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Contribution to the radiolarian fauna of the Middle Triassic of the Southern Alps

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Zusammenfassung

Aus oberanisischen bis unterladinischen Beckensedimenten (Nodosus-Schichten bzw. Buchensteiner Schichten) der Südalpen im Gebiet von Recoaro und Tretto (Vicentinische Alpen) wird eine reiche Radiolarienfauna beschrieben. Neben vielen von den Autoren bereits beschriebenen Formen werden in dieser Arbeit 4 neue Familien, 17 Gattungen sowie 28 Arten bzw. 3 Unterarten neu aufgestellt.

Obwohl sich bereits einige Leitarten abzeichnen, die in gleichalten Schichten der Nördlichen Kalkalpen sowie im Bakonygebirge (Ungarn) und in Rumänien auftreten, wird zunächst von einer stratigraphischen Auswertung Abstand genommen.

Summary

A rich radiolarian fauna from Upper Anisian to Lower Ladinian basin sediments ("Nodosus-Schichten" resp. "Buchenstein-Schichten") of the Southern Alps in the area of Recoaro and Tretto (Vicentinian Alps) is described. Beside many forms, which were already described by the authors, 4 new families, 17 genera,

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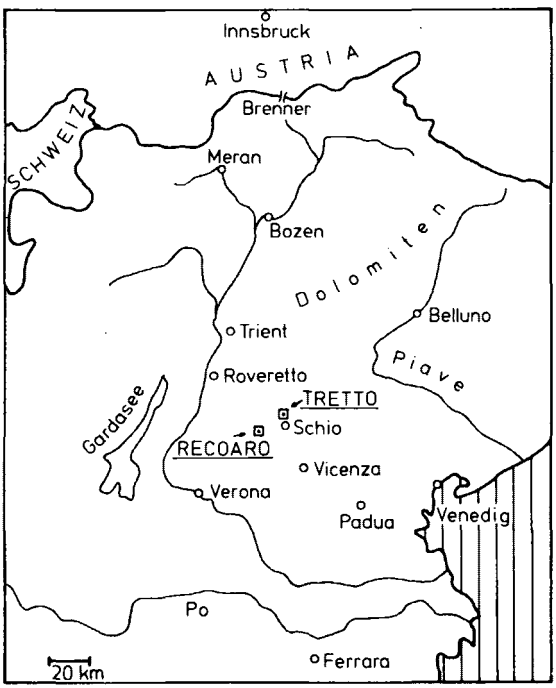
28 species and 3 subspecies are established.

Though some index-forms possibly appear in beds of the same age - Nördliche Kalkalpen, Bakony Mts. (Hungary) and in Rumania - for the moment a stratigraphic interpretation was not resolved.

Introduction

Almost no Triassic radiolarians were known before the first comprehensive study of Triassic radiolarians by KOZUR & MOSTLER, 1972. Since that time several papers on Triassic radiolarians contributed greatly to the understandig of this important fossil group in the Triassic (De WEVER et al., 1979; DUMITRICA, 1978a, b; KOZUR & MOSTLER, 1978, 1979, 1980; PESSAGNO, FINCH & ABOTT, 1979). In the present study further Middle Triassic radiolarians from the Southern Alps are described.
The material we studied, comes from different parts of the Vicentinian Alps, especially from two areas: Recoaro (NE of Monte Anghebe, SW and S of Monte Falison) and Tretto (around San Ulderico) (see fig. 1).



All radiolarians were found in Middle Triassic basin sediments named "Nodosus-Schichten" (= "Buchenstein-Schichten"). The exact stratigraphic position of the radiolarian-bearing beds could not be solved until now. Probably they belong to the Anisian/Ladinian boundary.

Subclass Radiolaria MÜLLER, 1858

Order Polycystina EHRENBERG, 1838

Suborder Spumellaria EHRENBERG, 1875

Family Heptacladidae n.fam.

Diagnosis: Skeleton spherical with a single or double-layered lattice cortical shell and seven, possibly less or more, radial spines originate in a medullary network. The radial spines bear several verticils of two opposite apophyses set in successively perpendicular planes of three apophyses, sometimes the inner ones being disorderly arranged. Medullary skeleton consisting of a network of straight bars connecting the internal apophyses.
Included genus: *Heptacladus* n.gen.
Occurrence: Middle and Upper Triassic of the European Tethys.
Remarks: Although in the Heptacladidae n.fam. there are no inner shells because the network of connecting bars ist too loose, in some positions to shells can be approximately remarked. By such kind of medullary skeleton and number of radial spines the Heptacladidae n.fam. can be clearly separated from all the other spumellarian families.

Three species belonging probably to two genera, one with three-bladed radial spines (two species) and another one with non-bladed spines, have been so far remarked. Only the last one is described herein.

Genus *Heptacladus* n.gen.

Derivatio nominis: According to the 7 radial spines.
Type species: *Heptacladus crassispinus* n.gen.n.sp.
Diagnosis: Shell sperical with 7 radial spines containing 3-5 or more verticils of two opposite apophyses set in successively perpendicular planes. Cortical shell lattice, single or double-layered, in the latter case only the inner layer being lattice. Medullary skeleton as with family.

Heptacladus crassispinus n.gen.n.sp.

(pl. 5, fig. 3; pl. 13, fig. 1-3, 5)

Derivatio nominis: According to the stout radial spines.
Holotype: The specimen figured at pl. 5, fig. 3.
Diagnosis: Radial spines stout, long, cylindrical. Cortical shell with thick bars and very large polygonal meshes. It originates in the two external verticils of the radial spines. From some of the nodal points of the cortical shell by-spines arise that may be simple or may be branched to form a peripheral shell (pl. 13, fig. 5).
Dimensions: Diameter of cortical shell without by-spines

135-150 µm, of medullary shell 45-50 µm, of radial spines 20 µm. The length of the radial spines could not be determined because they are always broken.

Occurrence: Rare in the Middle Triassic Buchenstein Beds.

Remarks: The forms with branched by-spines connected into a peripheral shell (pl. 13, fig. 5) might represent an independent species or subspecies, or old specimens.

Family Oertlispongidae KOZUR & MOSTLER n.fam.

Diagnosis: Spongy elongated-ellipsoidal to subspherical, sometimes also spherical, rare spindle-shaped to cylindrical shell with many layers and a minute microsphere in the centre. The stout spines, if present, originate in the microsphere, the smaller ones in the spongy network in different distance from the centre. Needle-like, sometimes bladed spines always present, mostly concentrated in the both pole areas . Main spines sometimes present, often cylindrical and bended in different manner, sometimes also bladed and twisted.

Included genera: *Oertlispongus* n.gen.
Gomberellus n.gen.
Tamonella n.gen.
n.gen.A
n.gen.B
n.gen.C

Occurrence: ? Early Paleozoic, frequent from the Carboniferous to Middle Triassic, rare in the Upper Triassic.

Remarks: The internal structure of the Early Paleozoic representatives is still unknown. In the Carboniferous and in the Permian until now two genera are known (n.gen.A and n.gen.B). These genera have spherical or ellipsoidal spongy shells with more than 10 layers and a small microsphere and rather small spines that are present on the whole shell and only slightly concentrated in the pole areas, if ellipsoidal shells are present. The youngest representative of the family is n.gen.C n.sp. (or *Gomberellus* n.sp.) from the Carnian (see KOZUR & MOSTLER, 1979, pl. 21, fig. 2) with spindle-shaped shell. This genus is similar to *Gomberellus* n.gen., but smaller spines are quite absent. Therefore a trend to reduction of the number of spines and to the enlargement of the spines can be observed within the family. In the Paleozoic representatives only forms with numerous small spines are present. The first stout main spines can be observed in the Middle Triassic, the number of the smaller spines is here already strongly reduced. One of the authors (P. DUMITRICĂ) includes the Oertlispongidae n.fam. to the Sponguridae HAECKEL, 1862. According to the other authors the Oertlispongidae n.fam. are not related to *Spongurus* HAECKEL, 1861, and therefore cannot belong to the emended Sponguridae HAECKEL, 1862 emend. KOZUR & MOSTLER, 1979.

Genus *Oertlispongus* n.gen.

Derivatio nominis: In honour to Dr. H.J. OERTLI, Pau, for his support of the paper.

Type species: *Oertlispongus inaequispinosus* n.gen.n.sp.
Diagnosis: Spongy shell subellipsoidal to spherical with two stout cylindrical polar spines. At least one of these spines is characteristically bended. Near to the equator or between the equator and one pole there are smaller cylindrical spines (2-3, situated in one spot). Inner structure as for the family. Commonly more than 10 layers are present.
Included species: *Oertlispongus inaequispinosus* n.gen.n.sp.
Oertlispongus cornubovis n.sp.
Occurrence: Middle Triassic of the Tethyan realm.

Remarks: *Tamonella* n.gen. has an elongated-ellipsoidal shell with many small cylindrical spines in the pole area.

Oertlispongus inaequispinosus n.gen.n.sp.

(pl. 10, fig. 7)

Derivatio nominis: According to the quite different polar spines.
Holotype: The specimen figured at pl. 10, fig. 7.
Diagnosis: Spherical spongy body, spongy network arranged in more than 10 layers. Two polar spines, round in cross section. One polar spine is very long, strongly curved and stout. The other one at the opposite side is long, straight, needle-like and not so stout. It may be accompanied by additional smaller spines. In the equatorial region there are 2-4, mostly 3 smaller needle-like spines situated in short distance from each other.
Occurrence: Middle Triassic of the European Tethys.
Remarks: *Oertlispongus cornubovis* n.sp. is distinguished by the subellipsoidal shape of the shell and above all by the nearly equal, curved and stout polar spines.

Oertlispongus cornubovis n.sp.

(pl. 10, figs. 4, 9)

Derivatio nominis: According to the shape of the polar spines.
Holotype: The exemplar figured at pl. 10, fig. 4, 9.
Diagnosis: Spongy shell with many layers and two stout polar spines, round in cross section. Both polar spines are curved like cow horns. 2 or 3 short needle-like spines are situated in short distance from each other between the equator and one pole (more near to the equator).
Occurrence: Middle Triassic of the European Tethys.
Remarks: *Oertlispongus inaequispinosa* n.sp. is distinguished by the heterogenous polar spine (one of which is always straight) and by the subelliptical shell.

Genus *Gomberellus* n.gen.

Derivatio nominis: Arbitrary combination of letters.
Type species: *Gomberellus hircicornus* n.gen.n.sp.
Diagnosis: Spherical to subspherical spongy shell. Spongy network arranged in many layers. All spines in their proximal parts bladed, in their distal parts needle-like with round

cross section. Most spines moderately long, delicate. Two spines are different from the other ones, mostly stout, twisted or bifurcated. At the surface of the shell they originate in short distance from each other. Mostly 3 of the moderately long spines are situated at the opposite side of these stout spines. One or two further moderately long spines are situated at the equatorial plane.

Included species: *Gomberellus hircicornus* n.gen.n.sp.
Gomberellus mocki n.sp.

Occurrence: Middle Triassic of Tethyan realm.

Remarks: *Oertlispongus* n.gen. is distinguished by the arrangement of the spines and the absence of opposite polar spines. *Tamonella* n.gen. has no main spines and the numerous small spines are situated in the polar areas of the elongated-ellipsoidal shell.

Gomberellus hircicornus n.gen.n.sp.

(pl. 10, fig. 6; pl. 14, fig. 3)

Derivatio nominis: According to the form and the arrangement of the main spines.

Holotype: The exemplar figured at pl. 10, fig. 6.

Diagnosis: Spongy test subspherical with many layers. The two stout spines originate at the shell surface in a short distance from each other and diverge at an angle of nearly 90°. They are three-bladed and twisted and they end in a long needle-like spine. On the opposite side mostly 3moderately long spines are present. A further moderately long spine is situated between these spine groups. All the moderately long spines are bladed in their proximal parts and needle-like with round cross-section in their distal parts. The position and sometimes even the number of the moderately long spines is somewhat variable, whereas the position of the stout twisted main spines is fairly constant.

Occurrence: Middle Triassic of the European Tethys.

Remarks: *Gomberellus mocki* n.sp. is distinguished by the absence of the stout twisted spines that are replaced by two bifurcated spines that do not so much diverge than the twisted spines at *G. hircicornus* n.sp.

Gomberellus mocki n.sp.

(pl. 10, figs. 2, 5)

Derivatio nominis: In honour to Dr. R. MOCK, Bratislava.

Holotype: The specimen figured at pl. 10, figs. 2, 5.

Diagnosis: Spongy subspherical shell. At one side of the shell two long, slightly diverging spines are present that bifurcate somewhat above their basis, sometimes also at the basis. On the opposite side a bunch of 3-4, seldom 5 moderately long spines is situated. Between these two spine groups two rather long spines are present that lie approximately opposite each other. Position and number of spines somewhat

variable. The spines are bladed proximally and needle-like distally.
Occurrence: Middle Triassic of the Southern Alps.
Remarks: *Gomberellus hircicornus* n.gen.n.sp. is distinguished above all by presence of two stout twisted spines instead of the bifurcated ones.

Genus *Tamonella* n.gen.

Derivatio nominis: Arbitrary combination of letters.
Type species: *Tamonella multispinosa* n.gen.n.sp.
Diagnosis: Elongated-ellipsoidal spongy shell. Spongy network arranged in many layers. Microsphere minute. The numerous (mostly more than 10) spines are rather short, needle-like and situated only in the pole areas. They all have nearly the same length.
Included species: *Tamonella multispinosa* n.gen.n.sp.
Occurrence: Middle Triassic of the European Tethys.
Remarks: All other genera of the Oertlispongidae are distinguished by the arrangement of the spines. Most similar is n.gen.B from the Permian, but the spines of this genus are shorter and regularly distributed on the shell surface.
The other Triassic genera of the Oertlispongidae have two main spines clearly stronger than the other spines or in other way different from the remaining spines.

Tamonella multispinosa n.gen.n.sp.

(pl. 10, figs. 1, 3, 8)

Derivatio nominis: According to the numerous spines.
Holotype: The specimen figured at pl. 10, fig. 8.
Diagnosis and occurrence: As for the genus.

Family Pentactinocarpidae DUMITRICĂ, 1978

Genus *Pentactinocarpus* DUMITRICĂ, 1978

Synonym: *Oertlisphaera* KOZUR & MOSTLER, 1979

Pentactinocarpus acanthicus DUMITRICA, 1978

(pl. 4, fig. 7)

1978 b *Pentactinocarpus acanthicus* n.sp. - DUMITRICĂ, p. 44-45, pl. 3, fig. 3.
Occurrence: Middle Triassic of the Southern Alps and Rumania, Carnian of Rumania.

Pentactinocarpus fusiformis DUMITRICĂ, 1978

(pl. 4, figs. 2, 3, 5, 6, 8)

1978 b *Pentactinocarpus fusiformis* n.sp. - DUMITRICĂ, p. 44, pl. 2, fig. 2.

Occurrence: Very frequent in the Middle Triassic of the Southern Alps.

Pentactinocarpus tetracanthus DUMITRICĂ, 1978

(pl. 4, figs. 1, 4)

1978 b *Pentactinocarpus tetracanthus* n.sp. - DUMITRICĂ, p. 44, pl. 2, fig. 1.

Occurrence: Middle Triassic of the Southern Alps.

Remarks: *Pentactinocarpus magnus* (KOZUR & MOSTLER, 1979) is distinguished by the absence of the antapical spine and by the broader rounded antapical part of the shell. Moreover, the free distal ends of the basal spines lies nearer to the antapical pole in *P. magnus* (KOZUR & MOSTLER, 1979) than in *P. tetracanthus* DUMITRICĂ, 1978.

Family Relindellidae KOZUR & MOSTLER n.fam.

Diagnosis: Medium-sized complete spongy disc with a very small microsphere in the centre. The spongy disc may have a distinct central depression surrounded by a spongy rim. 4-6 large, stout, three-bladed spines lie in the equatorial plane. They originate from the microsphere. Distal spinules at the spines often present.

Included genera: *Relindella* KOZUR & MOSTLER n.gen.
Pentaspongodiscus KOZUR & MOSTLER, 1979 emend.
Tetraspongodiscus KOZUR & MOSTLER, 1979

Occurrence: Middle Triassic and Carnian of the European Tethys.

Remarks: The Orbiculiformidae PESSAGNO, 1973, have always a marginal rim that surrounds a distinct depression. The marginal spines are always short or even absent. Maybe that the Relindellidae n.fam. are the forerunners of the Orbiculiformidae PESSAGNO, 1973, but no genus of the Orbiculiformidae PESSAGNO, 1973, has so long spines. Even at the Triassic Orbiculiformidae PESSAGNO, 1973, that have the longest spines of all genera of this family, the central disc has a several times longer diameter than the length of the spines. On the contrary at the Relindellidae n.fam. the spines are considerably longer than the diameter of the disc or at least so long as the latter. In spite of these constant considerable morphologic differences both families seem to be nearly related because of the corresponding inner structure.

Genus *Relindella* KOZUR & MOSTLER n.gen.

Derivatio nominis: Arbitrary combination of letters.
Type species: *Relindella hexaspinosa* n.gen.n.sp.
Diagnosis: Spongy disc with central depression and large marginal rim. Microsphere very small. The 6 stout spines are situated in the equatorial plane and they are about two times so long as the diameter of the medium-sized spongy disc. They originate in the microsphere. The spines are three-bladed and somewhat twisted, distal often with short spinules. Behind the spinules the spines end in needle-like tips.
Included species: *Relindella hexaspinosa* n.gen.n.sp.
Relindella n.sp.
Occurrence: Middle Triassic to Upper Carnian of the European Tethys.
Remarks: The completely spongy disc with the central depression, marginal rim and the very small microsphere corresponds with that of Orbiculiformidae PESSAGNO, 1973, but all genera of this family have only very short marginal spines, very much shorter than the diameter of the disc. *Hexaspongodiscus* n.gen. has no central depression and no marginal rim.

Relindella hexaspinosa n.gen.n.sp.

(pl. 8, figs. 1-3, 6)

Derivatio nominis: Acccording to the 6 spines.
Holotype: The exemplar figured at pl. 8, figs. 1-3, 6.
Diagnosis: The diameter of the central depression of the completely spongy disc is about half of the whole diameter of the spongy disc. Marginal rim broad, distinct. The 6 spines are very long, stout, three-bladed and somewhat twisted. Distally short spinules originate from the blades. They are directed obliquelly centrifugally. Behind the spinules the spines end in long needle-like tips.
Occurrence: Middle Triassic of the Southern Alps, ? Carnian of Rumania.
Remarks: *Relindella* n.sp. from the Carnian is distinguished by the form of the spines. One of the authors (P. DUMITRICĂ) regards *R. hexaspinosa* n.gen.n.sp. as species of *Pentaspongodiscus* KOZUR & MOSTLER, 1979 emend.

Pentaspongodiscus KOZUR & MOSTLER, 1979 emend.

Type species: *Pentapsongodiscus tortilis* KOZUR & MOSTLER, 1979.
Emended diagnosis: Medium-sized completely spongy disc with a very small central microsphere. Surface simple or with pseudoaulophacid structure. 5-6 long three-bladed spines originate from the microsphere and lie in the equatorial plane. Spines simple, twisted or bearing distal spinules.

Pentaspongodiscus tortilis ladinicus n.subsp.

(pl. 8, fig. 5)

Derivatio nominis: According to the occurrence in the Ladinian.
Holotype: The specimen figured at pl. 8, fig. 5.
Diagnosis: Small to medium-sized complete spongy disc of pentagonal equatorial outline. The 5 spines are stout and very long, moderately twisted, distally pointed, sometimes with short needle-like prolongation.
Occurrence: Middle Triassic of the Southern Alps, Carnian of the East Carpathians.
Remarks: *Pentaspongodiscus tortilis tortilis* KOZUR & MOSTLER, 1979, from the Carnian has more delicate, needle-like, twisted, three-bladed spines.
Pentaspongodiscus spinosus KOZUR & MOSTLER, 1979, has shorter and more stout untwisted spines with distal spinules.
Pentaspongodiscus mesotriassicus n.sp. has 6 spines, but is otherwise very similar. Maybe that *P. tortilis ladinicus* n.subsp. is more closely related to this species than to *P. tortilis* KOZUR & MOSTLER, 1979. The Carnian specimens differ from the Ladinian ones by the better development of the spinules.

Pentaspongodiscus symmetricus n.gen.n.sp.

(pl. 8, fig. 4)

Derivatio nominis: According to the quite symmetrical arrangement of the spines.
Holotype: The specimen figured at pl. 8, fig. 4.
Diagnosis: Medium-sized complete spongy shell with very small microsphere. The 6 spines in the equatorial plane are long, stout, three-bladed and quite straight without any torsion. They taper gently to a point.
Occurrence: Middle Triassic from the Southern Alps.
Remarks: *Pentaspongodiscus mesotriassicus* n.sp. has more slender twisted spines with long distal needle-like tips.

Pentaspongodiscus mesotriassicus n.sp.

(pl. 8, fig. 7)

Derivatio nominis: According to the occurrence in the Middle Triassic.
Holotype: The specimen figured at pl. 8, fig. 7.
Diagnosis: Small to medium-sized complete spongy disc with very small microsphere. The 6 spines originate from the microsphere. They are long, three-bladed, somewhat twisted and they end in long, needle-like tips.
Occurrence: Middle Triassic of the Southern Alps.
Remarks: *Hexaspongodiscus symmetricus* n.gen.n.sp. has more stout spines without any torsion.

Family Multiarcusellidae KOZUR & MOSTLER, 1979

Genus *Beturiella* n.gen.

Derivatio nominis: Arbitrary combination of letters.
Holotype: *Beturiella robusta* n.gen.n.sp.
Diagnosis: Cortical shell spherical, lattice, well developed. The 6 radial spines stout, three-bladed, connected by arches outlining the edges of a triangular prism. Medullary shell double, the innermost shell made of few bars connecting the proximal ends of the radial spines.
Occurrence: Middle Triassic.
Remarks: *Beturiella* n.gen. is the most primitive genus among the Multiarcusellidae. The primitivity consists in the stout radial spines, well developed cortical shell and more weakly arches as compared with *Baloghisphaera* KOZUR & MOSTLER. *Multiarcusella* KOZUR & MOSTLER has no cortical shell.

Beturiella robusta n.gen.n.sp.

(pl. 3, fig. 5; pl. 12, figs. 1-3)

Derivatio nominis: According to the very stout radial spines.
Holotype: The specimen figured at pl. 3, fig. 5.
Diagnosis: Cortical shell spherical or subspherical with moderately large pores. Surface rough, especially in the mature specimens as a result of the development of some short spines both at the nodal points and on the intervening bars. Radial spines stout, three-bladed, with blunt or rapidely pointed tips. Arches evident, included in the cortical shell. Along them the shell is slithly constricted. Medullary shell as with the genus.
Occurrence: Middle Triassic of the European Tethys.

The following spumellarian genera are listed in alphabetic order without suprageneric classification.

Genus *Amphisphaera* HAECKEL, 1882

Synonym *Amphistylus* HAECKEL, 1882

Amphisphaera mesotriassica n. sp.

(pl. 2, figs. 6, 9)

Derivatio nominis: According to the occurrence in the Middle Triassic.
Holotype: The specimen figured at pl. 2, figs. 6, 9.
Diagnosis: Spherical to subspherical cortical shell with medium-sized polygonal pores. Two short and stout polar spines with three high blades are present. Almost in the middle part of the spines from their blades stout spinules branch off almost perpendicular to the spines. Behind the

spinules the spines taper gently to a point. Medullary shell double.
Occurrence: Middle Triassic of the Southern Alps.
Remarks: Very similar to *Stauracontium trispinosum ladinicum* n.subsp., but only with 2 polar spines instead of 4 crossed spines in *Stauracontium trispinosum ladinicum* n.subsp. are present.

Hexacontium HAECKEL, 1882 emend. KOZUR & MOSTLER, 1979

Synonyma: *Hexadrymium* HAECKEL, 1882
Hexacontarium HAECKEL, 1887

Hexacontium ? mesotriassicum n.sp.

(pl. 2, figs. 2, 8; pl. 14, fig. 6)

Derivatio nominis: According to the occurrence in the Middle Triassic.
Holotype: The specimen figured at pl. 2, fig. 8.
Diagnosis: Cortical shell spherical with large polygonal pores of the irregular size and long conical by-spines. 6 three-bladed main spines in three normal axes, with needle-shaped distal ends. Medullary shell latticed with small polygonal meshes.
Dimensions: Diameter of cortical shell: 145-160 µm, diameter of medullary shell: 35 µm.
Occurrence: Very rare in the Middle Triassic of the European Tethys.

Genus *Parasepsagon* n.gen.

Derivatio nominis: According to the similarity of the inner structure with *Sepsagon* n.gen.
Type species: *Parasepsagon tetracanthus* n.gen.n.sp.
Diagnosis: Cortical shell spherical or ellipsoidal composed of two layers, an inner layer with small pores and a tuberculate outer one with triangular meshes. Four three-bladed unequal main spines: two of them opposite, longer and situated in the main axis, the other two shorter, perpendicular to the main axis but not in the prolongation of one another. Inner shell single, lattice, with a spicule included in its wall. The spicule has four descending rays the prolongation of which are the four external spines, and commonly three apical spines which are not protruding. Before coming out of the microsphere the four descending rays are connected by a proximal ring.
Remarks: *Parasepsagon* n.gen. has an inner structure similar to that of the genus *Sepsagon* n.gen. but differs from it in the fact that all descending rays are prolonged externally.
Occurrence: Anisian and Lower Ladinian.

Parasepsagon tetracanthus n.gen.n.sp.

(pl. 1, fig. 8; pl. 2, fig. 7)

Derivatio nominis: According to the 4 main spines.
Holotype: The specimen figured in pl. 1, fig. 8, and pl. 2, fig. 7.
Diagnosis: With the characteristics of the genus. Two opposite spines are longer than the other two.
Description: The long opposite spines three-bladed, slightly twisted, with almost parallel sides and gently tapering in the distal half. They are twice or more as long as the diameter of the cortical shell. The shorter spines about as long as the diameter of the cortical shell. They are pyramidal, three-bladed and not twisted.
Occurrence: Middle Triassic of the European Tethys.
Remarks: There still exist other species of *Parasepsagon* n.gen. that are distinguished by the shape and length of the spines. These species will be described in separate papers.

Genus *Plafkerium* PESSAGNO, 1979

Plafkerium ? confluens n.sp.

(pl. 1, fig. 1)

Derivatio nominis: According to the continuously connected blades of adjoining main spines.
Holotype: The specimen figured at pl. 1, fig. 1.
Diagnosis: Large cortical shell of subquadratic equatorial outline, somewhat flattened perpendicularly to the plane of main spines. Cortical shell double-layered and somewhat spongy. Inner layer with very small pores. Outer layer tuberculate with some ridges that enclose large and irregular meshes. 4 very stout twisted main spines in two axes at right angles to each other, with high blades. The blades of the adjoining main spines are connected by distinct ridges at the equatorial margin and by more indistinct ridges that run approximately parallel to the marginal ridges at the upper and lower surfaces of the cortical shell. All main spines taper gently to a point. The medullary shell is present but not yet studied.
Occurrence: Middle Triassic of the Southern Alps.
Remarks: *Plafkerium ? contortum* n.sp. has a smaller cortical shell and the main spines are not so broad and more twisted. Moreover, no distinct ridges can be observed at the surface of the cortical shell.

Plafkerium ? contortum n.sp.

(pl. 1, fig. 4)

Derivatio nominis: According to the strongly twisted main spines.

Holotype: The specimen figured at pl. 1, fig. 4.
Diagnosis: Medium-sized cortical shell of subquadratic equatorial outline, somewhat flattened perpendicularly to the plane of main spines. Shell thickened. Inner layer with very fine pores. Outer very irregular layer tuberculate. 4 stout main spines in two axes at right angle to each other. All spines sharply three-bladed. A short proximal straight part is followed by a longer strongly twisted part. The main spines end in moderately large needle-like tips. The lateral blades are connected by an indistinct ridge at the equatorial margin. A medullary skeleton could not be observed (? not present).
Occurrence: Middle Triassic of the Southern Alps.
Remarks: *Plafkerium abotti* PESSAGNO, 1979, is very similar, but one of the 4 main spines is about twice as long as the other 3 spines that are about equal in length.
Plafkerium ? confluens n.sp. has a larger cortical shell, broader and not so strong, but regularly twisted main spines. Moreover, distinct ridges connect the blades of the adjoining main spines.
In *Plafkerium ? muelleri* n.sp. the main spines have a long straight proximal part, a short, slightly twisted middle part, and a very long needle-like distal prolongation.

Plafkerium ? muelleri n.sp.

(pl. 1, fig. 3)

Derivatio nominis: In honour of Prof. Dr. A.H. MÜLLER, Freiberg.
Holotype: The specimen figured in pl. 1, fig. 3.
Diagnosis: Medium-sized cortical shell spherical to subspherical. Wall somewhat spongy with very small pores. In many portions a second outer irregular tuberculate layer is present. 4 very long main spines arranged in one plane along two axes at right angles to each other. The main spines are three-bladed. In the long proximal part the blades are quite straight. The shorter distal part is moderately twisted. Behind this part a very long needle-like prolongation is present that is so long or even longer than the remaining part of the spine. A medullary skeleton could not be observed (? not present).
Occurrence: Middle Triassic of the Southern Alps.
Remarks: *Plafkerium contortum* n.sp. is above all distinguished by the main spines. The untwisted proximal part is hort, the strongly twisted part is longer and the needle-like prolongation is shorter.

Genus *Sepsagon* n.gen.

Derivatio nominis: The name of the genus is an anagram for Dr. Emile A. PESSAGNO Jr. to honour his excellent works on fossil radiolarians. Masculin gender.
Type species: *Triactoma longispinosum* KOZUR & MOSTLER, 1979.

Diagnosis: Cortical shell spherical to slightly compressed. It is composed of two layers: an inner layer with small pores and a tuberculate outer layer with triangular meshes. Three unequal radial spines arranged in one plane. Internal shell single, ovoidal with the long axis in the plane of the radial spines. At one end it has a spicule with a short median bar with commonly 7 rays. Four of them, the descending rays are included in the wall of the internal shell and are connected at some distance from the median bar by a proximal ring. The other three, the apical rays are free and joint to the cortical shell with their ends. Two of the descending rays stop in the proximal ring, the other two extend into two of the radial spines. The third radial spine, opposite to the largest angle, originate in the antapical end of the internal shell.

Occurrence: Frequent in the Middle Triassic and Lower Carnian (Cordevolian) of the European Tethys.

Remarks: The internal shell of this genus is quite similar to the cortical shell of *Pentactinocarpus* DUMITRICĂ, 1978, from which it is distinguished by the presence of the median bar and the greater number of apical rays. This kind of internal shell is common to many Triassic "entactinids" under study by the authors. Almost all of them are characterized by a two-layers cortical shell with tuberculate surface. Some two- or many-spined spumellarians described as *Stylosphaera* (?) and *Hindeosphaera* by KOZUR & MOSTLER, 1979, and as *Archaeospongoprunum* (?) or Actinommid group A by De WEVER et al., 1979, also seem to belong to this group (most probably a new family). Some of the Capuchnospheridae De WEVER, 1979 emend. KOZUR & MOSTLER, 1979 also seem to be of the same nature.

Sepsagon longispinosus (KOZUR & MOSTLER, 1979)

(pl. 5, figs. 1, 2, 5, 6; pl. 15, fig. 1)

1979 *Triactoma longispinosum* n.sp. - KOZUR & MOSTLER, p. 59, pl. 1, fig. 6; pl. 11, figs. 3, 8; pl. 12, fig. 6; pl. 13, fig. 1

Remarks: The Lower Ladinian specimens are similar to the Carnian ones. The three radial spines are always of different length and situated at various angles. There is always a wider angle between the longest spine and one of the shorter. This angle corresponds in the inner side of the shell with the apical part of the inner shell.

Occurrence: Frequent in the Middle Triassic and Lower Carnian of the European Tethys.

Genus *Spongopallium* n.gen.

Derivatio nominis: According to the spongy mantle.

Type species: *Spongopallium contortum* n.gen.n.sp.

Diagnosis: Shell with two polar spines originating in an elongated microsphere situated at some distance inside

an elongated latticed shell. The latter is surrounded by a spongy mantle of various thickness.

Included species: *Spongopallium contortum* n.gen.n.sp. Maybe that also *Spongostylus carnicus* KOZUR & MOSTLER, 1979, *Spongostylus tortilis* KOZUR & MOSTLER, 1979, and *Spongostylus trispinosus* KOZUR & MOSTLER, 1979, belong to this genus.

Remarks: *Spongopallium* n.gen. looks like a *Stylosphaera* EHRENBERG, 1847, with the cortical shell covered by a spongy mantle.

The genus is very similar to *Spongotractus* HAECKEL, from which it differs in having a single and not a double medullary shell (see SANFILIPPO & RIEDEL, 1973: p. 518-519).

Spongopallium contortum n.gen.n.sp.

(pl. 2, fig. 5; pl. 11, fig. 1)

Derivatio nominis: According to the somewhat torsioned polar spines.

Holotype: The specimen figured at pl. 2, fig. 5.

Diagnosis: Medullary shell latticed, elongated with small polygonal meshes. Second shell latticed, situated at a distance from the medullary one as long as the diameter of the latter and connected to it by rays situated around the equatorial plane. Spongy shell (mantle) rather thick connected with the second shell by many rays. Polar spines three-bladed, stout, rather short, somwhat torsioned, with pointed tips.

Dimensions: Length of shell with spines 300-360 µm, diameter of medullary shell 25 µm, diameter of second shell 70-75 µm, diameter of spongy shell 155-170 µm.

Occurrence: Rare in the Middle Triassic.

Genus *Stauracontium* HAECKEL, 1882 emend. KOZUR & MOSTLER, 1979

Synonyma: *Ruestia* VINASSA de REGNY, 1898
Xiphostauria VINASSA de REGNY, 1898

Stauracontium ? granulosum n.sp.

(pl. 1, fig. 7; pl. 11, fig. 5)

Derivatio nominis: According to the rough surface of the cortical shell.

Holotype: The specimen figured at pl. 1, fig. 7.

Diagnosis: Cortical shell spherical with small circular pores. Surface rough. Main spines in one plane along two axes at right angle to each other. The main spines are three-bladed, stout, twisted and taper gently to a point. Medullary shell connected with the cortical shell in the axial region by two opposite three-bladed spines.

Dimensions: Diameter of the cortical shell: 105-130 µm, maximum span along two opposite spines: 310-390 µm.

Occurrence: Middle Triassic of the European Tethys.

Remarks: *Stauracontium ? alpinum* n.sp. has larger pores at the cortical shell and needle-shaped main spines with pyramidal three-bladed base.

Stauracontium ? alpinum n.sp.

(pl. 2, fig. 3; pl. 14, fig. 1)

Derivatio nominis: According to the occurrence in the Middle Triassic of the Southern Alps.
Holotype: The specimen figured at pl. 2, fig. 3.
Diagnosis: Cortical shell spherical with rounded polygonally framed pores. Surface rather smooth except for a few short spines arising from the nodal points of the lattice. Radial spines needle-shaped with three-bladed pyramidal base. Medullary shell double, axially connected with the cortical shell by only one three-bladed ray on each side.
Dimensions: Diameter of cortical shell 200 µm, length of radial spines 250-275 µm.
Occurrence: Very rare in the Middle Triassic of the Southern Alps.
Remarks: *Stauracontium ? granulosum* n.sp. has stout main spines and smaller pores at the cortical shell.

Stauracontium ? trispinosum ladinicum n.subsp.

(pl. 1, ? fig. 5; pl. 2, fig. 4; pl. 3, figs. 6, 7; pl. 5, fig. 4; pl. 14, fig. 5)

Derivatio nominis: According to the occurrence in the Ladinian.
Holotype: The specimen figured at pl. 3, fig. 7.
Diagnosis: Medium-sized to large cortical shell with polygonal pores. At many nodal points minute by-spines are present. 4 stout main spines along two axes at right angles to each other. The three distal spinules of the three-bladed main spines are short to medium-sized and directed obliquelly centrifugally. Behind the spinules a needle-shaped prolongation is present in all main spines. Medullary shell axially connected with the cortical shell by a single three-bladed ray on each side.
Dimensions: Diameter of cortical shell 110-140 µm, maximum span along to opposite spines 320-430 µm.

Occurrence: Frequent in the Middle Triassic of the European Tethys.
Remarks: *Stauracontium ? trispinosum ladinicum* n.subsp. is distinguished from *Stauracontium ? trispinosum trispinosum* (KOZUR & MOSTLER, 1979) by the shorter distal spinules that are directed obliquelly centrifugally.
The specimen figured at pl. 1, figs. 5 has no minute by-spines at the nodal points.

Genus *Tiborella* n.gen.

Derivatio nominis: Arbitrary combination of letters.
Type species: *Tiborella magnidentata* n.gen.n.sp.
Diagnosis: Spherical to slightly compressed very thick-walled cortical shell. Pores very large, commonly hexagonal. 4 radial spines in one plane along two axes at right angles to each other. Radial spines three-bladed. Medullary shell double, lattice, connected with the cortical one in the axial region by a bunch of thin rays.
Included species: *Tiborella magnidentata* n.gen.n.sp.
Tiborella n.sp.A (Upper Triassic)
Tiborella n.sp.B (Upper Triassic)
Occurrence: Middle and Upper Triassic of the Tethyan realm.
Remarks: *Tiborella* n.gen. is distinguished from *Stauracontium* HAECKEL, 1882 emend. KOZUR & MOSTLER, 1979, by the very thick-walled cortical shell with the very large regular pores. Moreover, the type of the axial connection of medullary and cortical shells is different.
Druppatractylis HAECKEL, 1887 (= *Pantanellium* PESSAGNO, 1977) with two polar spines and *Betraccium* PESSAGNO, 1977, with three spines in one plane have the same structure of cortical shell and a similar internal structure, but are distinguished by the number of main spines (2 polar ones or 3 in one plane respectively). These three genera are closely related and belong to one subfamily.

Tiborella magnidentata n.gen.n.sp.

(pl. 1, figs. 2, 6; pl. 11, figs. 2-4; pl. 12, fig. 4)

Derivatio nominis: According to the large pores.
Holotype: The specimen figured at pl. 1, fig. 2.
Diagnosis: Very thick-walled, spherical cortical shell. Pores very large, commonly hexagonal, about 6-7 on the diameter. Radial spines three-bladed, twisted in the middle and distal part, with pointed tips. In the equatorial plane there is an indistinct girdle formed by the connection of two blades of each spines with the blades of the adjoining spines. Towards the inner side of the cortical shell the large pores are closed by a thin lattice with small pores. Medullary shell connected in axial region with the cortical shell by a bunch of 6-7 thin rays.
Dimensions: Diameter of cortical shell 115-135 µm, maximum span along two opposite spines 250-310 µm, diameter of second medullary shell 35-37 µm, diameter of first medullary shell 20-25 µm.
Occurrence: Middle Triassic of the European Tethys.

Genus *Welirella* n.gen.

Derivatio nominis: Arbitrary combination of letters.
Type species: *Welirella weveri* n.gen.n.sp.

Diagnosis: Cortical shell spherical to subspherical with large rounded pores, irregular in size and arrangement. The 8-14 stout main spines are three-bladed exept of their distal parts. The grooves between the blades correspond with very large pores at the cortical shell.
The inner part is very difficult to recognize; it seems quite irregular.

Included species: *Welirella weveri* n.gen.n.sp.
Conosphaera ? fleuryi De WEVER, 1979
Occurrence: Lower Ladinian to Middle Norian of the Tethyan realm.
Remarks: *Conosphaera* HAECKEL, 1882, has no true main spines, but conical porous protuberances.

Welirella weveri n.gen.n.sp.

(pl. 3, fig. 4)

Derivatio nominis: In honour to Dr. P. De WEVER, Lille.
Holotype: The specimen figured at pl. 3, fig. 4.
Diagnosis: Cortical shell spherical with large rounded pores, irregular in aize and arrangement. The 8-10 main spines are stout, three-bladed with moderately long needle-shaped tips. The deep grooves between the blades of the spines end in a very large pore at the cortical shell. Inner structures as for the genus.
Occurrence: Very rare in the Middle Triassic of the Southern Alps.
Remarks: *Welirella fleuryi* (De WEVER, 1979) is distinguished above all by the greater number of spines (12-14).

Suborder Nassellaria EHRENBERG, 1875

Family Eptingiidae DUMITRICĂ, 1978

Genus *Eptingium* DUMITRICĂ, 1978

Eptingium manfredi manfredi DUMITRICĂ, 1978

(pl. 3, figs. 1-3; pl. 6, figs. 5-7)

1978 a *Eptingium manfredi* n.sp. - DUMITRICĂ, p. 33-34, pl. 3, fig. 3, 4; pl. 4, figs. 6, 7, non !, figs. 1, 5.
Occurrence: Middle Triassic of the European Tethys.
Remarks: All specimens of *E. manfredi* DUMITRICĂ, 1978, with gently tapering horns that end in long needle-like spines belong to *E. manfredi manfredi* DUMITRICĂ, 1978. The second subspecies, *E. manfredi robustum* n.subsp. is distinguished by very stout horns that end abruptly and have only very small tips in the centre of the broadly rounded distal ends of the horns or the tips are quite absent.

Eptingium manfredi robustum KOZUR & MOSTLER n.subsp.
(pl. 6, figs. 1-4, 8)

1978 a *Eptingium manfredi* n.sp., pars - DUMITRICĂ, p. 33-34, only pl. 4, figs. 1, 5.

Derivatio nominis: According to the very stout, distally broadly rounded horns.

Holotype: The specimen figured at pl. 6, figs. 1, 4.

Diagnosis: With the characteristics of the species. The three horns are very stout. They end distally abruptly. Distal ends broadly rounded with a very small tip in the centre or without any distal tip.

Occurrence: Lower and Middle Ladinian of the European Tethys.

Remarks: *E. manfredi manfredi* DUMITRICĂ, 1978, is distinguished by gently tapering horns with long needle-like distal spines.

One of the authors (P. DUMITRICĂ) regards *E. manfredi robustum* n.subsp. as extreme form in the field of variation of *E. manfredi* DUMITRICA, 1978.

Genus *Triassistephanidium* DUMITRICĂ, 1978

Triassistephanidium laticornis DUMITRICĂ, 1978
(pl. 6, fig. 9)

1978 a *Triassistephanidium laticornis* n.sp. - DUMITRICĂ, p. 32, pl. 1, figs. 5, 6; pl. 2, fig. 1; pl. 4, fig. 3.

Occurrence: In the Middle Triassic of the European Tethys.

Family Pylentonemidae DEFLANDRE, 1963

Remarks: Post-Carboniferous and pre-Middle Triassic Pylentonemidae are unknown until now. Despite of this fact species and genera of pylentonemid type are rather frequent in the Triassic. The external morphology and the spicule of Triassic Pylentonemidae is similar to those of the Carboniferous representatives of this family. The Triassic Pylentonemidae have a spicule similar to that of *Pylentonema antiqua* DEFLANDRE and *Cyrtisphaeronemium prudentigerum* DEFLANDRE as described by DEFLANDRE (1963, 1972). It consists of a medium bar (MB) with the apical spine (A), dorsal spine (D), vertical spine (V), secondary lateral spines (l) and primary lateral spines (L). No arches connecting such a system of spines were described at the Paleozoic species of Pylentonemidae although they may exist, but not so obvious as in the most Triassic species. In the Triassic Pylentonemidae the following arches are well defined: AV, Al, lD, Ll, LV. But even in the Triassic the arches are not well visible in some forms (*Parapoulpus* KOZUR & MOSTLER, 1979).

The Pylentonemidae DEFLANDRE, 1963, includes the following

Mesozoic genera: *Poulpos* De WEVER, 1979, *Parapoulpos* KOZUR & MOSTLER, 1979, *Eonapora* KOZUR & MOSTLER, 1979, *Hozmadia* n.gen., and *Saitoum* PESSAGNO, 1977, as the last representative of this group.

Genus *Eonapora* KOZUR & MOSTLER, 1979

Remarks: Only *Eonapora curvata* KOZUR & MOSTLER, 1979, is dicyrtid. The type species *E. pulchra* KOZUR & MOSTLER, 1979 is monocyrtid and closely related to *Poulpus* De WEVER, 1979. *Eonapora curvata* KOZUR & MOSTLER, 1979, belongs most probably to *Hinedorcus* n.gen.

Eonapora n.sp.

(pl. 9, figs. 3, 4)

Remarks: Because of the poor preservation this species cannot be described until now.
Occurrence: Middle Triassic of the Southern Alps.

Genus *Hozmadia* n.gen.

Derivatio nominis: The name of the genus is an anagram for Prof. Dr. A.I. ZHAMOIDA, Leningrad, to honour his important contributions to the knowledge of fossil Radiolaria.
Type species: *Hozmadia reticulata* n.gen.n.sp.
Diagnosis: Shell consisting only of a large globular cephalis with costate or alveolar surface, a well developed apical horn and bladed feet representing the prolongation of dorsal and primary lateral spines. Internal structure formed of MB, A, D, l, L and V as well as arches Al, AV, LV, Ll and lD.
Included species: *Hozmadia reticulata* n.gen.n.sp.
Occurrence: Middle Triassic of the European Tethys.
Remarks: *Hozmadia* n.gen. is related to *Poulpus* De WEVER, 1979, from which it is distinguished by the well developed apical horn and internal position of the median bar. *Eonapora* KOZUR & MOSTLER, 1979, has short but stout pyramidal prolongations of spines l and V beyond the cephalic wall.

Hozmadia reticulata n.gen.n.sp.

(pl. 9, figs. 9, 10)

Derivatio nominis: According to the sculpture of a reticulate network of ridges.
Holotype: The specimen figured at pl. 9, figs. 9, 10.
Diagnosis: Cephalis subspherical with small scattered pores. Surface covered with a reticulate network of ridges. Apical horn excentrical, stout, with 4 sharp blades.

Feet also four-bladed, the two external blades being commonly connected with the arches LV, Ll and lD, whereas the inner ones form by their connection the rim of the aperture. The latter is circular or triangular and widely open. Arches of the initial skeleton marked on the surface of cephalis by ridges not much differentiated by the other ridges that form the sculputre of the shell. Spines V and 1 do not extend beyond the cephalic wall. Their place of junction to the wall is situated about on the middle part of cephalis and is marked by crossing of four ridges.
Dimensions: Diameter of cephalis 90-100 µm, height of cephalis 85-105 µm, total heigth of shell 175-270 µm.
Occurrence: Middle Triassic of the Southern Alps, Carpathians and Hungary, very common.

Genus *Poulpus* De WEVER, 1979

Poulpus curvispinus n.sp.

(pl. 2, fig. 1; pl. 15, figs.5, 6)

Derivatio nominis: According to the sharply downward-curved long feet.
Holotype: The specimen figured at pl. 15, fig. 6.
Diagnosis: Shell subhemispherical with nodular to smooth surface and small irregularly scattered pores. Arches AV and Al marked outside by three costae. Spicule with stout elements and median bar at the base of cephalis. The three long feet are sharply downward-curved, three-bladed, the odd blade internal, the other two external enclosing a rounded groove that corresponds with a large pore in the cephalis wall.
Dimensions: Width of cephalis 70-85 µm, heigth of cephalis 55-75 µm, length of feet 100-170 µm.
Occurrence: Middle Triassic of the Southern Alps.
Remarks: *P. curvispinus* n.sp. differs from *P. pansus* De WEVER, 1979, and *P. phasmatodes* De WEVER, 1979, by the absence of peristomal tubercles.
P. piabyx De WEVER, 1979, is distinguished by rounded feet.
P. reschi KOZUR & MOSTLER, 1979, has shorter and not so sharply downward-bended feet.

Family Silicarmigeridae KOZUR & MOSTLER n.fam.

Diagnosis: Many segmented conico-cylindrical nassellarians with a stout apical horn and three feet representing the prolongations of the dorsal and primary lateral spines. Cephalis poreless with a spicule formed of MB, A, D, L, l, V and arches AV, Al, lD, Ll and LV. Secondary lateral spines do not extend outside, but the vertical spine has a short lamellar thorn on the outer surface of the wall. Postcephalic portion of shell with external transverse ribs and irregular pores.

Included genus: *Silicarmiger* n.gen.
Occurrence: Anisian and Lower Ladinian of the Southern Alps and Hungary.
Remarks: The transverse ribs are somewhat similar to those of *Popofskyelum annulatum* DEFLANDRE from the Visean of France and seems to be a primitive characteristic. In the opinion of one of the authors (P. DUMITRICĂ) *Silicarmiger* could be related to Popofskyellidae DEFLANDRE, 1964.

Genus *Silicarmiger* n.gen.

Derivatio nominis: Arbitrary combination of letters.
Type species: *Silicarmiger costatus* n.gen.n.sp.
Diagnosis and occurrence: As for the family.

Silicarmiger costatus n.gen.n.sp.

(pl. 7, figs. 1-6; pl. 14, fig. 4)

Derivatio nominis: According to the numerous transversal ribs.
Holotype: The specimen figured at pl. 7, fig. 2, 4, 6.
Diagnosis: Cephalis globular, poreless. Its surface is divided by ridges into irregular polygonal areas. Apical horn stout, three-bladed, sometimes with needle-shaped distal part. One of its blades is connected with the vertical spine, the other two with the secondary lateral spines. Prolongation of the vertical spine on the surface of wall short, three-bladed. Postcephalic portion of shell commonly with 5 or more transverse ribs of rather irregular position. Pores quite irregular in shape and size. They are formed by intersection of bars that extend in different directions between the ribs. The feet are long, bladed in their proximal parts, but subcylindrical to cylindrical and rather needle-shaped in most of their length. They are inserted as longitudinal ribs in the upper part of the post-cephalic shell. The blades at the proximal part of the feet represent the continuation of some transverse ribs on the shell. Dimensions: Total height of shell with spines 350-450 µm, length of apical horn 60-110 µm, diameter of cephalis 60-70 um, diameter of thorax 120-150 µm.
Occurrence: Lower Ladinian of the European Tethys. A similar species is present in the Upper Anisian of Hungary.

The following genera and species are listed in alphabetic order without suprageneric classification.

Genus *Hinedorcus* n.gen.

Derivatio nominis: Arbitrary combination of letters.
Type species: *Hinedorcus alatus* n.gen.n.sp.
Diagnosis: Shell dicyrtid. Cephalis small, poreless, armed with an apical horn. Thorax large, commonly pyramidal, with scattered pores and three feet representing the prolongation

of dorsal and primary lateral spines. Collar stricture well marked outside by a constriction. Internal cephalic structure with MB, A, D, L, V and l. Arches less obvious. Vertical, and exceptionally also secondary lateral spines extend beyond the wall in short thorns.

Included species: *Hinedorcus alatus* n.gen.n.sp.
Eonapora curvata KOZUR & MOSTLER, 1979.

Occurrence: Anisian to Carnian of the European Tethys.

Remarks: The genus *Hinedorcus* n.gen. shows some similarities with *Napora* PESSAGNO, 1977, and *Ultranapora* PESSAGNO, 1977, from which it is distinguished by the thin thoracic wall and by the number and disposition of its pores.

Hinedorcus alatus n.gen.n.sp.

(pl. 9, figs. 2, 8; pl. 15, fig. 4)

Derivatio nominis: According to the shape of the feet.

Holotype: The specimen figured at pl. 15, fig. 4.

Diagnosis: Cephalis small, smooth, with a stout, straight, commonly four-bladed apical horn. Thorn in prolongation of vertical spine short. Collar stricture well defined outside. Thorax large, pyramidal, smooth or with a few weak transverse undulations. Generally the wall is poreless except for the region around the edges, where there are large pores. Feet long, three-bladed. Lower part of thorax widely open.

Dimensions: Height of whole shell 275 um, diameter of cephalis 34-40 µm, height of thorax with feet 140-175 µm, length of apical horn 40-45 µm.

Occurrence: Middle Triassic of the Southern Alps.

Remarks: *Hinedorcus curvatus* (KOZUR & MOSTLER, 1979) is distinguished above all by the curved apical horn and by the absence of the large pores.

Genus *Nofrema* n.gen.

Derivatio nominis: The name of the genus is an anagram for Prof. Dr. Helen FOREMAN to honour her excellent works on fossil radiolarians.

Type species: *Nofrema trispinosa* n.gen.n.sp.

Diagnosis: Shell of two or three segments. Cephalis large, porous, with a stout apical horn the base of which is generally broad and latticed or spongy. Initial skeleton consists of MB, A, D, L, l, V and arches AV, Al, lD, Ll and LV. Secondary lateral spines and even vertical spine do not extend outside, but the dorsal and primary lateral spines extend along the shell wall and beyond it into three feet. Post-cephalic part of the shell latticed, increasing gradually in size, and with one ore more constrictions.

Included genus: *Nofrema trispinosa* n.gen.n.sp.

Occurrence: Middle Triassic of the European Tethys.

Nofrema trispinosa n.gen.n.sp.

(pl. 9, fig. 1; pl. 15, fig. 3)

Derivatio nominis: According to the three long, cylindrical, needle-shaped spine-like feet.
Holotype: The specimen figured at pl. 15, fig. 3.
Diagnosis: Bell-shaped shell. Cephalis and upper part of postcephalic segment usually covered by a spongy network. Apical horn four-bladed, pyramidal, with long needle-like tip. Most of the bladed part of the horn innudated by a spongy network. Collar stricture weakly expressed outside due to the spongy cover, but it is well marked at the inner part of the shell. Postcephalic segment much wider than the cephalis, with small irregularly scattered pores in the upper part and larger pores in the lower part. Terminal part flared, simple or with a spongy thickening that narrows the wide opening. Feet long, cylindrical, needle-shaped. Dimensions: Height of shell without feet and apical horn 165-190 µm, diameter of terminal part of the shell 165-175 µm, internal diameter of cephalis 60-70 µm.
Occurrence: Middle Triassic of the Southern Alps.

Genus *Stichomitra* CAYEUX, 1897

Stichomitra ? triassica n.sp.

(pl. 9, fig. 7)

Derivatio nominis: According to the occurrence in the Triassic.
Holotype: The specimen figured at pl. 9, fig. 7.
Diagnosis: Cephalis poreless, hemispherical. Apical horn stout, conical. Thorax somewhat larger, almost poreless with only a few widely scattered small pores. Postthoracic segments considerably larger, with a constriction in their middle part and with large irregular pores. With exception of the last segment there are well developed nodules at the nodal points, strongest in the abdominal segment. The last segment has a smooth surface. The pores in the wall of this segment are the largest ones. The constriction of the last segment is situated near the denticulated rim of the large aperture. Inner spicule consists of MB, A, D, V, L and l.
Occurrence: Middle Triassic of the Southern Alps. Rare.
Remarks: This species belongs together with a further new species with three-bladed apical horn most probably to a new genus.

Genus *Triassocampe* n.gen.

Derivatio nominis: According to the occurrence in the Triassic.
Type species: *Triassocampe scalaris* n.gen.n.sp.
Diagnosis: Long slightly conical to subcylindrical multisegmented shell without apical horn. Segments with biggest

diameter in their upper part. Internal cephalic structure with MB, A, D, L, l and V. Collar plate with 6 pores. Pores of shell arranged in one ore more transverse rows for each segment or irregularly. They are situated especially at the upper part of each segment and when there is only one row it is situated at the boundary with the previous segment.

Included species: *Triassocampe scalaris* n.gen.n.sp.
Dictyomitrella sp. A De WEVER, 1979

Occurrence: Middle and Upper Triassic of the European Tethys.

Remarks: *Canoptum* PESSAGNO, 1979, is distinguished by an outer microgranular layer that covers the inner layer of polygonal pore frame.

Triassocampe scalaris n.gen.n.sp.

(pl. 9, figs. 5, 6, 11; pl. 14, fig. 2)

Derivatio nominis: According to the shape of the segments.

Holotype: The specimen figured at pl. 9, fig. 11.

Diagnosis: Shell of 9-15 preserved segments, without apical horn. Cephalis and even thorax poreless with smooth surface. Collar stricture almost indistinct outside. Generally the pores begin with the third segment. They are arranged in 2-4, commonly 3 transverse rows. At the nodal points among pores there are rather well developed nodules. Between the first row of nodules that corresponds with the widest part of the segments, and the second row there is a circular external constriction. Another constriction, the deepest one, is at the lower part of segments and it corresponds with an inner constriction.

Dimensions: Height of shell 190-410 µm (it depends on the number of preserved segments), maximum diameter of shell 60-120 µm.

Occurrence: Rather frequent in the Middle Triassic of the European Tethys.

Remarks: Variability rather great expressed in the number of segments, in the number of rows of pores and in the shape of segments.

Triassocampe scalaris n.sp. differs from the congeneric *Dictymitrella* sp.A (De WEVER et al., 1979) in having more than one row of pores.

References

Only those papers are quoted that are related to the topic of the present paper and not referenced in the papers by KOZUR & MOSTLER, 1972, 1978, 1979.

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Explanation of plates

The specimens figured at pls. 1-15 are from Recoaro and Tretto (Southern Alps; North Italy). All holotypes originate from the layer VCB 1 near San Ulderico.

PLATE 1

Fig. 1: *Plafkerium ? confluens*, n.sp., holotype, x 120.
Figs. 2, 6: *Tiborella magnidentata* n.gen.n.sp., x 150, fig. 2 = holotype.
Fig. 3: *Plafkerium ? muelleri* n.sp., holotype, x 120.
Fig. 4: *Plafkerium ? contortum* n.sp., holotype, x 100.
Fig. 5: *Stauracontium ? trispinosum ladinicum* n.subsp. ?, x 150.
Fig. 7: *Stauracontium ? granulosum* n.sp., holotype, x 150.
Fig. 8: *Parasepsagon tetracanthus* n.gen.n.sp., holotype, x 80.

PLATE 2

Fig. 1: *Poulpus curvispinus* n.sp., oblique antapical view, x 120.
Figs. 2, 8: *Hexacontium ? mesotriassicum* n.sp., x 180, fig. 8 = holotype.
Fig. 3: *Stauracontium ? alpinum* n.sp., holotype, x 120.
Fig. 4: *Stauracontium ? trispinosum ladinicum* n.subsp., x 120.
Fig. 5: *Spongopallium contortum* n.gen.n.sp., holotype, x 150.
Figs. 6, 9: *Amphisphaera mesotriassica* n.sp., holotype, fig. 6: x 120, fig. 9:detail of one polar region, the same specimen as in fig. 6, x 300.
Fig. 7: *Parasepsagon tetracanthus* n.gen.n.sp., holotype, detail of the specimen figured in pl. 1, fig. 8, x 350.

PLATE 3

Figs. 1-3: *Eptingium manfredi manfredi* DUMITRICĂ, 1978, open shells with internal spicule, fig. 1: x 360, figs. 2, 3: x 180.
Fig. 4: *Welirella weveri* n.gen.n.sp., holotype, x 120.
Fig. 5: *Beturiella robusta* n.gen.n.sp., holotype, x 150.
Figs. 6, 7: *Stauracontium ? trispinosum ladinicum* n.subsp., x 120, fig. 7 = holotype.

PLATE 4

Figs. 1, 4: *Pentactinocarpus tetracanthus* DUMITRICĂ, 1978, x 150.
Figs. 2, 3, 5, 6, 7,?8: *Pentactinocarpus fusiformis* DUMITRICĂ, 1978, fig. 2: lateral view, x 80, fig. 5: detail of apical part of the specimen figured in fig. 2,

x 450, fig. 3: apical view, x 320, fig. 6: latero-apical view, x 150, fig. 8: lateral view, this specimen may belong to another subspecies, because the shell is not so elongated as in the typical forms.

PLATE 5

Figs. 1, 2, 5, 6: *Sepsagon longispinosus* (KOZUR & MOSTLER, 1979), fig. 1: detail of fig. 2, x 300, fig. 2: x 100, fig. 5: x 130, fig. 6: detail of fig. 5, x 350 x.

Fig. 3: *Heptacladus crassispina* n.gen.n.sp., holotype, x 280 x.

Fig. 4: *Stauracontium ? trispinosum ladinicum* n.subsp., detail of one main spine, x 360.

PLATE 6

Figs. 1-4, 8: *Eptingium manfredi robustum* KOZUR & MOSTLER n.subsp., fig. 4 = holotype, x 180, fig. 1: detail of a horn of the same specimen, x 720, fig. 2: detail of a horn of another specimen, x 720, fig. 3: view on the distal end of a horn with needle-like tip in the centre of the distal end of the horn (arrow), x 700, fig. 8: broken specimen with internal spicule , x 200.

Figs. 5-7: *Eptingium manfredi manfredi* DUMITRICĂ, 1978, fig. 5: x 180, fig. 7: detail of a horn of the same specimen, x 550, fig. 6: detail of a horn of another specimen, x 320.

Fig. 9: *Triassistephanidium laticornis* DUMITRICĂ, 1978, x 220.

PLATE 7

Figs. 1-6: *Silicarmiger costatus* n.gen.n.sp., fig. 1: latero-antapical view, x 400, figs. 2, 4, 6: holotype, fig. 2: latero-antapical view, x 200, figs. 4, 6: details of the same specimen, fig. 3: lateral view, x 200, fig. 5: antapical view, x 350, figs. 4, 6: x 750.

PLATE 8

Figs. 1-3, 6: *Relindella hexaspinosa* n.gen.n.sp., holotype, fig. 1: detail of the rim, x 420, fig. 2: detail of the spongy disc, x 420, fig. 3: lateral view of the whole specimen, x 120, fig. 6: oblique lateral view of the whole specimen.

Fig. 4: *Pentaspongodiscus symmetricus* n.gen.n.sp., holotype, x 200.

Fig. 5: *Pentaspongodiscus tortilis ladinicus* n.subsp., holotype, x 120.

Fig. 7: *Pentaspongodiscus mesotriassicus* n.sp., holotype, x 120.

PLATE 9

Fig. 1: *Nofrema trispinosa* n.gen.n.sp., holotype, x 120.
Figs. 2, 8: *Hinedorcus alatus* n.gen.n.sp., x 200, fig. 2: holotype.
Figs. 3, 4: *Eonapora* sp., fig. 3: latero-antapical view, x 120, fig. 4: lateral view, x 200.
Figs. 5, 6, 11: *Triassocampe scalaris* n.gen.n.sp., fig. 5: x 200, fig. 6: latero-antapical view, x 400, fig. 11: holotype, x 120.
Fig. 7: *Stichomitra ? triassica* n.sp., holotype, x 200.
Figs. 9, 10: *Hozmadia reticulata* n.gen.n.sp., holotype, fig. 10: x 200, fig. 9: detail of the wall of the same specimen, x 400.

PLATE 10

Figs. 1, 3, 8: *Tamonella multispinosa* n.gen.n.sp., x 200, fig. 8: holotype, x 120.
Figs. 2, 5: *Gomberellus mocki* n.sp., holotype, fig. 5: whole specimen, x 180, fig. 2: detail of the same specimen, x 420.
Figs. 4, 9: *Oertlispongus cornubovis* n.sp., holotype, fig. 4: whole specimen, x 120, fig. 9: detail of the same specimen, x 280.
Fig. 6: *Gomberellus hircicornus* n.gen.n.sp., holotype, x 110.
Fig. 7: *Oertlispongus inaequispinosus* n.gen.n.sp., holotype, x 120.

PLATE 11

Fig. 1: *Spongopallium contortum* n.gen.n.sp., thin section
Figs. 2-4: *Tiborella magnidentata* n.gen.n.sp.; 2 - axial section, the black line indicates the equatorial plane; 3 - specimen showing the thin lattices plate enclosing the pores at the inner side; 4 - equatorial section showing the medullary shell.
Fig. 5: *Stauracontium ? granulosum* n.sp., section showing the medullary shell.
Figs. 1, 3-5 x 360, Fig. 2 x 720. All figures from sample Rc4, Buchenstein Formation, Recoaro, Italy.

PLATE 12

Figs. 1-3 *Beturiella robusta* n.gen.n.sp.; 2, 3 - sections showing the medullary shell.
Fig. 4: *Tiborella magnidentata* n.gen.n.sp., showing the thin lattice plate closing the pores at the inner side.
Fig. 1 x 500, Figs. 2, 3 x 360, Fig. 4 x 320. All figures from Rc3, Buchenstein Formation, Recoaro, Italy.

PLATE 13

Figs. 1-3, 5: *Heptacladus crassispinus* n.gen.n.sp., broken specimen showing the innermost shell, 2 - optical section, 3 - broken specimen showing the inner shell, 5 - specimen showing the peripheral shell.
Fig. 4: *Heptacladus* n.sp., inner shell.
Fig. 1 x 500, Figs. 2, 5 x 360, Fig. 3 x 700, Fig. 4 x 1000.
All figures from Rc 4, Buchenstein Formation, Recoaro, Italy.

PLATE 14

Fig. 1: *Stauracontium ? alpinum* n.sp.
Fig. 2: *Triassocampe scalaris* n.gen.n.sp.
Fig. 3: *Gomberella hircicornus* n.gen.n.sp.
Fig. 4: *Silicarmiger costatus* n.gen.n.sp., showing the inner skeleton.
Fig. 5: *Stauracontium ? trispinosum ladinicum* n.subsp.
Fig. 6: *Hexacontium ? mesotriassicum* n.sp.
Figs. 1-6 x 360, all from Rc 4, Buchenstein Formation, Recoaro, Italy.

PLATE 15

Fig. 1: *Sepsagon longispinosus* (KOZUR & MOSTLER), young specimen showing the entactiniacean internal shell.
Fig. 2: *Silicarmiger costatus* n.gen.n.sp., young specimen.
Fig. 3: *Nofrema trispinosa* n.gen.n.sp., holotype.
Fig. 4: *Hinedorcus alatus* n.gen.n.sp., holotype.
Figs. 5, 6: *Poulpus curvispinus* n.sp., 5 - basal view showing the collar plate with six openings, 6 - holotype.
Figs. 1, 2, 4-6 Rc 4; Fig. 3 Rc 2 - Buchenstein Formation, Recoaro, Italy.

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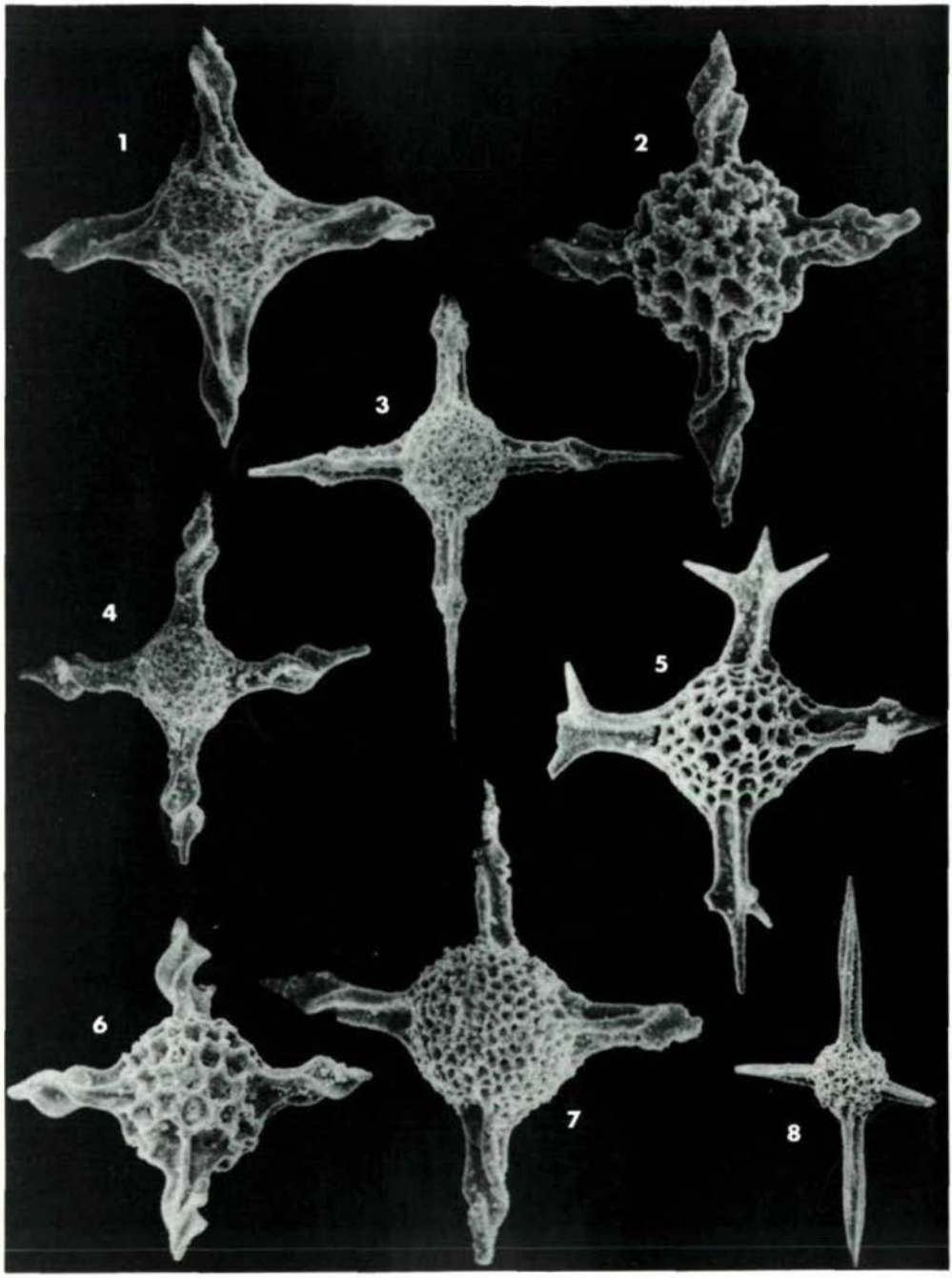

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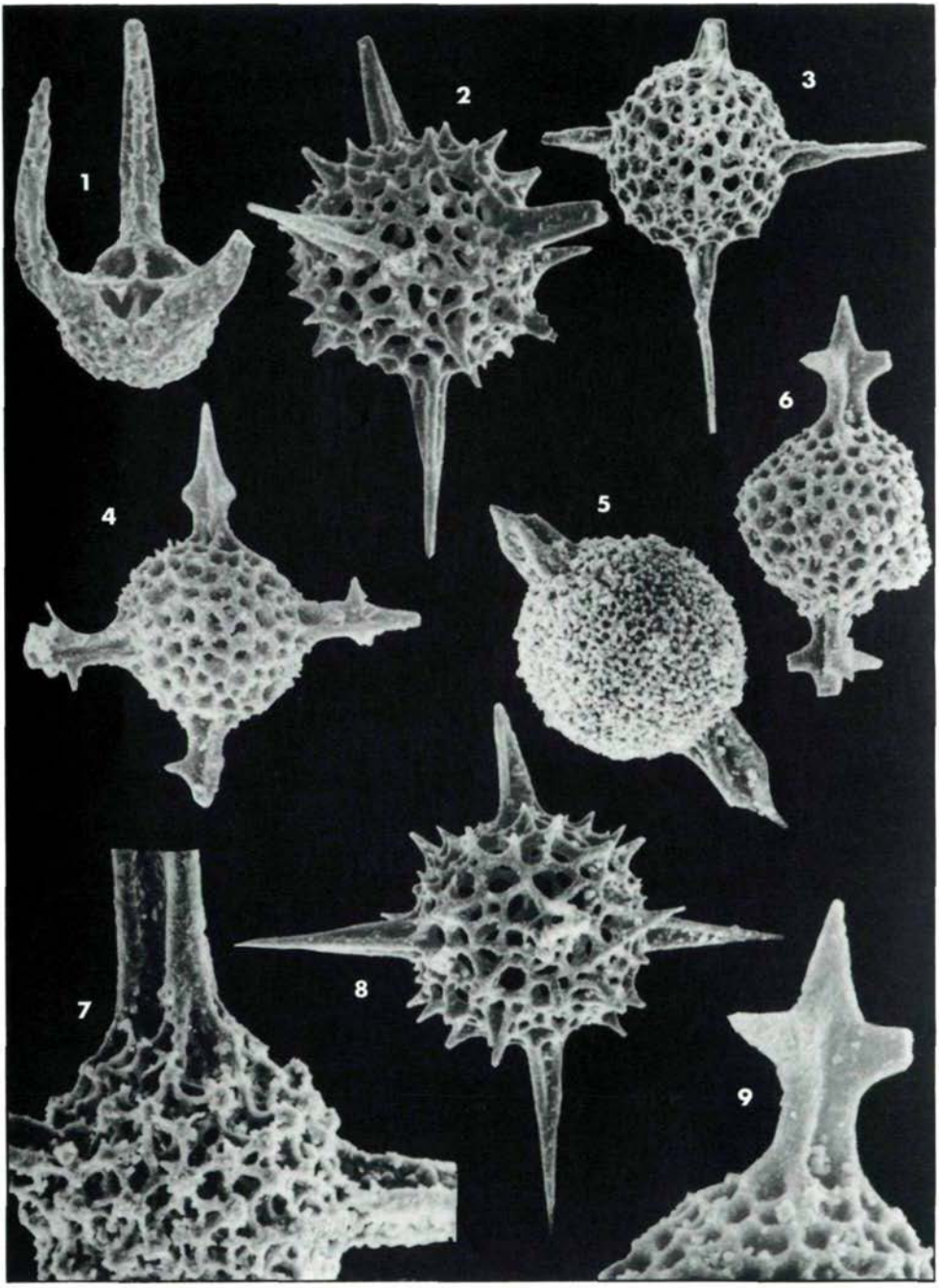

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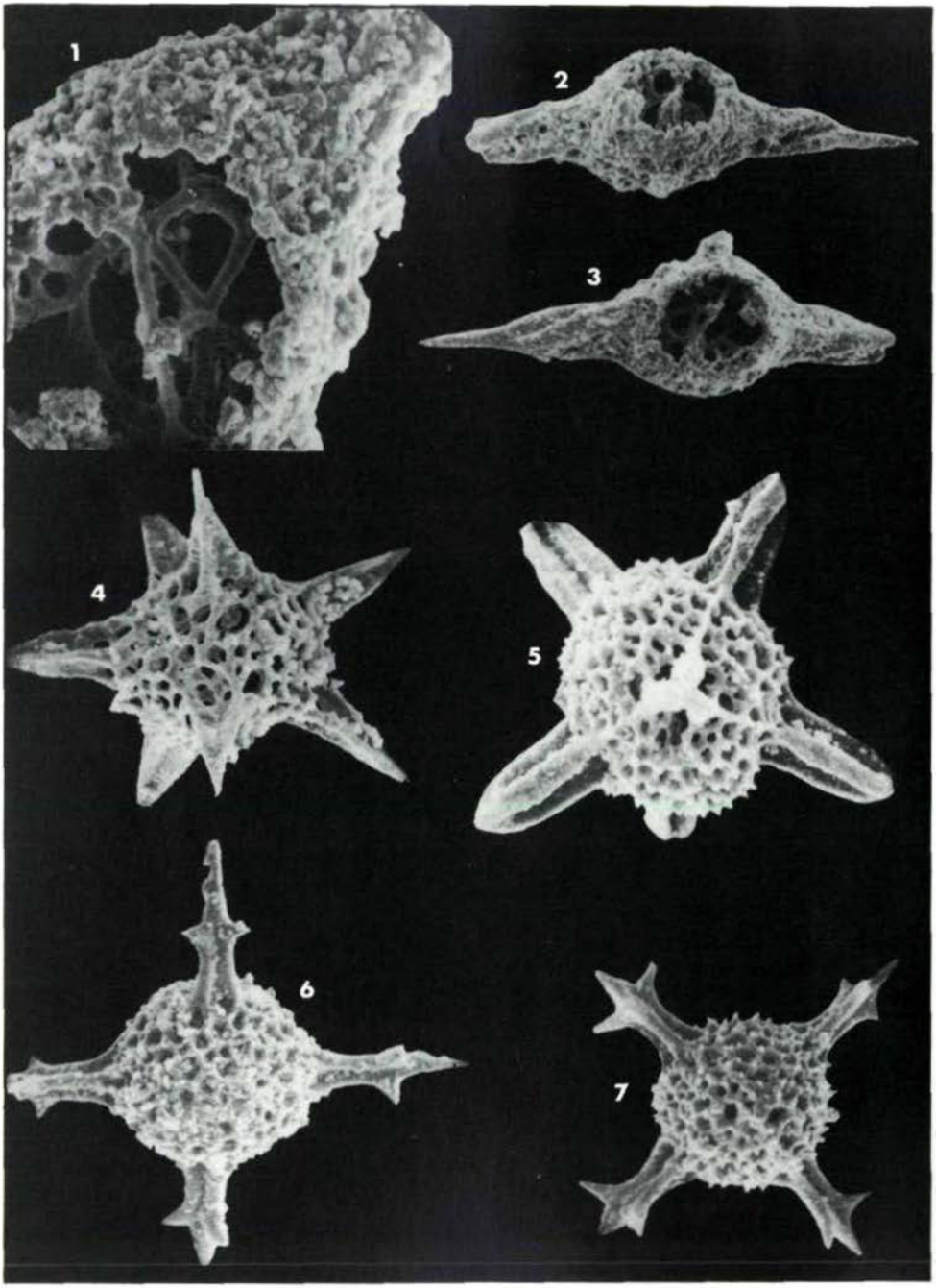

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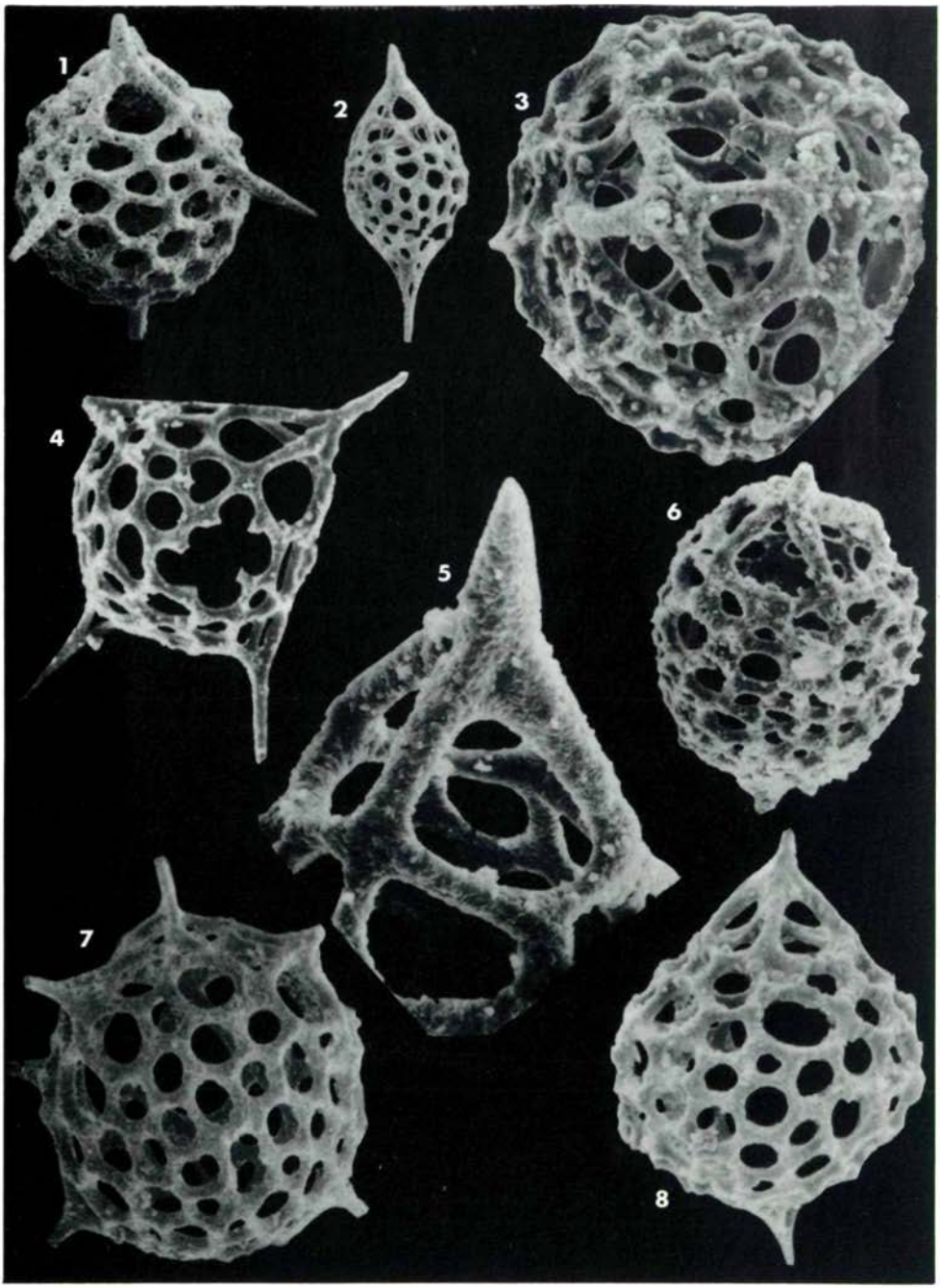

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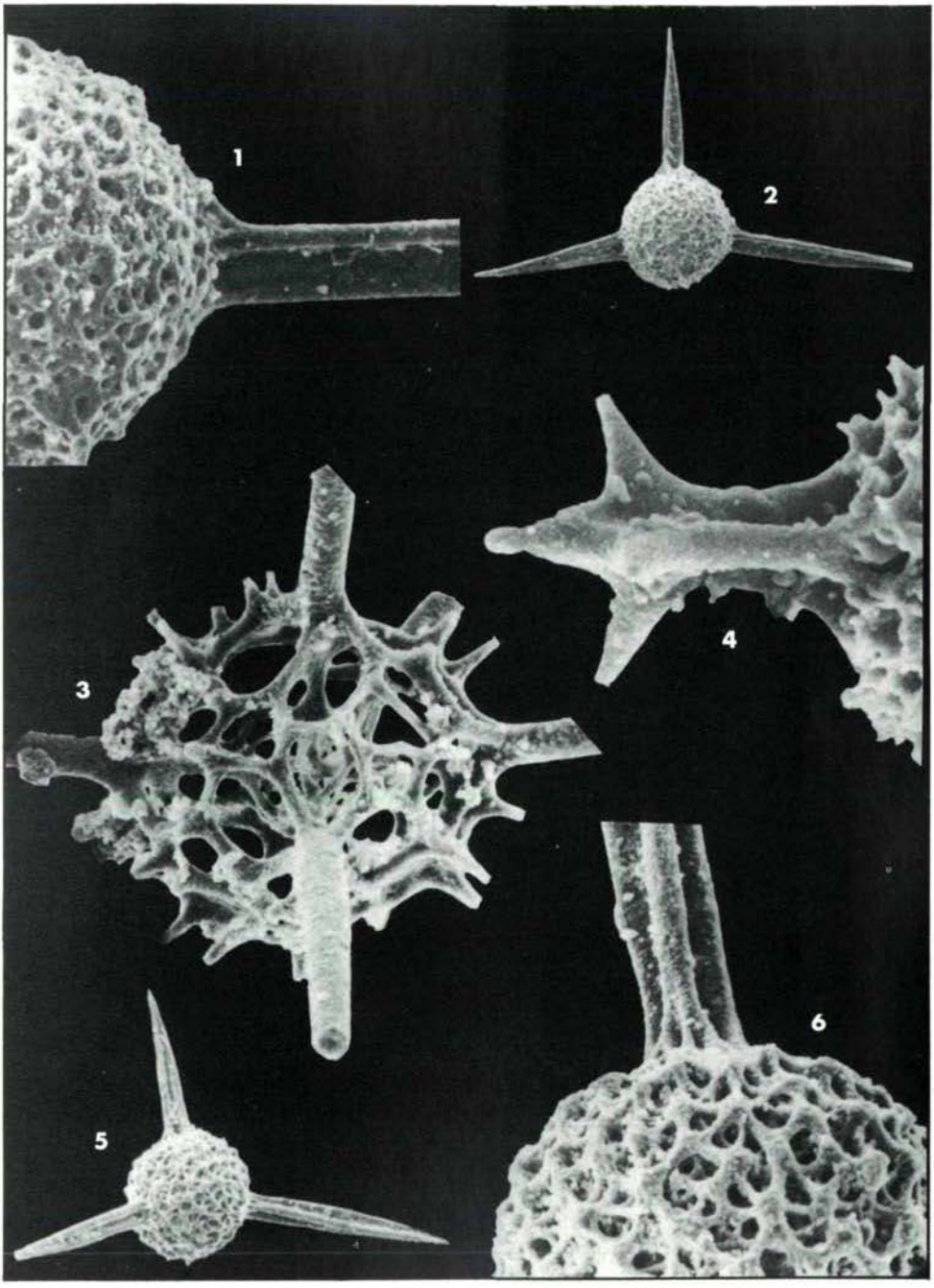

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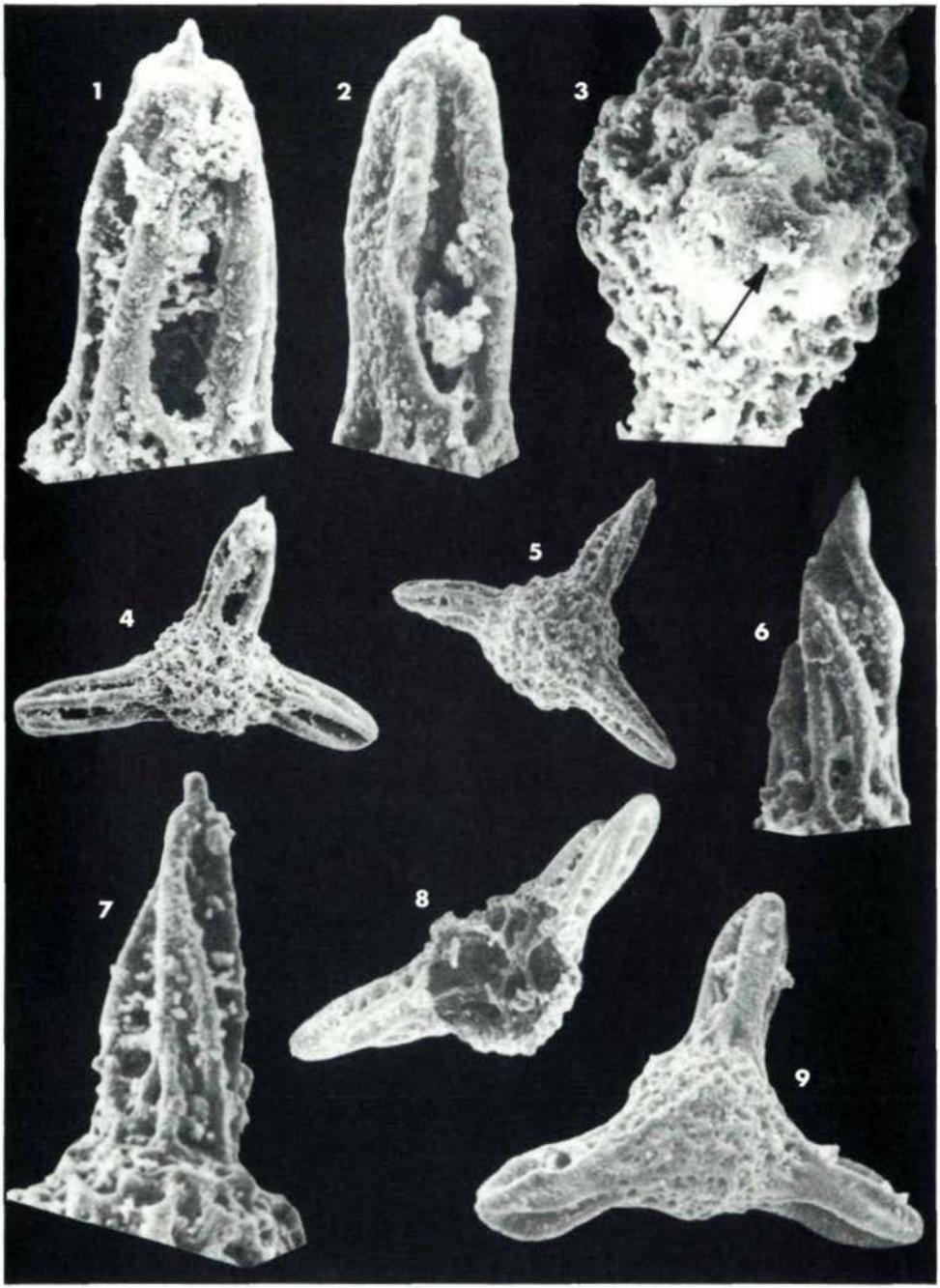

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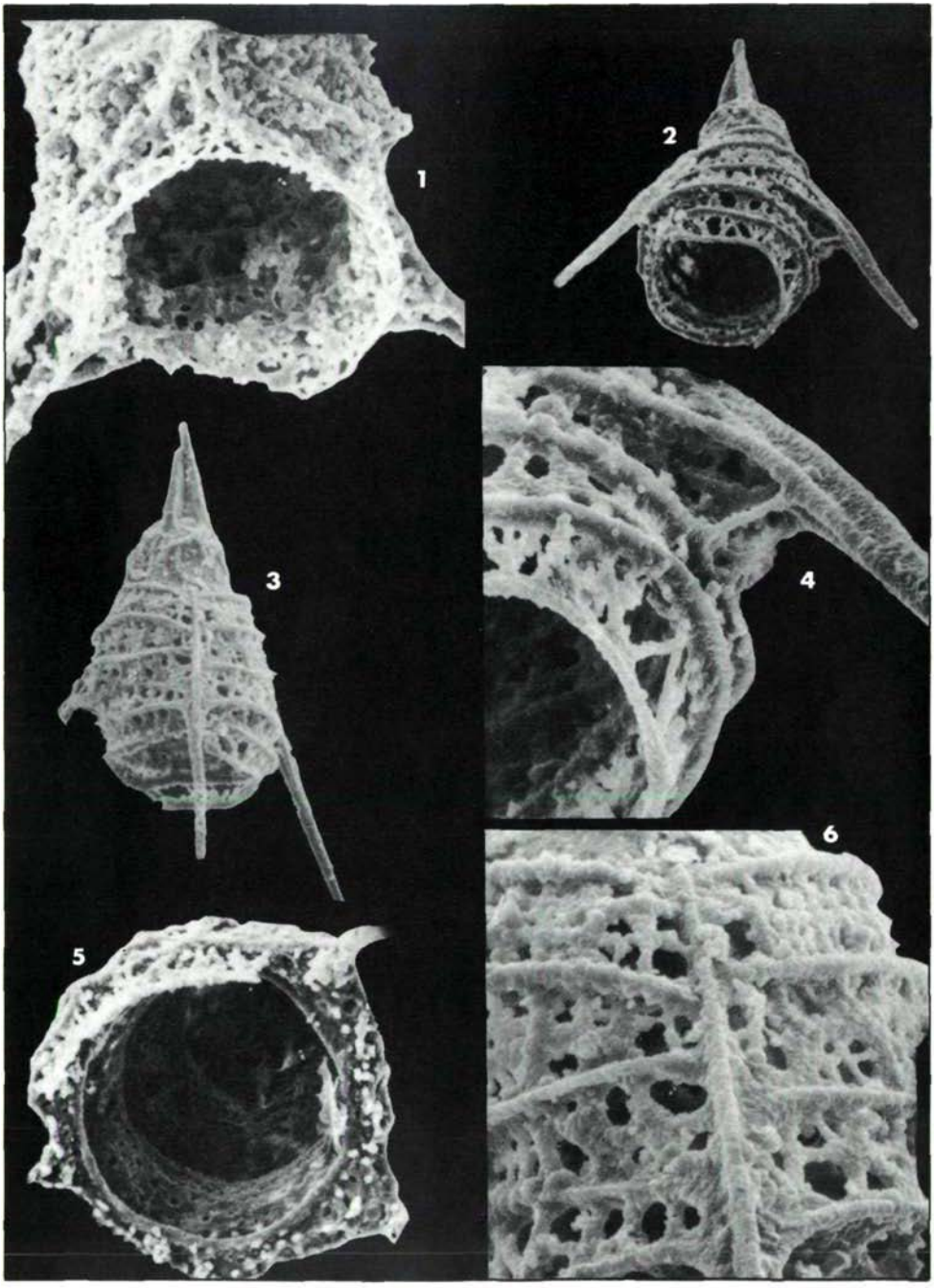

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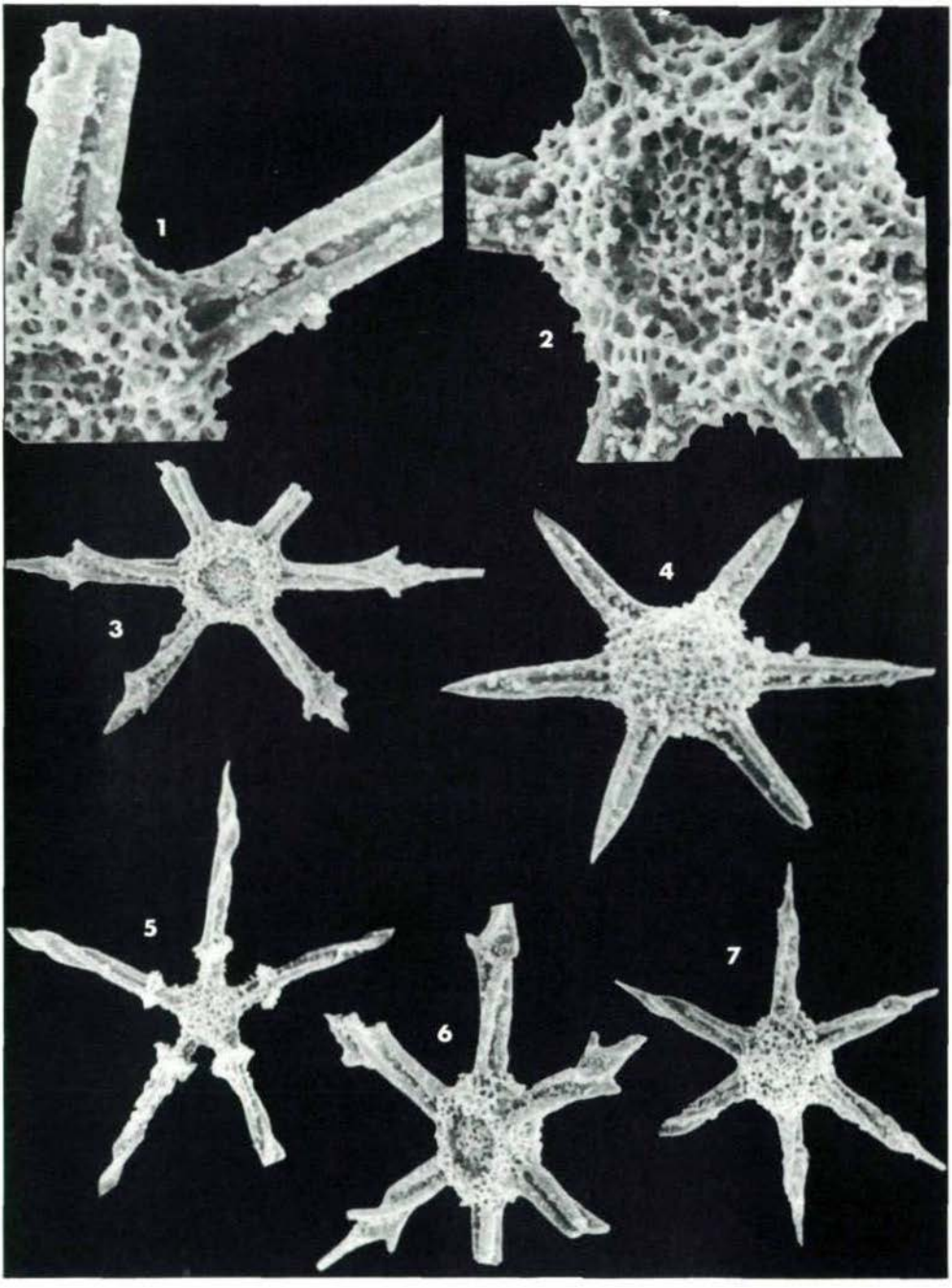

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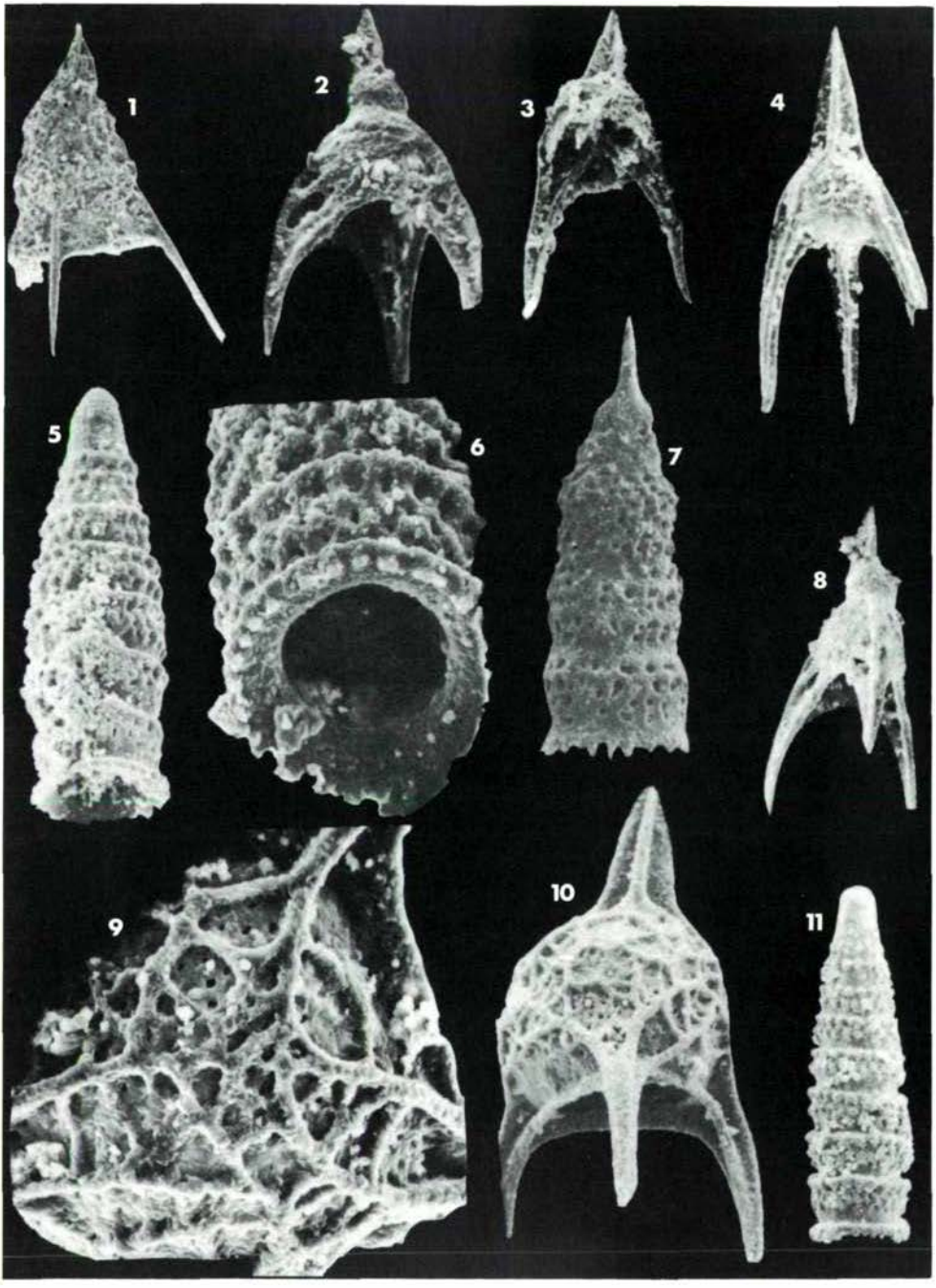

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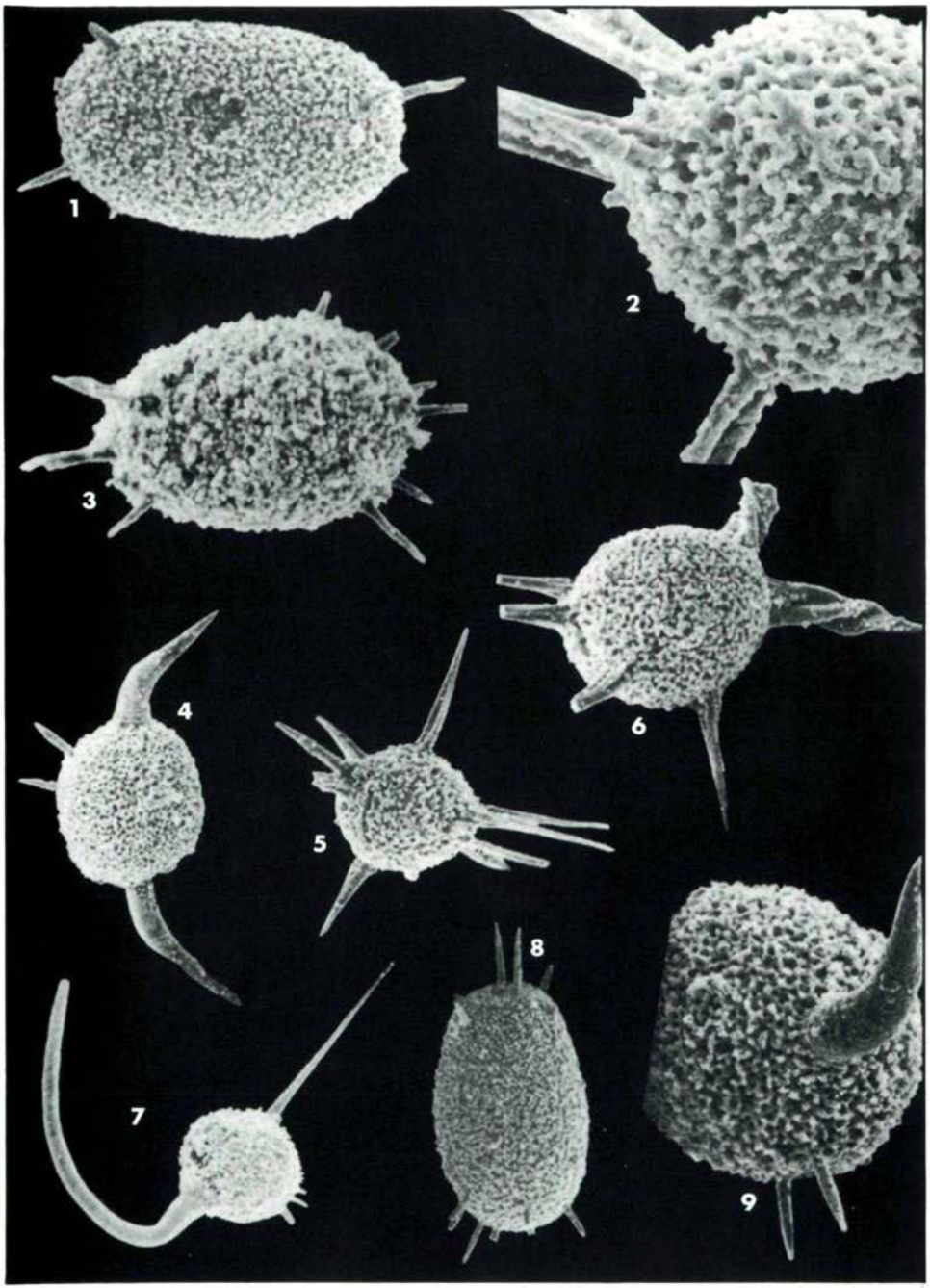

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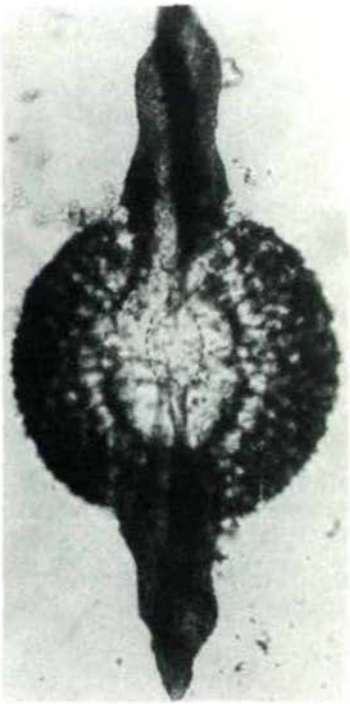

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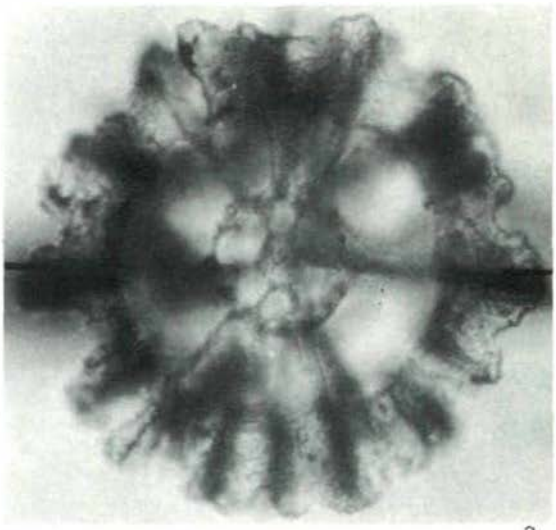

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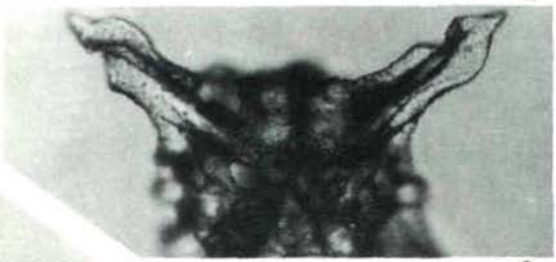

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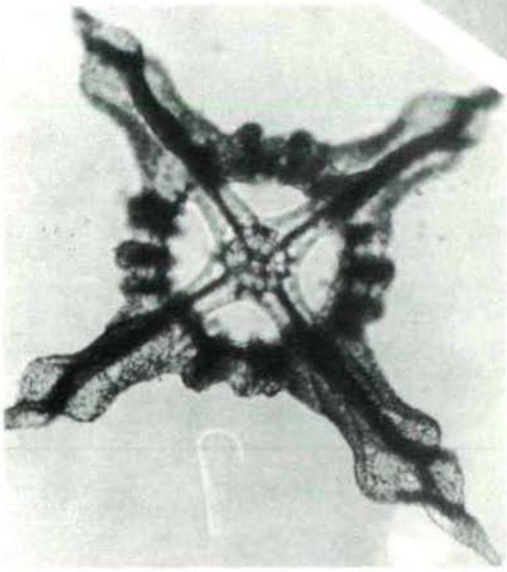

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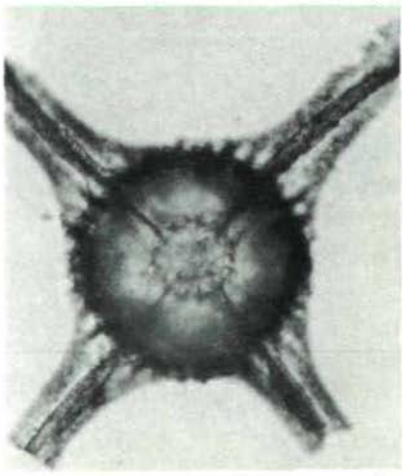

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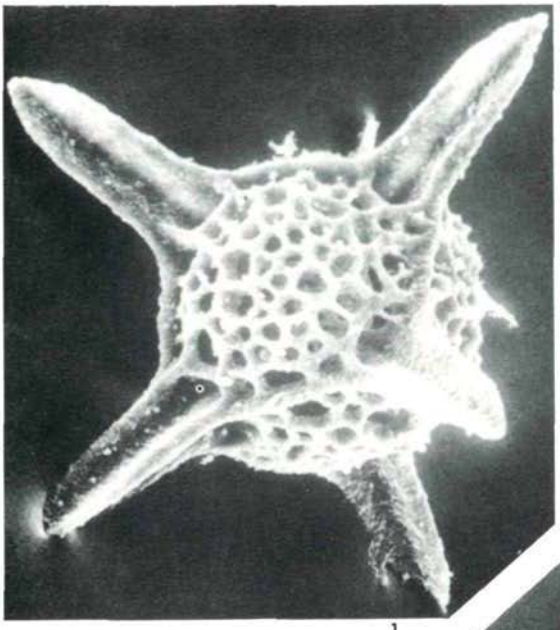

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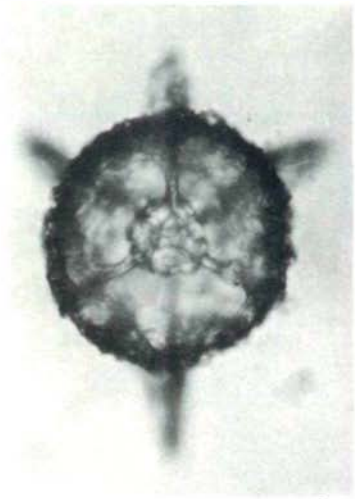

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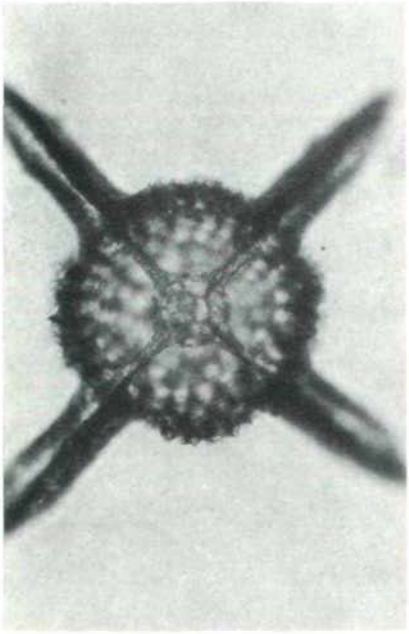

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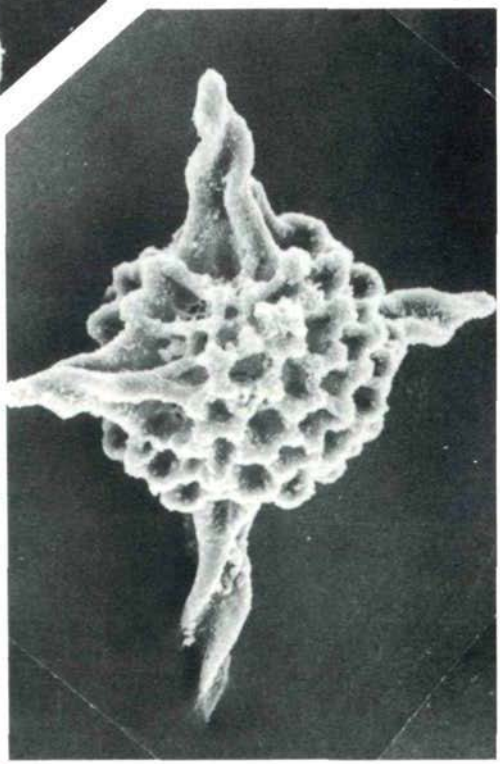

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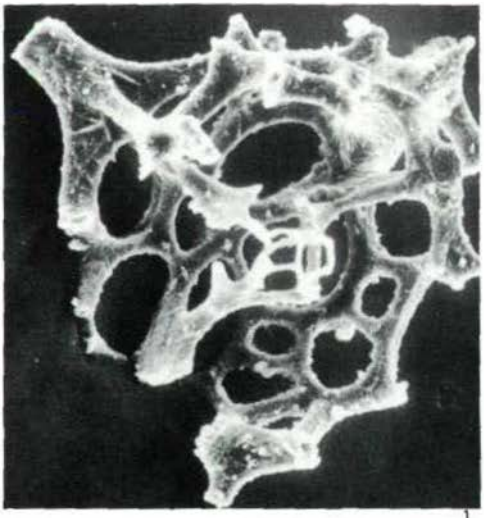

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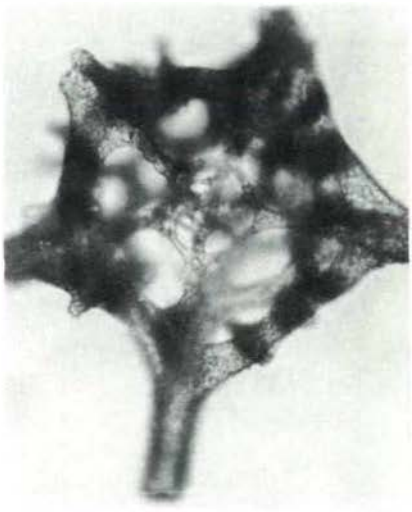

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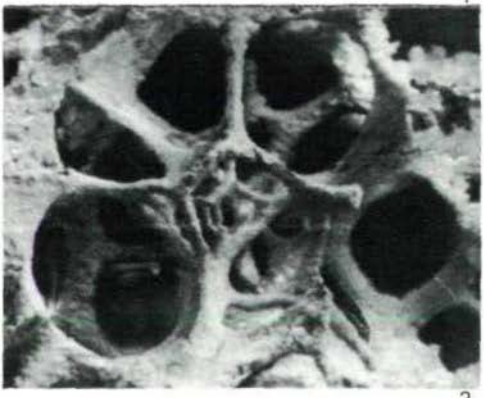

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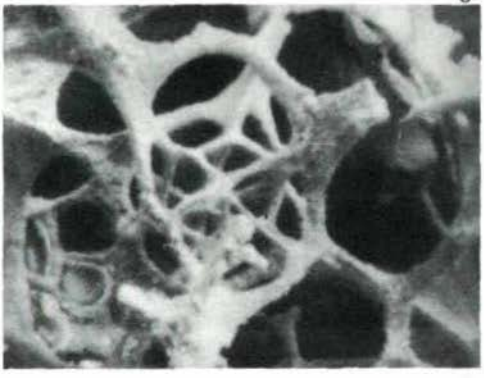

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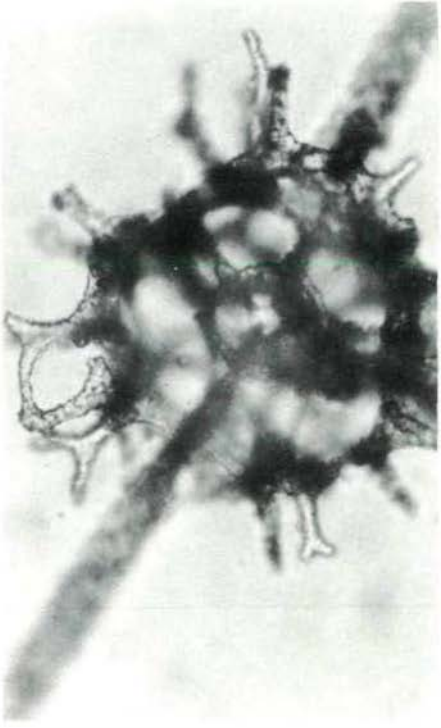

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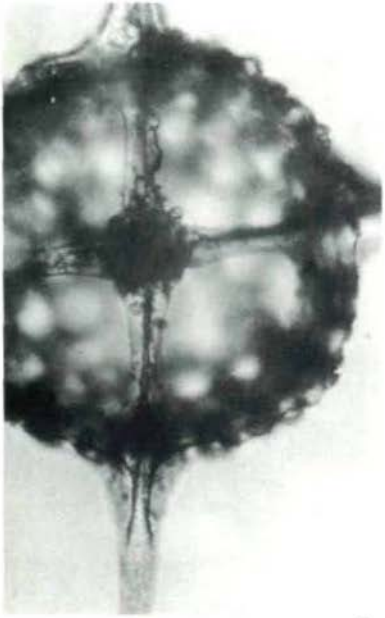

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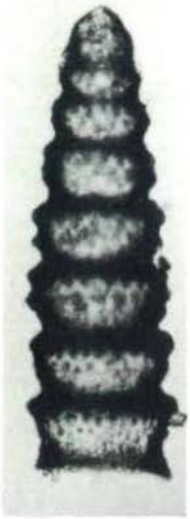

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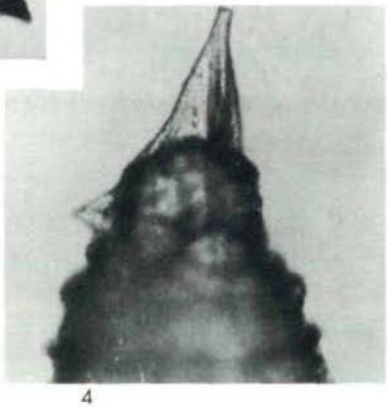

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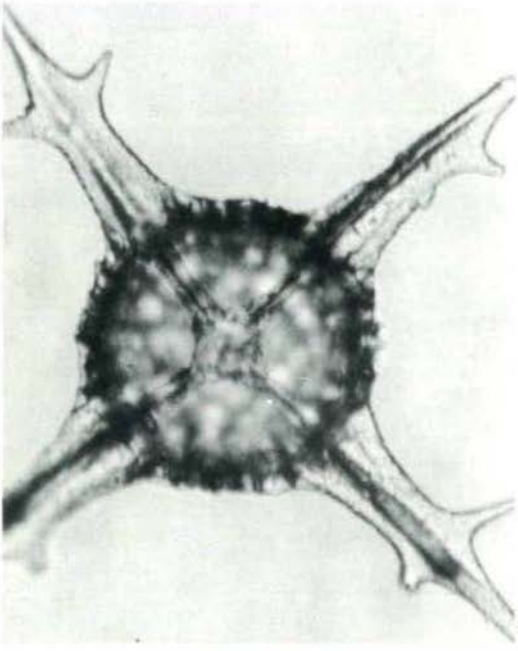

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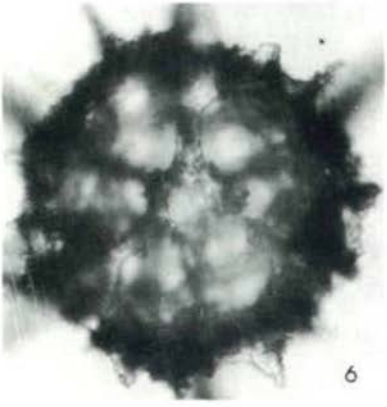

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Tafel 15