, 100 x magn.; Fig. 2 - *Acanthocircus dicranacanthos* (Squinabol), 4908, 110 x magn.; Fig. 3 - *Acanthocircus* sp. B - 7526, 110 x magn.; Fig. 4 - *Acanthocircus* sp. A - 6456, 110 x magn.; Fig. 5 - *Acanthocircus carinatus* Foreman - 7534, 110 x magn.; Fig. 6 - *Mesosaturnalis hueyi* (Pessagno) - 4899, 100 x magn.; Fig. 7 - *Pantanellium lanceola* (Parona) - 7541, 150 x magn.; Fig. 8 - *Acaeniotyle umbilicata* (Rüst) - 7450, 120 x magn.; Fig. 9 - *Mesosaturnalis aculeatus* (Rüst) - 6470, 100 x magn.; Fig. 10 - *Acaeniotyle umbilicata* (Rüst) - 8458, 170 x magn.; Fig. 11 - *Acanthocircus dicranacanthos* (Squinabol) - 6457, 110 x magn.; Fig. 12 - *Pantanellium lanceola* (Parona) - 8435, 210 x magn.; Fig. 13 - *Acaeniotyle diaphorogona* Foreman - 8433, 145 x magn.; Fig. 14 - *Triactoma echiodes* Foreman - 7543, 200 x magn.; Fig. 15 - *Cecrops septemporatus* (Parona) - 4894, 200 x magn.; Fig. 16 - *Acaeniotyle diaphorogona* Foreman - 7483, 180 x magn. (See page 319)

Plate 2: Fig. 1 - *Triactoma echiodes* Foreman - 7523, 200 x magn.; Fig. 2 - *Alievium helenae* Schaaf - 8450, 130 x magn.; Fig. 3 - *?Angulobracchia crassa* (Ožvoldová) - 8448, 130 x magn.; Fig. 4 - *?Angulobracchia crassa* (Ožvoldová) - lateral view of Fig. 3, 180 x magn.; Fig. 5 - *Triactoma echiodes* Foreman - 7536, 135 x magn.; Fig. 6 - *Orbiculiforma* sp. A - 6461, 125 x magn.; Fig. 7 - *Alievium helenae* Schaaf - 8451, 125 x magn.; Fig. 8 - *Orbiculiforma* sp. A - lateral view of Fig.6 - 8036, 200 x magn.; Fig. 9 - *Crucella* sp. - 7516, 190 x magn.; Fig. 10 - *Gen. et* sp. *indet.* - 7515, 140 x magn.; Fig. 11 - *Orbiculiforma tecta* Tumanda - lateral view of Fig. 12, 7538, 175 x magn.; Fig. 12 - *Orbiculiforma tecta* Tumanda - 7532, 160 x magn.; Fig. 13 - *Orbiculiforma coronata* Tumanda - 7208, 125 x magn., (See page 320)

Plate 3: Fig. 1 - *Orbiculiforma* sp. B - 7478, 120 x magn.; Fig. 2 - *Podobursa triacantha* (Fischli) - 6466, 150 x magn.; Fig. 3 - *Mirifusus chenodes* (Renz) - 7546, 135 x magn.; Fig. 4 - *Syringocapsa agolarium* Foreman - 8463, 200 x magn.; Fig. 5 - *Ultranapora praespinifera* Pessagno - 8455, 190 x magn.; Fig. 6 - *Holocryptocanium barbui* Dumitrica - 7451, 100 x magn.; Fig. 7 - *Holocryptocanium barbui* Dumitrica - 4895, 280 x magn.; Fig. 8 - *Sethocapsa leiostraca* Foreman - 4910, 140 x magn.; Fig. 9 - *Sethocapsa trachyostraca* Foreman - 4898, 140 x magn.; Fig. 10 - *Microsciadiocapsa monticelloensis* Pessagno - 7473, 190 x magn.; Fig. 11 - *Cyrtocapsa grutterinki* Tan Sin Hok - 6465, 230 x magn.; Fig. 12 - *Parvicingula boesii* (Parona) - 8019, 230 x magn.; Fig. 13 - *Cyrtocapsa grutterinki* Tan Sin Hok - oral part of Fig. 11, 7551, 260 x magn. (See page 321)

Plate 4: Fig. 1 - *Archaeodictyomitra pseudoscalaris* (Tan Sin Hok) - 6471, 225 x magn.; Fig. 2 - *Parvicingula* cf. *dhimenaensis* Baumgartner - 8454, 140 x magn.; Fig. 3 - *Pseudodictyomitra* cf. *lilyae* (Tan Sin Hok) - 8428, 230 x magn.; Fig. 4 - *Xitus spicularius* (Aliev) - 8028, 230 x magn.; Fig. 5 - *Archaeodictyomitra* sp. - 8459, 250 x magn.; Fig. 6 - *Xitus spicularius* (Aliev) - 7537, 205 x magn.; Fig. 7 - *Archaeodictyomitra pseudoscalaris* (Tan Sin Hok) - 4901, 230 x magn.; Fig. 8 - *Thanarla conica* (Aliev) - 6447, 285 x magn.; Fig. 9 - *Obesacapsula rotunda* (Hinde) - 8460, 170 x magn.; Fig. 10 - *Thanarla conica* (Aliev) - 6447, 285 x magn.; Fig. 11 - *Podobursa triacantha* (Fischli) - 8452, 180 x magn.; Fig. 12 - *Sethocapsa trachyostraca* (Foreman) - 7455, 160 x magn.; Fig. 13 - *Pseudodictyomitra carpatica* Lozynjak - 8429, 170 x magn. (See page 322)

Plate 5: Fig. 1 - *Paronaella trifoliacea* Ožvoldová n. sp. - holotype 6467, 210 x magn.; Fig. 2 - *Paronaella trifoliacea* Ožvoldová n. sp. - paratype 4914, 150 x magn.; Fig. 3 - *Paronaella trifoliacea* Ožvolodová n. sp. - paratype 7199, 130 x magn.; Fig. 4 - *Paronaella trifoliacea* Ožvoldová n. sp. - lateral view of Fig. 3, 7198, 170 x magn.; Fig. 5 - *Paronaella trifoliacea* Ožvoldová n. sp. - central area of Fig. 1, 6468, 400 x magn.; Fig. 6 - *?Acaeniotyle florea* Ožvoldová n. sp. - paratype, 7178, 140 x magn.; Fig. 7 - *?Acaeniotyle florea* Ožvoldová n. sp. - holotype, 7183, 160 x magn.; Fig. 8 - *?Acaeniotyle florea* Ožvoldová n. sp. lateral view of Fig. 7, 7185, 235 x magn.; Fig. 9 - *Cyclastrum decorum* Peterčáková n. sp. - holotype, 7479, 160 x magn.; Fig. 10 - *Orbiculiforma decora* Peterčáková n. sp. - holotype, 7445, 190 x magn. (See page 323)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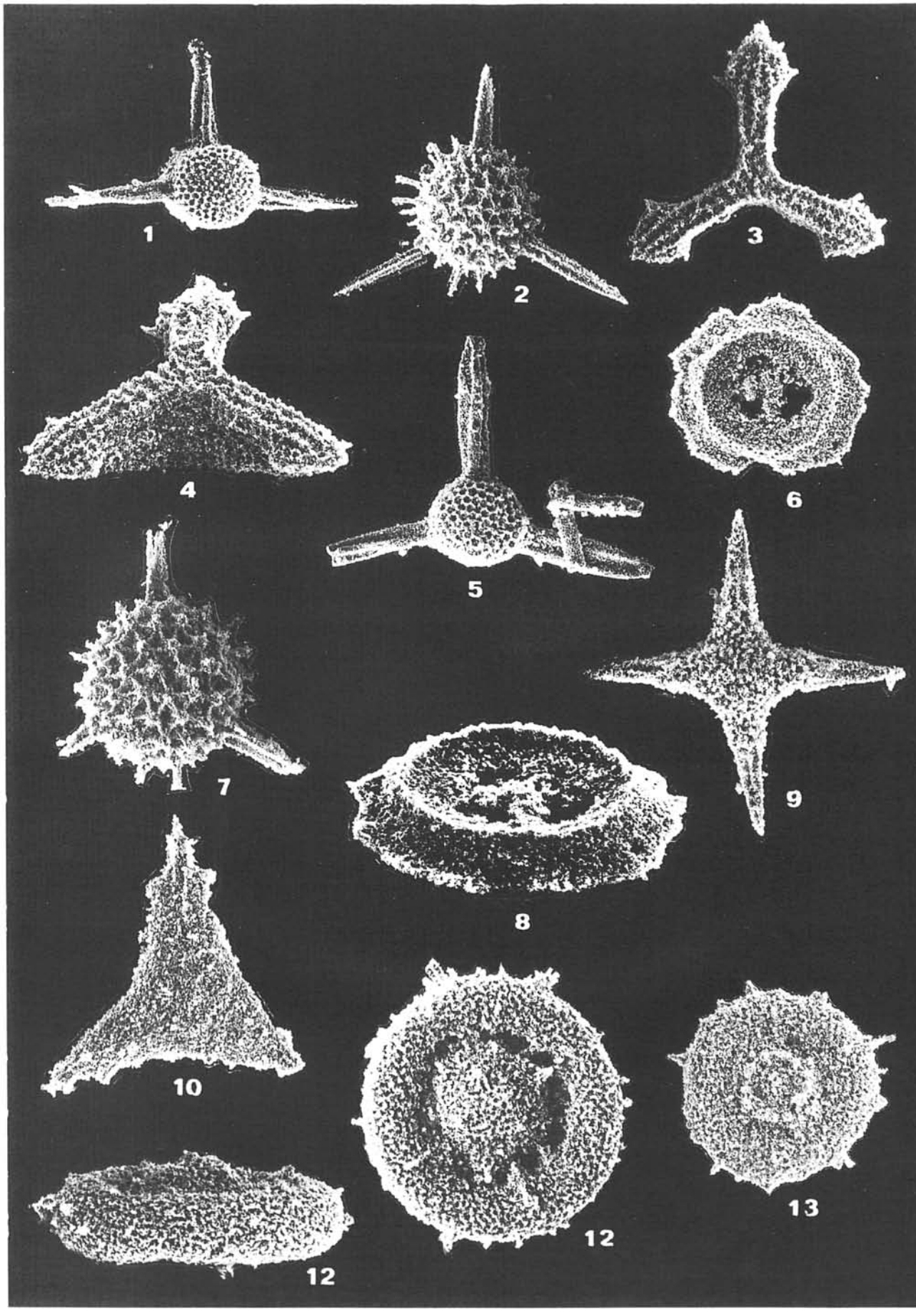
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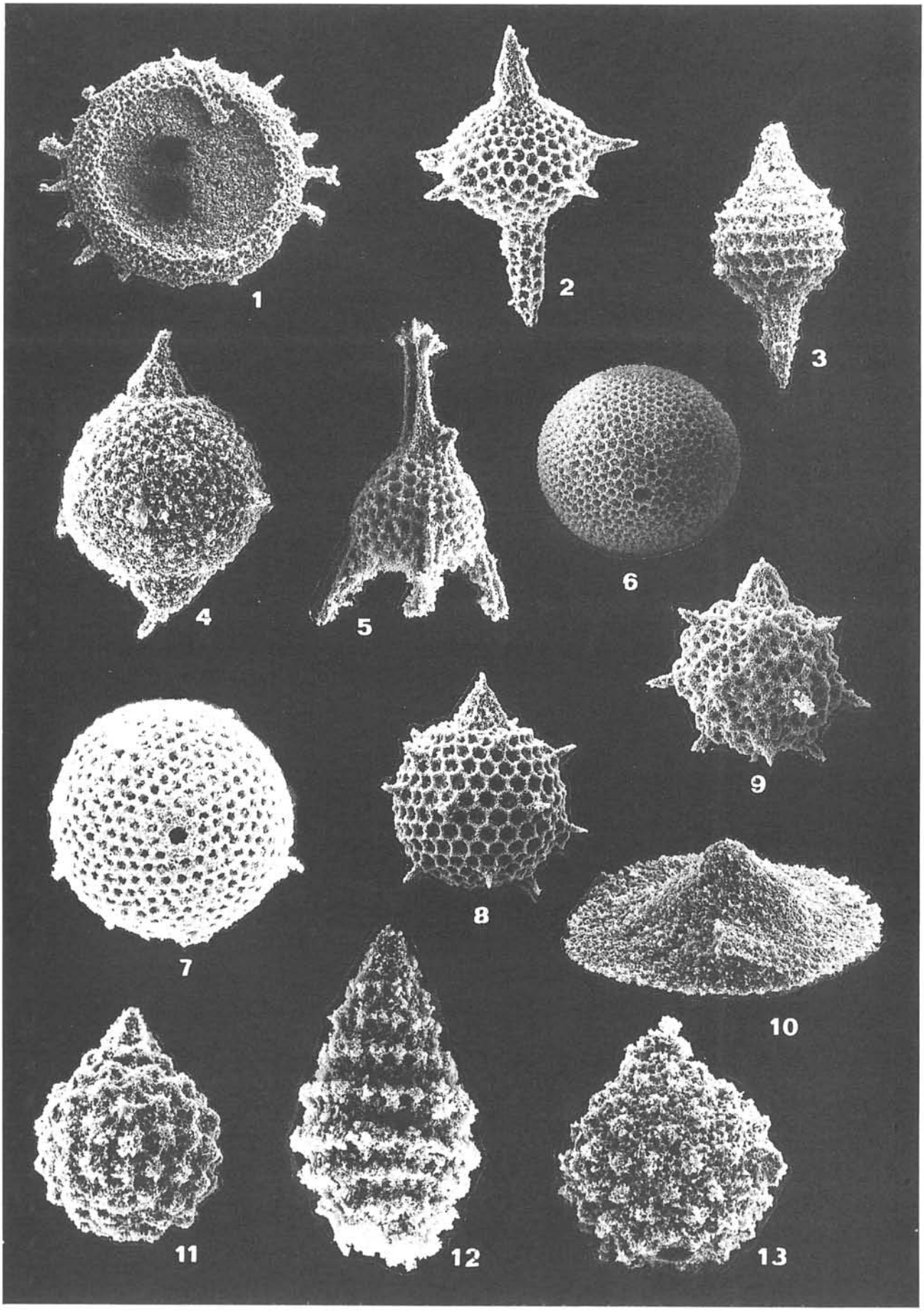
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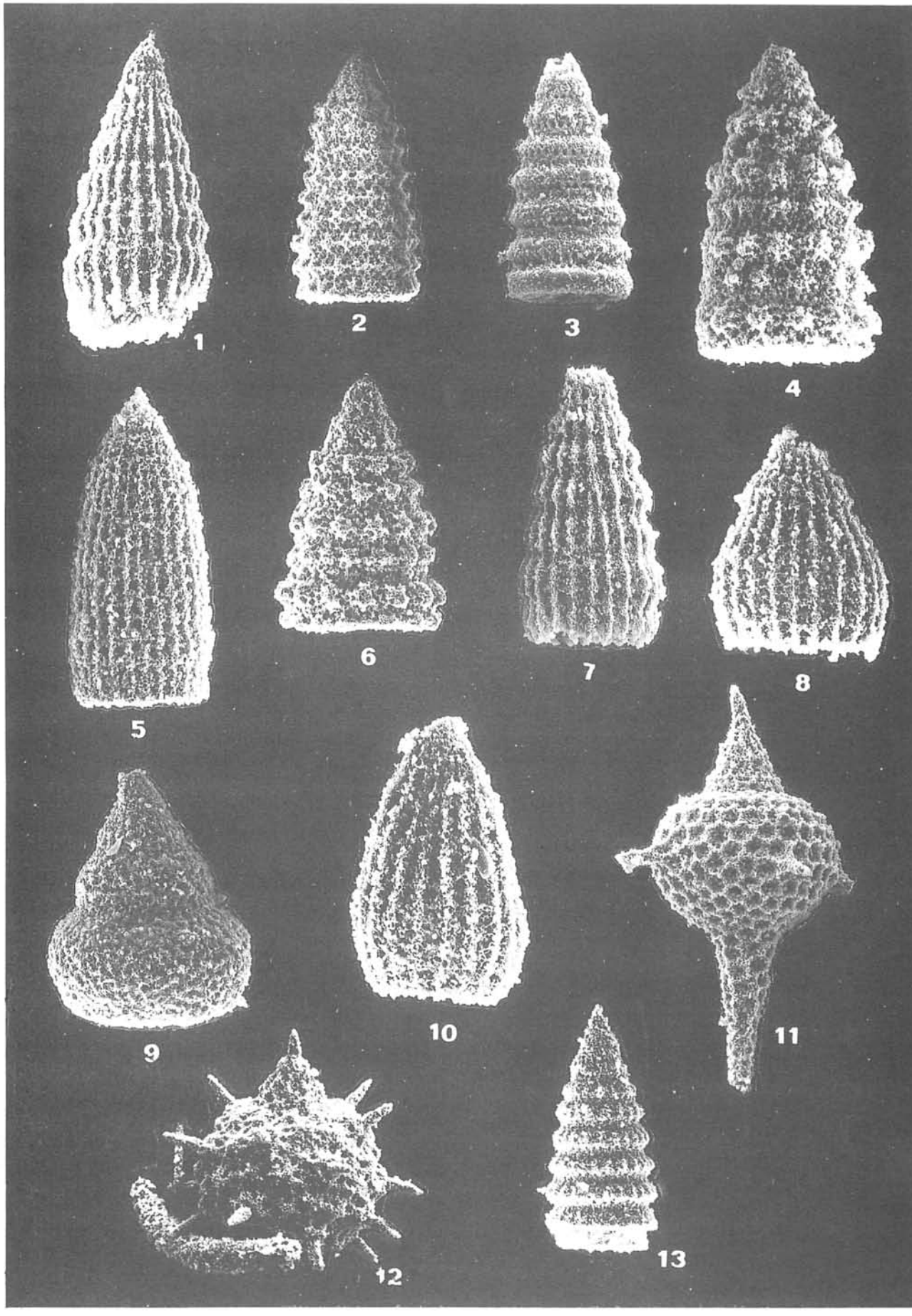
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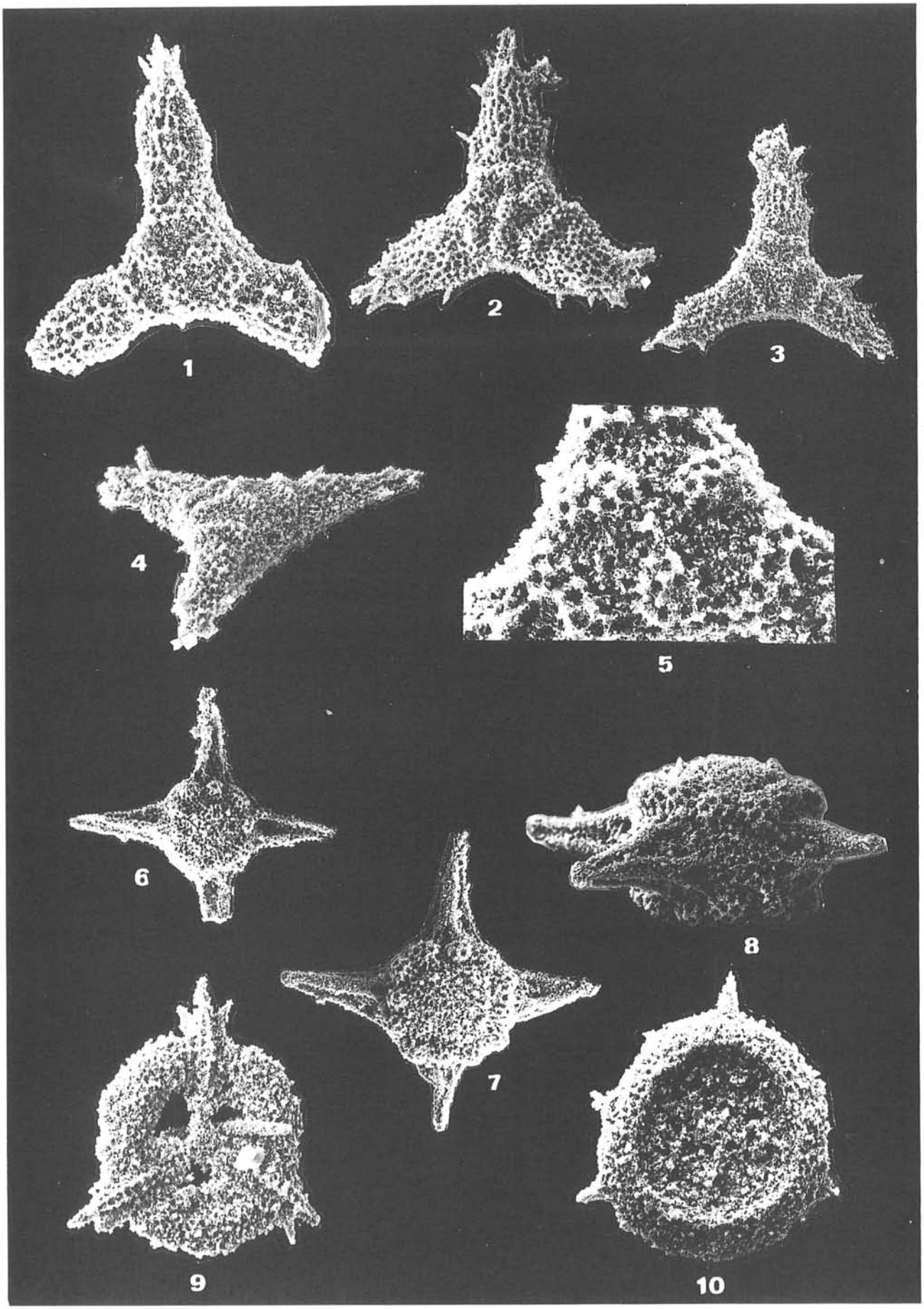
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