

## ANISIAN TO MIDDLE CARNIAN RADIOLARIAN ZONATION AND DESCRIPTION OF SOME STRATIGRAPHICALLY IMPORTANT RADIOLARIANS

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With 10 figures and 51 plates

### Abstract:

Triassic radiolarian faunas have been investigated in several sections in Hungary (Balaton Highland: Felsőörs, Köveskál; Darnóhegy area between Mátra Mts. and Bükk Mts.), Italy (Passo della Gabiola, road cut between Mte. Spitz and Mte. Fallison, San Ulderico, all Vicentinian Alps; and Sosio Valley, Sicily) and Austria (Großreifling, Göstling, Öfenbachgraben). Additionally, several single samples have been investigated. They have been derived from China, Turkey, Greece, Italy, Austria, Hungary, Yugoslavia. 4 families, 14 genera, 141 species and 23 subspecies have been newly established.

The biostratigraphic investigations have been concentrated on the Anisian to Early Ladinian, Early Longobardian to Julian, and Norian to Hettangian time intervals. The development of the radiolarian faunas from the Upper Anisian and Lower Ladinian is discussed in detail. The following radiolarian zones have been established: *Parasepsagon robustum* Zone (Upper Pelsonian), *Tetraspinocytis laevis* Zone (Illyrian sensu *P. trinodosus* Zone), *Spongosilicarmiger italicus* Zone (Lower Fassinian sensu 'X.' *reitzi* Oppel Zone, *Ladinocampe multiperforata* Zone (Middle Fassinian, ? lower part of Upper Fassinian), *Muelleritortis cochleata* Zone (Middle and Upper Longobardian), *Tritortis kretaensis* Zone (Cordevolian, including *Frankites sutherlandi* Zone), *Pseudosaturiniforma carnica* Zone (Julian), *Nakasekoellus inkensis* Zone (Tuvalian), *Capnodoce ruesti* Zone (Lower Norian), *Livarella densiporata* Zone (Rhaetian).

Very distinct changes in the radiolarian faunas occur at the base of the 'X.' *reitzi* Oppel Zone, within and at the top of the *Kellnerites* faunas of the lower 'X.' *reitzi* Oppel Zone. These fundamental changes in the radiolarian faunas support the original position of the Anisian-Ladinian boundary at the base of the 'X.' *reitzi* Oppel Zone or at the base of the 'X.' *reitzi* Range Zone (= base of the *A. avisianum* Subzone). According to the radiolarian faunas, the *A. avisianum* 'Zone' is not older than the 'X.' *reitzi* Oppel Zone, but contemporaneous with the upper half of the 'X.' *reitzi* Oppel Zone. Very distinct changes in the radiolarian faunas occur also at the base of the *Trachyceras archelaus* Zone, at the base of the Cordevolian (including the *Frankites sutherlandi* Zone), near the Lower/Middle Carnian boundary and at the base of the Sevatian (including the *Halorites macer* Zone).

### Zusammenfassung:

Triassische Radiolarienfaunen wurden von mehreren Profilen in Ungarn (Balaton-Hochland: Felsőörs, Köveskál; Darnóhegy-Gebiet zwischen Mátra- und Bükk-Gebirge), Italien (Passo della Gabiola, Straßeneinschnitt zwischen Mte. Spitz und Mte. Fallison, San Ulderico, alles Vicentinische Alpen; Sosio-Tal, Sizilien) und Österreich (Großreifling, Göstling, Öfenbachgraben) untersucht. Zusätzlich wurden mehrere Einzelproben aus China, der Türkei, Griechenland, Italien, Österreich, Ungarn und Jugoslawien untersucht. 4 Familien, 14 Gattungen, 141 Arten, und 23 Unterarten werden beschrieben.

Die biostratigraphischen Untersuchungen konzentrierten sich auf die Bereiche Anis bis Unterladin, Oberlongobard bis Jul und Nor bis Hettang. Die Entwicklung der Radiolarien-Faunen vom Oberanis bis Unterladin wird im Detail diskutiert. Die folgenden Radiolarienzonen werden ausgeschieden: *Parasepsagon robustum*-Zone (Oberpelson), *Tetraspinocytis laevis*-Zone (Illyr, im Sinne der *P. trinodosus*-Zone), *Spongosilicarmiger italicus*-Zone (Unterfassan, im Sinne der „X.“ *reitzi* Oppel-Zone), *Ladinocampe multiperforata*-Zone (Mittelfassan, ? unteres Oberfassan), *Muelleritortis cochleata*-Zone (Mittel- und Ober Longobard), *Tritortis kretaensis*-Zone (Cordevol, einschließlich der *Frankites sutherlandi*-Zone, *Pseudosaturiniforma carnica* (Jul), *Nakasekoellus inkensis*-Zone (Tuval), *Capnodoce ruesti*-Zone (Unternor), *Livarella densiporata*-Zone (Rhät). Sehr deutliche Änderungen in den Radiolarienfaunen kommen an der Basis der „X.“ *reitzi* Oppel-Zone sowie innerhalb und an der Obergrenze der *Kellnerites*-Faunen der unteren „X.“ *reitzi* Oppel-Zone vor. Diese fundamentalen Änderungen in den Radiolarienfaunen bekräftigen die Lage der Anis/Ladin-Grenze an der Basis der „X.“ *reitzi* Oppel-Zone oder an der Basis der „X.“ *reitzi* range-Zone (= Basis der *A. avisianum*-Subzone). Diese Grenze entspricht der Originaldefinition der Ladin-Basis. Nach den Radiolarienfaunen ist die *A. avisianum*-„Zone“ nicht älter als die „X.“ *reitzi*-Zone, sondern gleichaltrig mit der oberen Hälfte der „X.“ *reitzi* Oppel-Zone. Sehr deutliche Änderungen in den Radiolarienfaunen kommen auch an der Basis der *Trachyceras archelaus*-Zone, an der Basis des Cordevols (einschließlich der *Frankites sutherlandi*-Zone, nahe der Unter-/Mittelkarn-Grenze und an der Basis des Sevats (einschließlich der oberen *Halorites macer*-Zone) vor.

## I. Introduction

Among the stratigraphically important Triassic fossils, the radiolarians have the highest potential for detailed stratigraphic subdivisions. Ammonoids and conodonts show similar evolutionary rates as the most rapidly evolving radiolarian groups. However, the diversity in species and genus level is considerably larger in radiolarians than in ammonoids and conodonts. Rich radiolarian samples have generally more than 100 species, sometimes more than 200 species. Among them are always species that are in a stage of rapid evolution in the transitional field between 2 species. For this reason nearly in every bed new taxa appear within phylomorphogenetic lines.

In the past 10 years 17 Triassic radiolarian zonations have been published (BLOME, 1984, 1987, BLOME et al. 1987, 1988, CHENG, 1989, IGO & NISHIMURA, 1984, ISHIDA, 1984, KISHIDA & HISHIDA, 1985, 1986, KISHIDA & SUGANO, 1982, NAKASEKO & NISHIMURA, 1979, NISHIZONO & MURHIH, 1984, SAHIDA, 1984, SATO & MURATA, 1982, SATO et al. 1986, YAO MATSUDA & ISOZAKI, 1980, YAO, MATSUOKA & NAKATANI, 1982, YEH, 1989, YOSHIDA, 1986). However, in the Middle Triassic most of these zonations are based on single or few samples with well preserved rich radiolarian faunas.

Real successions have been investigated only by few authors, because it is difficult to find rich and well preserved radiolarians in one section from continuous rock sequences representing a longer time interval.

The present paper is based on more than 200 radiolarian-rich samples from several sections in Austria, Hungary and Italy.

## II. Investigated sections

### 1. Göstling and Großreifling, Austria (Figs. 1, 2)

The section Göstling and Großreifling yielded the richest Triassic radiolarian faunas of the world mostly described by KOZUR & MOSTLER (1982, 1978, 1979, 1981). The richest radiolarian faunas derived from limestones 0.5–5.0 m below Middle Carnian shales. These beds were placed by KOZUR & MOSTLER and LAHM (1984) in the Upper Cordevolian because of the occurrence of *Trachyceras aonoides* near the boundary between the radiolarian-bearing limestones and the overlying shales (MOSTLER & SCHEURING, 1974). However, accord-

ing to KRYSTYN (pers. comm.) in this level already *Austrotrachyceras* is present. For this reason, the radiolarian-bearing samples cannot be older than the lower part of Julian substage, indicated also by a conodont fauna with *Gladigondolella tethydis* (HUCKRIEDE) and *Paragondolella polygnathiformis* (BUDUROV & STEFANOV). Also the Cordevolian holothurian fauna with *Fissobracites inusitata* KOZUR & MOSTLER and *Theelia koeveskalensis* KOZUR & MOSTLER disappeared below the radiolarian-bearing level.

### 2. Felsőörs, Hungary (Fig. 3)

The famous section at Forráshegy in the Malomvölgy (Mill Valley) has yielded rich Illyrian and Fasnian radiolarian faunas. In this section good correlations between the radiolarian-, ammonoid-, and conodont faunas are possible. The oldest rich fauna is known from bed Fö 87, a limestone within a tuffit layer in the horizon with *Paraceratites trinodosus*. Up to bed 90 *Paraceratites trinodosus* occurs. The level from bed 91 - bed 99C corresponds to the horizon with *Longobardites*, *Parakellnerites ? meriani* and '*Reiflingites*' ? *camunus* at the Anisian-Ladinian boundary.

Beds 100 E - 110 represent the '*Xenoprotrachyceras*' *reitzei* Oppel Zone of the Balaton Highland. Its lower part is characterized by '*Parakellnerites*' *hungaricus*, *Kellnerites felsőörsensis* and *Hungarites* spp., the upper part by *Halilucites*, *Hungarites* and '*X.*' *reitzei*. The typical spined *Xenoprotrachyceras reitzei* is restricted – like in other occurrences at this Oppel Zone – to a short interval from beds 100 (?), 104–105.

According to the priority both the *A. avisianum* Zone and the '*X.*' *reitzei* Zone have been placed into the Ladinian. In contrast to this clearest priority of any Triassic stage boundary, recently the Anisian/Ladinian boundary was often placed above the '*X.*' *reitzei* Oppel Zone. In North America and in the Arctic even time-equivalents of the *Eoprotrachyceras curionii* Zone have been placed at the base of the Ladinian.

The radiolarian distribution confirms the traditional Anisian-Ladinian boundary. At the base of the '*X.*' *reitzei* Oppel Zone (base of the *Kellnerites felsőörsensis* subzone) *Triassocampe scalaris* DUMITRICĂ, KOZUR & MOSTLER appears that is the most frequent and typical species of the Lower Ladinian. In the same level the genera *Oertlispongia* DUMITRICĂ, KOZUR & MOSTLER and *Yeharaia* NAKASEKO & NISHIMURA begin that are worldwide distributed guide-forms of the Lower La-

dinian. Furthermore several Ladinian *Triassocampe* species and *Spongosilicarmiger italicus*, a typical species of the whole 'X.' *reitzei* Oppel Zone makes its first appearance.

### 3. Köveskál, Hungary (Fig. 4)

At the cemetery of Köveskál (Baleton Highland) an Upper Fassanian to Cordevolian sequence is exposed that yielded rich radiolarian faunas from the Upper Fassanian up to the Upper Longobardian. In this section the radiolarian faunas can be well correlated with the conodont zonation of the *Budurovignathus truempyi*-, *B. hungaricus*-, and *B. mungoensis* Assemblage Zones that have all yielded both the conodont index species and rich radiolarian faunas.

### 4. Dallapuszta (Darnó Hill, northern Hungary)

This section, located near the road between Recsk and Sirok at the southern flank of the Darnó Hill, NE of Mátra Mts., consists of red bedded cherts. It is a block of Triassic rocks surrounded by other blocks of Triassic rocks (red cherts, pillow lava) and Jurassic manganese shales and turbidites in the Darnó Melange Nappe (KOZUR & MOCK, 1988).

Radiolarians from this section have been investigated by DE WEVER (1984), KOZUR & KRAHL (1984), KOZUR (1988 a, b) and DOSZTÁLY (1989). DE WEVER (1984) found only 3 radiolarian-bearing samples with determinable radiolarian among 13 investigated samples. DOSZTÁLY (1989) investigated 24 samples from which 22 ones yielded radiolarians. KOZUR (1988 a, b), KOZUR & KRAHL (1984) and KOZUR & MOCK (1988) investigated 30 samples, all of them have radiolarians and partly also conodonts. The preservation of the radiolarians is mostly bad, but the succession is very important because it crosses the Ladinian-Carnian boundary and the Cordevolian part is rather rich in conodonts.

The different results of the investigations have been already discussed by DOSZTÁLY (1989). DE WEVER found in one sample (H198) a lot of Oertlispongidae, among them both Lower Ladinian forms (*Oertlispongius inaequispinosus* DUMITRICĂ, KOZUR & MOSTLER, *Falcispongius falciformis* DUMITRICĂ and Longobardian forms or forms that occur both in the Fassanian and

Longobardian (*Baumgartneria curvispina* DUMITRICĂ, DUMITRICĂ, *Falcispongius hamatus* DUMITRICĂ, *F. rostratus* DUMITRICĂ, *Spongoserrula raraurana* DUMITRICĂ). The latter species was indicated by DUMITRICĂ (1982) from the Longobardian up to Tuvalian, but the Tuvalian specimens (sample R106) are derived from a megabreccia in which the radiolarian fauna is dominated by *Muelleritortis cochleata* (NAKASEKO & NISHIMURA), a Longobardian guide-form. The 'Carnian' red chert-diabase sample R88 is likewise either upper Ladinian or Cordevolian. So, *S. raraurana* is a Longobardian form that ranges up to the Cordevolian.

The figured material from sample H198 contains typical *Tritortis kretaensis* (KOZUR & KRAHL), determined by DE WEVER (1984) as *Sepsagon longispinosus* or *Eptingium manfredi*. The specimen determined as *Falcispongius calcaneum* DUMITRICĂ is *Falcispongius hamatus* DUMITRICĂ, a Longobardian-Cordevolian species. *Falcispongius falciformis* is an undetermined oertlispongid Radiolaria. Also a broken *Palaeosaturnalis* was figured by DE WEVER (1984) from this sample that contains also *Muelleritortis cochleata* (NAKASEKO & NISHIMURA).

Our data from Dallapuszta are in good agreement with the data by DOSZTÁLY (1989), but our fauna is by far richer and the upper fauna (dominated by *Tritortis kretaensis*) is here placed into the Cordevolian and not into the Longobardian. This is supported also by a conodont fauna with *Paragondolella foliata foliata* BUDUROV, transitional to *P. tadpole* (HAYASHI), *P. polygnathiformis* (BUDUROV & STEFANOV) and *Budurovignathus mirautae* KOVÁCS & KOZUR.

### 5. San Ulderico (Southern Alps, Italy) (Fig. 5)

The profile is published by MIETTO & PETRONI (1979). According the MIETTO & PETRONI (1979) the 'X.' *reitzei* zone above the *A. avisianum* zone begins in the level of the first limestone bank above the tuffites. From this bed (sample TT1) MIETTO provided one of the authors (H. KOZUR) with a rich radiolarian fauna that corresponds to the highest part of the Lower Fassanian *Spongosilicarmiger italicus* Zone. This level lies in the Felsőörs section (type locality at the X. *reitzei* Oppel Zone) above the X. *reitzei* Zone. This interval is younger than the *reitzei* Zone and older than the *curionii* Zone. This interval is not documented in the ammonoid zonation. Even the highest level of the profile, placed into the *Eoprottrachyceras cu-*

*curionii* Zone, is according to the radiolarians older than the *E. curionii* Zone.

These data are well supported by the conodont data published by MIETTO & PETRONI (1979). *Paragondolella trammeri* (KOZUR) begins in the Balaton Highland always clearly above the "X." *reitzei* Zone, but well below the *E. curionii* Zone. The view of KOVÁCS (in KOVÁCS & NICORA, 1990) that this species begins in the Balaton, Highland at the base of the *Nevadites* fauna is unsubstantiated (see chapter V).

According to the figured conodont fauna, the „X.“ *reitzei* Oppel Zone is present in the "A. avisianum Zone" sensu MIETTO & PETRONI (1979). This is fully confirmed by radiolarian faunas in other sections.

The best outcrop of the upper part of the *Nodosus* Formation (= Buchenstein Formation) is shown along the road starting north of San Ulderico, leading to the village Pallé.

The approximately 5 m thick section (section TT) consists of a sequence of nodular limestone, alternating with layers of clayish siltstones. The radiolarian-rich nodular limestone was sampled in summer 1978, together with Dr. DONOFRIO, University of Innsbruck (see also the upper part of the section, published by MIETTO & PETRONI, 1979).

#### 6. Passo della Gabiola (Figs. 6, 7)

The best section within the Recoaro area is exposed near Passo della Gabiola in the western part of Val di Cremo. The whole thickness of this profile is about 5 m, consisting of limestones of the Buchenstein Formation, partly of nodular texture. Only some limestone beds are cherty. They are intercalated by greenish siltstones. At the base of the section below the road, the Spitz limestone is exposed without contact to the Buchenstein Formation. This is one of the best radiolarian-bearing sections in the area around Recoaro.

A second section is exposed 200 m above the same road in eastern direction. It shows a short profile with a direct contact to the Monte-Spitz-Kalk Formation. This outcrop consists of the same nodular limestone of the Buchenstein Formation but the topmost part consists of a thick limestone with graded bedding. The debris components are from the carbonate platform.

### III. Taxonomic part

Only such new taxa are described that are stratigraphically important.

#### Suborder Entactinaria KOZUR & MOSTLER, 1982

##### Superfamily Hexastylacea HAECKEL, 1882

##### emend. PETRUSEVSKAJA, 1979

##### Family Eptingiidae DUMITRICĂ, 1978

##### Genus *Eptingium* DUMITRICĂ, 1978

**Type species:** *Eptingium manfredi* DUMITRICĂ, 1978

##### *Eptingium manfredi manfredi* DUMITRICĂ, 1978

(Pl. 1, fig. 3)

1978 *Eptingium manfredi* n. sp. pars – DUMITRICĂ, pp. 33–34, pl. 3, figs. 3, 4; pl. 4, figs. 1, 2, 3, 6, non! figs. 5, 7

**Occurrence:** Lower and Middle Fassanian of the Tethys.

##### *Eptingium manfredi robustum* KOZUR &

##### MOSTLER, 1980

(Pl. 1, figs. 1–2)

1980 *Eptingium manfredi robustum* KOZUR & MOSTLER n. subsp. – DUMITRICĂ, KOZUR & MOSTLER, p. 20, pl. 6, figs. 1–4, 8

**Occurrence:** Upper subzone at Lower Fassanian *Spongosilicarmiger italicus* A.Z. to Middle Fassanian *Ladinocampe multiperforata* A.Z.

##### *Eptingium manfredi japonicum* (NAKASEKO &

##### NISHIMURA, 1979)

(Pl. 1, fig. 4)

1979 *Tripocylia japonica* NAKASEKO & NISHIMURA, n. sp., pars – NAKASEKO & NISHIMURA, p. 73, pl. 4, Figs. 4–6

**Occurrence:** Illyrian (*Paraceratites trinodosus*-Zone) of Japan and Hungary.



**Remarks:** The specimen figured by NAKASEKO & NISHIMURA (1979, pl. 4, Fig. 6) with strong torsion of the tricarinate spines corresponds well to our material. The other 2 specimens, including the holotype, have only a slight torsion of the 3 main spines. Maybe that this is a taxonomic difference, but we have not enough material to study the intraspecific variability that is regarding the torsion also high in *E. manfredi manfredi* DUMITRICĂ, 1978.

The entactiniid spicular system is characteristic of the genus *Eptingium* DUMITRICĂ, 1978. *E. manfredi manfredi* DUMITRICĂ, 1978 is very similar, but the ridges of the spines have a distinct central furrow in their proximal half.

***Eptingium nakasekoi* n. sp.**

(Pl. 1, fig. 5)

1979 *Tripocyclia* cf. *acythus* DE WEVER – NAKASEKO & NISHIMURA, pp. 72–73, pl. 4, figs. 1 (?), 2, 3 (?)

**Derivatio nominis:** In honour of Prof. Dr. K. NAKASEKO, Osaka

**Holotypus:** The specimen on pl. 1, fig. 5, rep.-no. KoMo 1980 I-138.

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** 19 specimens.

**Diagnosis:** Cortical shell in lateral view with rounded subtriangular equatorial outline with pylom between 2 main spines, partly replaced by an area with different sculpture. Surface two-layered; inner pore frames with small roundish pores; outer pore frames larger, irregular. 3 tricarinate main spines, with high, but relatively narrow, rounded ridges that display mostly no central furrow. If present, this furrow is restricted to the basal part up to proximal third of the ridges. Furrows between the ridges broad and deep. Distal part of the spines needle-shaped. No torsion of spines. Entactinariid inner structure as for the genus (see DUMITRICĂ, 1978 and pl. 1 fig. 4)

**Dimensions:**

Diameter of shell = 139–161 µm

Length of spines = 133–167 µm

**Occurrence:** Rare in the Illyrian (*Paraceratites trinodosus* Zone) of Balaton Highland (Hungary). Frequent in the Illyrian and basal Fassanian (?) in Japan and Philippines.

**Remarks:** In *Eptingium manfredi manfredi* DUMITRI-

CĂ, 1978 the spines display different degree of torsion, the ridges are broader and display always a central furrow of different length, and are connected by some transverse bars.

**Genus *Polystephanidium* DUMITRICĂ, 1978**

**Type species:** *Polystephanidium clavator* DUMITRICĂ, 1978

*Polystephanidium clavator* DUMITRICĂ, 1978

(Pl. 1, fig. 6)

1978 *Polystephanidium clavator* n. sp. – DUMITRICĂ, pp. 34–35, pl. 2, figs. 6, 7

**Occurrence:** Middle and Upper Fassanian of the Tethys, rare.

**Superfamily Palaeoscenidiacea RIEDEL, 1967**

**emend. KOZUR & MOSTLER, 1982**

**Family Hindeosphaeridae KOZUR & MOSTLER, 1981**

**Genus *Hindeosphaera* KOZUR & MOSTLER, 1979**

**Type species:** *Hindeosphaera foremanae* KOZUR & MOSTLER, 1979

***Hindeosphaera ? balatonica* n.sp.**

(Pl. 1, fig. 7)

**Derivatio nominis:** According to the occurrence in the Balaton Highland.

**Holotypus:** The specimen on pl. 1, fig. 7; rep.-no KoMo 1980 I-112.

**Locus typicus:** Felsőörs (Balaton Highland, Hungary) Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** 4 specimens.

**Diagnosis:** Cortical shell subspherical, with coarse pore frames displaying large tetragonal to hexagonal pores. Inner pore frames fragile, only some bars are preserved (or present?) that do not connect each other to build an inner layer.

Main cusp very large with 3 high, narrow ridges and deep and broad furrows. On the opposite side several (mostly 3–4) small carinate, distal round spines are present.

Character of medullary shell not clear, because no broken specimens are known. It is connected by several spines with the cortical shell. Most of them do not continue beyond the cortical shell.

**Dimensions:**

Diameter of cortical shell = 117–140  $\mu\text{m}$

Length of the main spine = 110–116  $\mu\text{m}$

Length of the small spine = 23–30  $\mu\text{m}$

**Occurrence:** *Paraceratites trinodosus* Zone (Illyrian) of Balaton Highland.

**Remarks:** *Hindeosphaera* ? *balatonica* n. sp. belongs to the *Hindeosphaera* ? *spinulosa* group. *H.* ? *spinulosa* (NAKASEKO & NISHIMURA, 1979) displays an inner layer with small penta- to hexagonal pores. The outer layer is fragile and consists mainly of distinct spines on the pore frame joints. Often a larger spine is present opposite to the main spine indicating transitional character to *Pseudostylosphaera* KOZUR & MOSTLER, 1981.

**Genus *Pseudostylosphaera*  
KOZUR & MOSTLER 1982**

**Type species:** *Pseudostylosphaera gracilis* KOZUR & MOSTLER, 1981

***Pseudostylosphaera coccostyla* (RÜST, 1892)**

1892 *Spongattractus coccostylus* n. sp. – RÜST, p. 161, pl. 21, fig. 8

1979 *Archaeospongoprimum compactum* NAKASEKO & NISHIMURA n. sp. – NAKASEKO & NISHIMURA, p. 68, pl. 1, figs. 3, 7

1981 *Pseudostylosphaera coccostyla* (RÜST, 1892) – KOZUR & MOSTLER, pp. 31–32, pl. 15, fig. 3, pl. 46, fig. 5

**Occurrence:** Illyrian to Longobardian of Tethys.

***Pseudostylosphaera coccostyla coccostyla*  
(RÜST, 1892)**

1892 *Spongattractus coccostylus* n.sp. – RÜST, p. 161, pl. 21, fig. 8

1981 *Pseudostylosphaera coccostyla* (RÜST, 1892) – KOZUR & MOSTLER, pp. 31–32, pl. 15, fig. 3; pl. 46, fig. 5

**Occurrence:** Ladinian of Tethys.

**Remarks:** The Illyrian *Pseudostylosphaera coccostyla compacta* (NAKASEKO & NISHIMURA, 1979) has a more globular cortical shell and broad ridges on the very big polar spines are not yet subdivided by a central furrow.

***Pseudostylosphaera coccostyla compacta*  
(NAKASEKO & NISHIMURA, 1979)  
(Pl. 1, fig. 8)**

1979 *Archaeospongoprimum compactum* NAKASEKO & NISHIMURA, n. sp. – NAKASEKO & NISHIMURA, p. 1, figs. 3, 7

**Occurrence:** Illyrian, rarely Lower Fassinian of Balaton Highland (*Paraceratites trinodosus* Zone), Italy (Lagonero Basin) and Japan, there erroneously placed into the Upper Triassic.

**Remarks:** In the Ladinian *Pseudostylosphaera coccostyla coccostyla* (RÜST, 1898) the broad ridges of the very big polar spine are subdivided by a central furrow. Moreover, the cortical shell is more ellipsoidal.

***Pseudostylosphaera postjaponica* n.sp.  
(Pl. 1, figs. 9–10)**

1984 *Pseudostylosphaera japonica* (NAKASEKO & NISHIMURA, 1979) – LAHM, p. 34, pl. 4, figs. 9, 10

**Derivatio nominis:** According to the assumed phylogenetic sequence.

**Holotypus:** The specimen on pl. 1, fig. 9; rep.-no. KoMo 1980 I-588.

**Locus typicus:** Passo della Gabiola near Recoaro, Vicentian Alps (Italy).

**Stratum typicum:** Sample MD 18, upper *Oertlispongia primitivus* Subzone of *Spongosilicarmiger italicus* Zone, upper part of Lower Fassinian.

**Material:** 59 specimens.

**Diagnosis:** Cortical shell slightly ellipsoidal, two-layered, long axis distinctly shorter than length of spines. The inner layer displays small, irregularly spaced roundish pores.

Pore frames of the outer layer with nodes on the joints, from which narrow bars radiate. Near the poles the pore frames are often arranged in irregular longitudinal ribs. Outer pores of different size, triangular to pentagonal and oval, larger than inner pores. Medullary shell part of a modified pentactine spicular system.

Polar spines distinctly longer than long axis of cortical shell, broadest about in the midlength, tricarinate with deep, wide furrows.

**Measurements:**

Diameter of cortical shell (long axis): 116–133 µm

Diameter of cortical shell (short axis): 107–113 µm

Length of polar spines: 187–215 µm

Occurrence: Middle *Spongosilicarmiger italicus* Zone to lower *Ladinocampe multiperforata* Zone (upper part of Lower Fassanian to lower part of Middle Fassanian).

Remarks: *Pseudostylosphaera japonica* (NAKASEKO & NISHIMURA, 1979) from the Lower Fassanian (? and Illyrian) displays shorter spines compared with the length of the cortical shell (spines as long as cortical shell or somewhat shorter).

**Family Parentactiniidae**

**KOZUR & MOSTLER, 1981**

**Genus *Parentactinia* DUMITRICĂ, 1978**

**Type species:** *Parentactinia pugnax* DUMITRICĂ, 1978

***Parentactinia pugnax* DUMITRICĂ, 1978**

(Pl. 1, figs. 11–12)

1978 *Parentactinia pugnax* n. sp. - DUMITRICĂ, pp. 50–51, pl. 4, figs. 4?, 5; pl. 5, figs. 1–3

**Occurrence:** Upper Anisian *Paraceratites trinodosus* Zone up to Lower Ladinian.

***Parentactinia lata* n. sp.**

(Pl. 2, fig. 1)

**Derivatio nominis:** According to the wide shell.

**Holotypus:** The specimen on pl. 2, fig. 1, rep.-no. KoMo 1980 I-104.

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** 12 specimens.

**Diagnosis:** Test very small. Modified pentactine spicular system very robust. On both sides of a median bar 2 free, round, straight, apical spines and 2 curved, cylindric very strong descending spines are present. The descending spines are connected by strong arches and bars that form at least distally a loose, short, broad subglobular shell, that is somewhat broader than long.

**Dimensions:**

Length of apical spines: 43–48 µm

Height of shell: 81–86 µm

Width of shell: 90–96 µm

**Occurrence:** *Paraceratites trinodosus*-Zone (Illyrian) of Balaton Highland.

**Remarks:** *Parentactinia pygnax* DUMITRICĂ, 1978 has 4 spines in prolongation of the 4 descending (basal) spines.

*Parentactinia inerme* DUMITRICĂ, 1978 has also a loose shell without basal spines, but the shell is always elongated (ellipsoidal), somewhat longer than broad. Moreover, Mb is seemingly shorter.

**Family Pentactinocarpidae DUMITRICĂ, 1978**

**Genus *Pentactinocapsa* DUMITRICĂ, 1978**

**Type species:** *Pentactinocapsa quadripes* DUMITRICĂ, 1978

***Pentactinocapsa quadripes* DUMITRICĂ, 1978**

(Pl. 2, fig. 2)

1978 *Pentactinocapsa quadripes* n. sp. - DUMITRICĂ, p. 45–46, pl. 1, figs. 2–4

**Occurrence:** Characteristical, but very rare species in the middle part of Lower Ladinian of the Southern Alps.

*Pentactinocapsa awaensis*  
(NAKASEKO & NISHIMURA, 1979)  
(Pl. 2, figs. 10–11)

1979 *Acanthosphaera awaensis* NAKASEKO & NISHIMURA, n. sp. – NAKASEKO & NISHIMURA, p. 67, pl. 1, figs: 1, 5, 6

**Emended diagnosis:** Cortical shell subcylindrical with low-conical apical and distal sector, with very large round to oval pores. Pentactine spicular system partly within the cortical shell, partly free. Apical spine entirely outside the shell. The 4 basal spines built up in the apical part of the test a shallow cone, in which they are connected by 3 short pairs of vertices with the shell in 2 of the basal spines. In the alternating other 2 basal spines they are directly part of the wall of the cortical shell, because the 3 vertices pairs branch in these basal spines laterally from the spines. The then following vertical to slightly outward-directed part of the 4 basal spines is clearly separated from the shell wall. The end of this part joins the distal shell wall and continues beyond it as round spines. Beside these 4 spines and the apical spine still other 4 round spines are present at the transition from the apical conical to the central subcylindrical part. These spines originate from joints of the pore frames between the 4 basal spines.

**Dimensions:**

Diameter of shell (long axis): 195–206 µm

Diameter of shell (short axis): 160–173 µm

**Occurrence:** Illyrian of Japan. *Paraceratites trinodosus* Zone (Illyrian) of Balaton Highland (Hungary).

**Remarks:** The Lower Ladinian *Pentactinocapsa quadrupes* DUMITRICĂ, 1978 has smaller pores and all 4 basal spines are in the apical part situated within the shell wall.

In the Illyrian *Pentactinorbis dimitricai* n. sp. the apical branching point of the basal spines and the apical spines are inside the shell and the pyramidal apical part of the basal spines is not connected with the cortical shell.

*Pentactinocapsa awaensis* (NAKASEKO & NISHIMURA, 1979), is a transitional form between the genera *Pentactinocapsa* DUMITRICĂ, 1978 (apical spine entirely above the cortical shell, branching point of the basal spines in the shell wall) and *Pentactinorbis* DUMITRICĂ, 1978 (apical part of basal spines partly inside the wall of the cortical shell). The connection with *Pentactinocapsa* are closer. Seemingly *Pentactinocapsa awaensis* (NAKASEKO & NISHIMURA) is the oldest and most primitive species of this genus that has apparently evolved from *Pentactinorbis*.

**Genus *Pentactinocarpus* DUMITRICĂ, 1978**

**Type species:** *Pentactinocarpus fusiformis* DUMITRICĂ, 1978

*Pentactinocarpus fusiformis* DUMITRICĂ, 1978  
(Pl. 2, fig. 4)

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

**Occurrence:** Lower Ladinian. Not yet found until the Lower part of the *Spongosilicarmiger italicus* Zone („*Xenoprot-rachyceras*“ *reitzei* Oppel Zone).

**Remarks:** The figured specimen has tiny spines on the joints of the pore frames, otherwise it is identical with the type material from which DUMITRICĂ (1978) has only given a drawing. Small cones on the joints of the pore frames have been also indicated on this drawing.

*Pentactinocarpus acanthicus* DUMITRICĂ, 1978  
(Pl. 2, figs. 3, 5)

1978 *Pentactinocarpus acanthicus* n. sp. – DUMITRICĂ, pp. 44–45, pl. 3, fig. 3

**Occurrence:** Ladinian, to but not yet lowermost Ladinian, ? Carnian. Tethys.

**Remarks:** *Pentactinocarpus illyricus* n. sp. is distinguished by the apical flat and broad shell.

According to DUMITRICĂ (1978) this species is the least frequent one of the genus. However, in our material it is the most frequent one, whereas *P. fusiformis* DUMITRICĂ, 1978 and *P. tetracanthus* DUMITRICĂ, 1978 are rare. LAHM (1984), in turn, found most frequent *P. tetracanthus* and considerably fewer *P. fusiformis* and *P. acanthicus*. All investigations have been carried out above all in the Ladinian of the Vicentinian Alps. Seemingly the frequency of these species varies from sample to sample without stratigraphic meaning.

*Pentactinocarpus illyricus* n. sp.  
(Pl. 3, figs. 1–2)

**Derivatio nominis:** According to the occurrence in the Illyrian.

**Holotypus:** The specimen on pl. 3, figs. 1-2; rep.-no. Ko-Mo I-557.

**Lower typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone sample 87 within a greenish tuffit, *Paraceratites trinodosus* Zone (Illyrian)

**Material:** 3 specimens.

**Diagnosis:** The 4 basal spines are in their free part not or almost not downward directed. Shell globular with pores of irregular size (from small to very large in one specimen). 2 of the descending (basal) spines end at the beginning of the shell without prolongation in a spine. The other 2 are also in their distal part only a little downward directed and end immediately below the irregular proximal ring at the beginning of the shell. One or both are prolonged in a spine. 4 further spines are situated in the upper to middle part of the shell and 2 may be present in the lower part of the shell. Apical and antapical spine not observed (broken away?)

**Occurrence:** Very rare and only species of *Pentactinocarpus* in the very rich Illyrian to radiolarian fauna of the Balaton Highland (Hungary).

**Remarks:** In *Pentactinocarpus acanthicus* DUMITRICĂ, 1978 and all other Ladinian to Upper Triassic *Pentactinocarpus* species the upper (free) part of the basal spines is conical because the descending spines are strongly downward directed. Moreover, no basal spine ends at the beginning of the shell as 2 basal spines do in *P. illyricus* n. sp. and also not immediately below the upper margin of the shell as the 2 other basal spines do. Moreover, all 4 basal spines are prolonged into spines on the shell and not only 2 as in *P. illyricus* n. sp.

### *Pentactinocarpus tetracanthus* DUMITRICĂ, 1978

(Pl. 2, figs. 6-7)

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

**Occurrence:** Lower Ladinian of the Tethys.

### Genus *Pentactinorbis* DUMITRICĂ, 1978

**Type species:** *Pentactinorbis kozuri* DUMITRICĂ, 1978

### *Pentactinorbis kozuri* DUMITRICĂ, 1978

1978 *Pentactinorbis kozuri* n. sp. – DUMITRICĂ, pp. 46-47, pl. 3, figs. 4, 5

**Occurrence:** Frequent in the upper part of Lower Fassanian and in the Middle Fassanian of the Tethys.

### *Pentactinorbis dumitricai* n. sp.

(Pl. 3, figs. 4-7; pl. 4, figs. 1-2)

**Derivatio nominis:** In honour of Dr. P. DUMITRICĂ who has excellently investigated this genus.

**Holotypus:** The specimen on pl. 3, figs. 4-7; rep.no. Ko-Mo 1980 I-99.

**Lower typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffits, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** More than 100 specimens. Cortical shell globular, consisting of few thick bars including very large pores. Inner pentactine spicular system similar as in the type species. Short apical spine mostly dibranching before reaching the cortical shell; outside indicated by 2 small spines that may be also missing. The 4 basal spines build up a apical pyramid. They are strongly spinose. About in the equator or somewhat above it, the pentactine spinular system is connected by 2 vertices with the cortical shell. The vertices continue outside into 8 spines. The 4 basal spines are there connected by a ring. From there the 4 basal spines continue vertically downward and are in the distal third again connected by a ring. 2 of the basal spines are here directly connected with the cortical shell by a spine that continues as outer spine. The 2 other basal spines are once more connected by vertices that continue also as spines beyond the cortical shell. The distal region has therefore 6 spines.

### **Dimensions:**

Diameter of cortical shell: 190-210 µm

**Occurrence:** Frequent in the *Paraceratites trinodosus* Zone (Illyrian) of the Balaton Highland (Hungary).

**Remarks:** The general structure of *Pentactinorbis dumitricai* is similar to *P. kozuri* DUMITRICĂ, 1978. However, in this species the basal spines are smooth or only very slightly spined in the pyramdial upper part. The continuation of the basal spines between the proximal and distal rings is not in form of an inverted frustum of pyramid, but rectangular. The pores of cortical shell are considerably larger in *P. dumitricai* n. sp. than in *P. kozuri* DUMITRICĂ, 1978.

*Pentactinorbis mostleri* DUMITRICĂ, 1978 has also distinctly spined upper basal spines, but the pentactine spicular system has an other form and the pores of the cortical shell are considerably smaller.

***Pentactinorbis pessagnoii* n. sp.**

(Pl. 4, figs. 3–4)

**Derivatio nominis:** In honour of Prof. Dr. E. H. PESSAGNO, Dallas, for his outstanding papers on Mesozoic radiolarians.

**Holotypus:** The specimen on pl. 4, figs. 3–4; rep.-no. KoMo 1980 I-104.

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffite, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** 15 specimens.

**Diagnosis:** Cortical shell sphaerical, with very big round, oval, and intermediate moderately large round to triangular pores. Apical spine cylindric, relatively large, smooth. The 4 basal feet built up an apical pyramid. In this part they are clearly spined. At the end of the pyramid they are connected by a ring. After the ring they are smooth, vertical, bordering with the apical and distal ring 4 rectangles. From each upper corner of these rectangles 2 vertices join the cortical shell, but do not continue as spine beyond it. Maximally very short, pyramidal spines to nodes may be present. From each lower corner of the rectangles one obliquely downward directed bar connects the pentactine spicular system with the cortical shell. Also on this joints maximally very short spines are present. The third connection between the cortical shell and the large pentactine spicular system is at the apical spine. Also the apical spine does not continue as spine beyond the joint with the cortical shell.

**Dimensions:**

Diameter of shell: 172–178 µm

**Occurrence:** Illyrian (*P. trinodosus* Zone) of the Balaton Highland.

**Remarks:** *Pentactinorbis pessagnoii* n. sp. is clearly distinguished from all other *Pentactinorbis* species by the missing spines at the joints between the pentactine spicular system and the cortical shell.

**Family Sepsagonidae KOZUR & MOSTLER, 1981**

**Genus *Sepsagon* DUMITRICA, KOZUR & MOSTLER, 1980**

**Type species:** *Triactoma longispinosum* KOZUR & MOSTLER, 1979

***Sepsagon ladinicus* n. sp.**

(Pl. 4, figs. 5–9)

1980 *Sepsagon longispinosus* (KOZUR & MOSTLER, 1979) – DUMITRICĂ, KOZUR & MOSTLER, p. 15, pl. 5, figs. ?1, ?2, 5, 6; pl. 15, fig. 1

1984 *Sepsagon longispinosus longispinosus* (KOZUR & MOSTLER, 1979), pars – LAHM, p. 39, pl. 6, fig. 5, non! figs. 3, 4

1984 *Sepsagon* cf. *longispinosus longispinosus* (KOZUR & MOSTLER, 1979) – LAHM, p. 39, pl. 6, figs. 6, 7

**Derivatio nominis:** According to the occurrence in the Lower Ladinian.

**Holotypus:** The specimen on pl. 4, fig 9; rep.-no. KoMo 1980/I-555.

**Locus typicus:** Val di Creme section near Recoaro, Italy  
**Stratum typicum:** Sample VCB, limestone from the upper part of the Lower Fassinian *Spongosilicarmiger italicus* A.Z.

**Material:** More than 100 specimens.

**Diagnosis:** Cortical shell subspherical, consisting of 2 layers. Inner layer with small pore frames with triangular, rarely tetragonal, polygonal or oval pores. Outer layer with large pore frames and distinct rounded nodes on the joints. 3 tricarinate, slender, long spines of distinctly different length are arranged under distinctly different angles. They are situated in one plane.

Palaeosoeniid inner structure. Medullary shell ellipsoidal, latticed, long axis in the plane of the spines. The medullary shell includes a modified pentactine spicular system. 3 apical spines are free and join mostly the cortical shell. This apical side corresponds to the side with the larger angle between the long spine and one of the shorter spine. The 4 descending spines are included into the wall of the medullary shell and are connected at some distance from the apical end by a ring somewhat above the mid-length of the medullary shell. 2 of them stop in the proximal ring. The other 2 extend into 2 of the outer radial spines. The third radial spine, opposite to the largest angle, originate in the antapical end of the internal shell. It is connected by a vertical ring with the base of the apical spines.

**Dimensions:**

Diameter of cortical shell: 160–190 µm

Length of the longest spine: 290–330 µm

Length of the shortest spine: 180–220 µm

**Occurrence:** Fassanian. Not yet observed in the lower and middle part of the *Spongosilicarmiger italicus* Zone.

**Remarks:** *Sepsagon longispinosus* (KOZUR & MOSTLER, 1979) from the Upper Triassic has somewhat more slender spines, the differences in the length of the spines are not so pronounced (photos of this species with apparently distinctly different spines have not been taken in the plane of the spines), the angles between the spines are not so different. The inner pore frames of *S. longispinosus* have predominantly round small pores. The nodes on the joints of the outer pore frames are pointed (often they are small spines), never broadly rounded as in the new species.

***Sepsagon longispinosus*  
(KOZUR & MOSTLER, 1979)  
(Pl. 5, fig. 2)**

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

1980 *Sepsagon longispinosus* (KOZUR & MOSTLER, 1979) – DUMITRICĂ, KOZUR & MOSTLER, p. 15, the figured specimens belong to *Sepsagon ladinicus* n. sp.

1983 *Sarla longispinosum* (KOZUR & MOSTLER) – BLOME, pp. 19–20, figured Norian form belongs to a different taxon

1984 *Sarla longispinosa* (KOZUR & MOSTLER, 1979) (emend. BLOME, 1983) – BLOME, p. 31, the figured Norian specimen belongs to a different taxon

**Occurrence:** Carnian, worldwide.

**Remarks:** The Ladinian forms, assigned to this species, belong to *Sepsagon ladinicus* (differences see under this species).

The Norian specimen, figured by BLOME (1983, 1984) as *Sarla longispinosa* belongs to an other taxon. The spines are about twice so broad compared with the outer diameter of the shell. The pore frames of the outer layer are different.

***Sepsagon robustus* LAHM, 1984**

(Pl. 4, fig. 10; pl. 5, figs. 1, 6)

1984 *Sepsagon ? robustus* n. sp. – LAHM, pp. 40–41, pl. 6, fig. 10

**Occurrence:** Middle and upper part of Lower Fassanian *Spongosilicarmiger italicus* Zone of Southern Alps.

**Remarks:** The inner structure confirms the assignment to *Sepsagon*. The palaeoscanidiid spicular system displays 4 apical spines.

**Genus *Parasepsagon* DUMITRICĂ, KOZUR & MOSTLER, 1980**

**Type species:** *Parasepsagon tetracanthus* DUMITRICĂ, KOZUR & MOSTLER, 1980

***Parasepsagon asymmetricus asymmetricus*  
KOZUR & MOSTLER, 1981**

1981 *Parasepsagon asymmetricus* n. sp. – KOZUR & MOSTLER, p. 35, pl. 5, figs. 2–4

**Occurrence:** Pelsonian of Großreifling, Austria, *Bulogites zoldianus* beds of Aszöfö (Balaton Highland, Hungary).

**Remarks:** In *Parasepsagon asymmetricus praetetracanthus* n.sp. from the *Paraceratites trinodosus* Zone (Illyrian) the axes of spines deviates only slightly from the rectangular position as in *P. tetracanthus* DUMITRICĂ, KOZUR & MOSTLER 1980 from the Lower Ladinian.

***Parasepsagon asymmetricus praetetracanthus*  
n.subsp.  
(Pl. 5, fig. 3)**

**Derivatio nominis:** According to the transitional character between *P. asymmetricus asymmetricus* KOZUR & MOSTLER and *P. tetracanthus* DUMITRICĂ, KOZUR & MOSTLER.

**Holotypus:** The specimen on pl. 5, fig. 3; rep.-no. KoMo 1980/I-137.

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone sample 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian)

**Material:** 23 specimens.

**Diagnosis:** Cortical shell globular, two-layered. Inner layer with small, round, oval or rounded triangular pores, outer layer with coarser pore frames, displaying rounded conical nodes on the joints. All 4 spines have the same size and are situated in one plane. Their axes deviate only a little from perpendicular. The spines become continuously narrower from their relatively broad basis toward the tips. They are tricarinate with broad ridges and deep furrows. Their terminal part is round and needle-like.

Inner structure not observed.

**Dimensions:**

Diameter of cortical shell: 152–166  $\mu\text{m}$

Length of spines: 207–240  $\mu\text{m}$

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone) of Balaton Highland.

**Remarks:** Transitional form between *Parasepsagon asymmetricus asymmetricus* KOZUR & MOSTLER, 1981 and *P. tetracanthus* DUMITRICĂ, KOZUR & MOSTLER, 1980. The spines are still of equal length as in *P. asymmetricus asymmetricus*, but their arrangement is almost rectangular as in Lower Ladinian *P. tetracanthus* in which the spines in one axis are distinctly shorter than in the other axis.

***Parasepsagon tetracanthus* DUMITRICĂ,  
KOZUR & MOSTLER, 1980**  
(Pl. 5, figs. 4, 5)

1980 *Parasepsagon tetracanthus* n. gen. n. sp. –  
DUMITRICĂ, KOZUR & MOSTLER, p. 13, pl. 1,  
fig. 8; pl. 2, fig. 7

**Occurrence:** Frequent in the Tethyan Lower Ladinian.

**Genus *Pseudosepsagon* n. gen.**

**Derivatio nominis:** According to the similarity with *Sepsagon* DUMITRICĂ, KOZUR & MOSTLER, 1980

**Type species:** *Pseudosepsagon pentaspinosus* n. gen. n. sp.

**Diagnosis:** Cortical shell subglobular, two-layered. Outer layer with coarse, high tetragonal to hexagonal pore frames with very short spines or nodes on the joints. Inner layer with small pores, sometimes delicate pore frames. 3 radial spines of different length and under different angles, proximal

part displaying slight to moderate torsion. Distal part long, needle-like, round. One or two needle-like spines outside the plane of the 3 main spines are present.

Medullary shell part of a palaeoscanidiid spicular system. 3 needle-like, narrowly spaced apical spines are situated at the side with the widest spines between the 3 main spines. One of these spines continues beyond the cortical shell as the needle-like spine at the side of biggest angle between the 3 main spine. This spine is situated out of the plane of the main spines. The other 2 apical spines join the cortical shell, but do not reach beyond it.

3 of the 4 descending spines continue beyond the cortical shell as the 3 main spines. The fourth may continue in a spine out of the plane of the main spines on the side with the second largest angle between the main spines.

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone) of Balaton Highland (Hungary).

**Assigned species:**

*Pseudosepsagon pentaspinosus* n. gen. n. sp.

*Pseudosepsagon illyricus* n. sp.

**Remarks:** In *Sepsagon* DUMITRICĂ, KOZUR & MOSTLER, 1980 mostly only the 3 main spines are present that are situated in continuation of 2 descending spines and of the antapical spine of the pentactine spicular system. Very rarely a fourth spine in continuation of one of the apical spines (?) is present (*Sepsagon recoaroensis* LAHM, 1984), but it is situated in the plane of the 3 main spines opposite to one of the spines, seemingly with all transitions to the genus *Parasepsagon* DUMITRICĂ, KOZUR & MOSTLER, 1980. In this genus all 4 spines are nearly cross-like arranged, quite different from *Pseudosepsagon*, but they are all prolongations of the descending spines as in *Pseudosepsagon*.

***Pseudosepsagon pentaspinosus* n. gen. n. sp.**  
(Pl. 5, figs. 7–9)

**Derivatio nominis:** According to the presence of 5 spines.

**Holotypus:** The specimen on pl. 5, figs. 7–9; rep.-mo. Ko-Mo 1980/5–108.

**Locus typicus:** Felsöörs (Balaton Highland, Hungary) Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** 16 specimens.

**Diagnosis:** With the character of the genus. The proximal part of all 3 main spines displays a strong torsion of the 3 ridges. The distal part is long, needle-like, with round cross



section. In prolongation of one apical spine of the modified pentactine spicular system a short spine outside the plane of the main spines is present on the side with the largest angle between the 3 main spines. The fifth spine, a little larger than the apical one, lies on the side of the next smaller angle between the main-spines. It lies also outside the plane of the main spine in prolongation of the fourth descending spine of the spicular system.

Outer pore frame of the outer layer very robust, high, mostly pentagonal to hexagonal. Inner layer consists of fragile pore frames with small pores at the inner side of the outer layer. It is only present in well preserved material, but even in this material broken away in many places of the shell.

#### Dimensions:

Diameter of cortical shell = 100–120  $\mu\text{m}$

Length of the largest spine = 200–218  $\mu\text{m}$

Length of the shortest spine = 140–160  $\mu\text{m}$

**Occurrence:** Illyrian of Balaton-Highland.

**Remarks:** In *Pseudosepsagon illyricus* n. sp. 2 of the 3 main spines are considerably stronger than the third one. Only a needle-shaped, rather long, delicate spine in prolongation of one apical spine is present. The inner pore frames with mainly small pores are robust.

#### *Pseudosepsagon illyricus* n. sp.

(Pl. 6, fig. 1)

**Derivatio nominis:** According to the occurrence in the Illyrian.

**Holotypus:** The specimen on pl. 6, fig. 1; rep.-no. KoMo 1980 I-109.

**Lower typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** 7 specimens.

**Diagnosis:** With the character of the genus. 2 of the 3 main spines are very strong, broad, in the proximal half with 3 ridges and deep furrows, displaying slight torsion. Distal half needle-like, with round cross section. The third main spine is only basally carinate, in the remaining part needle-like, round. It is much smaller and narrower than the other 2 spines that lie almost opposite to each other. At the side with the larger angle between the 3 main spines, a fourth spine lies in prolongation of one of the 3 apical spines. This spine is basally carinate, otherwise needle-like with round cross section. Outer pore frames robust, high, mostly pen-

tagonal to hexagonal, but also trigonal, tetragonal, hexagonal. Inner pore frames robust, including numerous small pores.

#### Dimensions:

Diameter of cortical shell = 120–130  $\mu\text{m}$

Length of the longest spines = 170–210  $\mu\text{m}$

Shortest spine not fully preserved in our material.

**Occurrence:** Illyrian (*P. trinodosus* Zone) of the Balaton Highland.

**Remarks:** *Pseudosepsagon pentaspinosus* n. gen. n. sp. has main spines undifferentiated in size and shape. Outer spines are present in prolongation of all 4 descending spines. The inner pore frames are very fragile and often not preserved.

#### Family Tiborellidae n. fam.

**Diagnosis:** Shell subspherical, slightly flattened, in lateral view with rounded subquadratic outline. Very big hexagonal to pentagonal pore frames. Pores closed by fragile inner pore frames (often broken away) with small pores. 4 main spines cross-like arranged, tricarinate, often with torsion.

Medullary shell latticed. Entactinaria spicular system with median bar and 3 spicules on each end of Mb.

**Occurrence:** Tethyan Middle Triassic.

**Assigned genus:** *Tiborella* DUMITRICĂ, KOZUR & MOSTLER, 1980

**Remarks:** The Muelleritortidae KOZUR, 1988 have often also 4 main spines in cross-like position and their wall structure and pore frames are identical with those of the Tiborellidae. However, there is a modified pentactine spicular system and the spines are situated in prolongation of the basal spines.

Other Mesozoic to Recent forms with 4 cross-like arranged spines have no internal spicular system.

The Austrosaturnalidae KOZUR & MOSTLER, 1983 have the same pore frames on the cortical shell and the same internal spicular system, but the 4 cross-like arranged spines are situated totally inside the shell that is surrounded by a saturnalid ring.

**Genus *Tiborella* DUMITRICĂ,  
KOZUR & MOSTLER, 1980**

**Type species:** *Tiborella magnidentata* DUMITRICĂ,  
KOZUR & MOSTLER, 1980

***Tiborella magnidentata* DUMITRICĂ,  
KOZUR & MOSTLER, 1980**

1980 *Tiborella magnidentata* n. sp. DUMITRICĂ, KO-  
ZUR & MOSTLER, p. 18, pl. 11, figs. 2, 6; pl. 11,  
figs. ? 2, 3, 4; pl. 12, fig. 4

***Tiborella anisica* n.sp.  
(Pl. 6, figs. 3, ? 5, 6–8)**

**Derivatio nominis:** According to the occurrence in the  
upper Anisian (Illyrian).

**Holotypus:** The specimen on pl. 6, figs. 7–8; rep.-no. Ko-  
Mo 1980 I-86

**Locus typicus:** Felsőörs (Balaton Highland, Hungary),  
Forráshegy section

**Stratum typicum:** Limestone bed 87 within greenish tuf-  
fites, *Paraceratites trinodosus* Zone (Illyrian)

**Material:** 56 specimens.

**Diagnosis:** Cortical shell subspherical, in lateral view with  
subquadratic equatorial outline. Outer pore frames very  
high, very large, tetragonal to heptagonal. Inner pore  
frames fragile, with small pores. 4 tricarinate main spines  
in one plane cross-like arranged. One spine longer than the  
other 3 and displaying distinct torsion. Other spines short  
to moderately long, stout, without torsion, in near related  
forms with slight torsion. Medullary shell latticed. Central  
spicular system fragile, consisting of a median bar with 3  
spines on both ends.

**Dimensions:**

Diameter of cortical shell = 100–130 µm

Length of the longest spine = 80–100 µm

Length of the other spines = 40–60 µm

**Occurrence:** Frequent in the Illyrian of Balaton Highland,  
Hungary.

**Remarks:** In the Lower Ladinian *Tiborella magnidenta-*  
*ta* DUMITRICĂ, KOZUR & MOSTLER, 1980 all spines  
have the same strong torsion and there are distinct nodes on  
the joints of the outer pore frames.

The holotype of *Tiborella florida* (NAKASEKO &  
NISHIMURA, 1979) from the Lower Fassinian of Japan

displays in the longer spine the same slight torsion than in  
the shorter spines. Moreover, the outer pore frames weak-  
en considerably on the solid equatorial ring that connect  
the spines. This ring is therefore in upper view well visible.  
The latter is also the case in the paratype that is otherwise  
more similar to *Tiborella anisica* n. sp.. It is here deter-  
mined as *Tiborella* cf. *florida* (NAKASEKO & NISHI-  
MURA, 1979). Its age is probably Illyrian (it has derived  
from sample 1707-2; the sample 1707-1 is Illyrian)

***Tiborella florida tortilis* n. subsp.  
(Pl. 6, figs. 2, 4)**

**Derivatio nominis:** According to stronger torsion of the 4  
spines compared with *T. florida* (NAKASEKO & NISHI-  
MURA)

**Holotypus:** The specimen on pl. 6, figs. 2, 4; rep.-no. Ko-  
Mo 1980 I-609.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vin-  
centinian Alps, Italy)

**Stratum typicum:** Sample TT 13, upper subzone of Mid-  
dle Fassinian *Ladinocampe multiperforata* Zone

**Material:** 4 specimens.

**Diagnosis:** Cortical shell in upper view subquadratic, with  
4 strong, tricarinate spines in the corners, situated in one  
plane. The distal half of the spines displays strong torsion,  
the proximal half (or a little shorter part) displays no tor-  
sion. One spine is distinctly longer than the other three  
ones. Outer pore frame of the cortical shell penta- to hep-  
tagonal, very high, coarse, thickened at the joints. The pore  
frames become low on the equatorial ring (that connects  
the spines) and contain here only radial elements. There-  
fore the ring is well visible in upper and lower view. Outer  
pores very large, mostly oval. Inner pore frames very  
delicate, mostly broken away, with small pores.

Medullary shell latticed. Inner structure not ob-  
served.

**Dimensions:**

Diameter of cortical shell = 127–135 µm

Length of longest spine = 127–131 µm

Length of other 3 spines = 88–96 µm

**Occurrence:** Higher part of middle Fassinian *Ladino-*  
*campe multiperforata* Zone. Italy.

**Remarks:** *Tiborella florida florida* (NAKASEKO &  
NISHIMURA, 1979) from the Lower Fassinian of Japan  
and Philippines (= *Tiborella* sp. sensu CHENG, 1989) dis-  
plays only a slight torsion of the spines and has fewer pores  
on the cortical shell.

*Tiborella magnidentata* DUMITRICĂ, KOZUR & MOSTLER, 1980 from the upper subzone of the Lower Fassanian *S. italicus* Zone displays still stronger torsion of the spines and the untwisted proximal part of the spines is shorter. The outer pore frames totally overgrow the equatorial ring between the spines that is therefore not visible in upper view that shows a roundish equatorial outline.

**Superfamily Sponguracea** HAECKEL, 1862  
emend. KOZUR & MOSTLER, 1981

**Family Archaeospongoprunicidae** PESSAGNO, 1973  
emend. KOZUR & MOSTLER, 1981

**Genus Archaeospongoprunum** PESSAGNO, 1973  
emend. KOZUR & MOSTLER, 1981

**Type species:** *Archaeospongoprunum venadoense*  
PESSAGNO, 1973

*Archaeospongoprunum bispinosum*  
KOZUR & MOSTLER, 1981  
(Pl. 7, figs. 1–2)

1981 *Archaeospongoprunum bispinosum* n. sp. – KOZUR & MOSTLER, pp. 41–42, pl. 43, fig. 2

**Occurrence:** *Paraceratites trinodosus* Zone (Illyrian) of Balaton Highland.

*Archaeospongoprunum brevispinosum* n. sp.  
(Pl. 7, fig. 5)

**Derivatio nominis:** According to the short spines

**Holotypus:** The specimen on pl. 7, fig. 5; rep.-no. KoMo 1980 I-89

**Locus typicus:** Felsöörs (Balaton, Highland, Hungary), Forráshegy section

**Stratum typicum:** Limestone bed 110 about 3 m below the upper boundary of the pietra verde, uppermost part of the '*Xenoprotrachyceras*' *reitzei* Oppel Zone above the range of *X. reitzei*. Upper part of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 3 specimens.

**Diagnosis:** Shell asymmetrically spindle-shaped consisting of several layers of a fine-spongy meshwork. Axial spines on a somewhat arched axis broad; one is moderately long, the opposite one short. Periaxial spine (situated under acute angle to the short of the axial spines) likewise broad,

short. All spines are tricarinate.

**Dimensions:**

Length of outer shell = 221–230  $\mu\text{m}$

Maximum width of outer shell = 106–115  $\mu\text{m}$

Length of short spines = 52–58  $\mu\text{m}$

**Occurrence:** Upper part of '*Xenoprotrachyceras*' *reitzei* Oppel Zone somewhat above the last occurrence of "*X. reitzei*". Balaton Highland, Hungary.

**Remarks:** In the similar Illyrian *Archaeospongoprunum bispinosum* KOZUR & MOSTLER, 1981 also the 2 spines that enclose an acute angle are large, even if they are generally somewhat shorter than the opposite axial spine.

*Archaeospongoprunum mesotriassicum*  
*mesotriassicum* KOZUR & MOSTLER, 1981  
(Pl. 7, fig. 3)

1981 *Archaeospongoprunum mesotriassicum mesotriassicum* n.sp. – KOZUR & MOSTLER, p. 41, pl. 42, fig. 4

**Occurrence:** *Paraceratites trinodosus* Zone (Illyrian) of Balaton Highland (Hungary).

*Archaeospongoprunum mesotriassicum*  
*asymmetricum*  
KOZUR & MOSTLER, 1981  
(Pl. 7, fig. 4)

1981 *Archaeospongoprunum mesotriassicum asymmetricum* n. subsp. – KOZUR & MOSTLER, p. 41, pl. 42, fig. 3

**Occurrence:** *Paraceratites trinodosus* Zone (Illyrian) of Balaton Highland (Hungary).

*Archaeospongoprunum tetraspinosum* n. sp.  
(Pl. 7, fig. 6)

**Derivatio nominis:** According to the 4 spines.

**Holotypus:** The specimen on pl. 7, fig. 6; rep.-no. KoMo 1980 I-93.

**Locus typicus:** Felsöörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian)

**Material:** 9 specimens.

**Diagnosis:** Spongy shell, in lateral view with wedge-shaped equatorial outline, consisting of several layers of dense spongy network.

Axis of the 2 polar spines slightly arched. Third spine (lateral spine) nearly perpendicular to one of the polar spines and more oblique to the other one. The 2 polar spines and the lateral spine have about the same size. They are tricarinate, in the proximal part the ridges are subdivided by a central furrow.

The fourth spine is also tricarinate, but somewhat smaller and the ridges are not subdivided by a central furrow. This spine lies on the opposite side of the lateral spine near to one of the polar spines to which it runs under small acute angle.

**Measurements:**

Length of the shell (in direction of the polar axis) = 149–158  $\mu\text{m}$

Width of the shell (in direction of the lateral spine) = 100–115  $\mu\text{m}$

Length of polar and lateral spines = 81–100  $\mu\text{m}$

Length of the fourth spine = 75–79  $\mu\text{m}$

**Occurrence:** *Paraceratites trinodosus* Zone (Illyrian) of Balaton Highland (Hungary).

**Remarks:** The Illyrian *Archaeospongoprimum bispinosum* KOZUR & MOSTLER, 1981 has no mid-lateral spine and an asymmetric spindle shape test.

The Illyrian *Archaeospongoprimum trispinosum* n. sp. has a mid-lateral spine, but no side-spine near to the polar spine.

***Archaeospongoprimum trispinosum* n. sp.**

(Pl. 7, figs. 7, 8)

**Derivatio nominis:** According to the 3 main spines.

**Holotypus:** The specimen on pl. 7, fig. 7; rep.-no. KoMo 1980 I-91.

**Locus typicus:** Felsőörs (Balaton Highland), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** 32 specimens.

**Diagnosis:** Shell densely spongy, consisting of several concentric layers. Equatorial outline rounded subtriangular, rounded part opposite to the lateral spine. 2 polar spines and a third spine, perpendicular or nearly perpendicular to the polar spines, are present. All spines have about the same size, are tricarinate, often slightly twisted. Ridges

mostly with central furrow. Furrows between the ridges deep, in the proximal half crossed by bars that connect adjacent ridges.

**Dimensions:**

Length of shell (in direction of polar spines) = 110–173  $\mu\text{m}$

Width of shell (in direction of lateral) shell = 90–123  $\mu\text{m}$

Length of spines = 80–100  $\mu\text{m}$

**Occurrence:** *Paraceratites trinodosus* Zone (Illyrian) of Balaton Highland, Hungary.

**Remarks:** In *Archaeospongoprimum bispinosum* KOZUR & MOSTLER, 1981 the third spine lies in small acute angle to the polar spines, sometimes almost parallel to them. The shell is asymmetrically spindle shaped.

In the Illyrian *Archaeospongoprimum tetrspinosum* n. sp. additionally to the third spine of similar position as in *A. trispinosum* n. sp. on the opposite side a spine under acute angle to the polar axis is present.

**Subfamily Tamonellinae**

**KOZUR & MOSTLER, 1981**

**Genus *Tamonella* DUMITRICĂ,**

**KOZUR & MOSTLER, 1980**

**Type species:** *Tamonella multispinosa* DUMITRICĂ, KOZUR & MOSTLER, 1980

***Tamonella rarispinosa* n. sp.**

(Pl. 7, fig. 9)

**Derivatio nominis:** According to the few spines, present only on one polar region.

**Holotypus:** The specimen on pl. 7, fig. 9; rep.-no. KoMo 1980 I-325.

**Locus typicus:** Passo della Gabiola section, Vicentinian Alps (Italy).

**Stratum typicum:** Sample MD 22, Upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 34 specimens.

**Diagnosis:** Shell elongated-ellipsoidal, consisting of numerous spongy shells around a microsphere. The 4–7 spines are carinate and all concentrated around one pole. Opposite polar region without spines.

**Dimensions:**

Long axis of shell = 290–311  $\mu\text{m}$

Short axis of shell = 173–180  $\mu\text{m}$

Length of spines = 8–31  $\mu\text{m}$

**Occurrence:** Upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Remarks:** *Tamonella multispinosa* DUMITRICĂ, KOZUR & MOSTLER, 1981 from the highest Lower Fassanian displays numerous spines in the polar regions of both poles.

#### Family Gomberellidae KOZUR & MOSTLER, 1981

**Remarks:** This family was originally placed as subfamily into the Oertlispongidae KOZUR & MOSTLER, 1980. The genus *Katorella* KOZUR & MOSTLER, 1981 is related to this family in its original wide scope. However, the genus *Gomberellus* DUMITRICA, KOZUR & MOSTLER, 1980 with carinate main spines, arranged around one pole, is the forerunner of the genus *Karnospongella* KOZUR & MOSTLER, 1981 that was placed into the Archaeospongopruidae by KOZUR & MOSTLER, 1981.

Both *Gomberellus* and *Karnospongella* are nearer related to the Archaeospongopruidae PESSAGNO, 1973 than to the Oertlispongidae KOZUR & MOSTLER, 1980. By the arrangement of the polar spines the Gomberellidae are distinctly different from the Archaeospongopruidae. They are here regarded as independent family.

#### Genus *Gomberellus* DUMITRICĂ, KOZUR & MOSTLER, 1981

**Type species:** *Gomberellus hircicornus* DUMITRICĂ, KOZUR & MOSTLER, 1980

**Remarks:** New material has shown that *Gomberellus* comprises forms with one, two or three main spines with twisted ridges around one pole. Forms without twisted spines are placed into *Praegomberellus* n. gen.

The genus *Karnospongella* KOZUR & MOSTLER, 1981 has evolved from *Gomberellus* species with two twisted main spines by lost of the by-spines.

#### *Gomberellus hircicornus* DUMITRICĂ, KOZUR & MOSTLER, 1980 (Pl. 7, figs. 12–14)

1980 *Gomberellus hircicornus* n. gen. n. sp. – DUMITRICĂ, KOZUR & MOSTLER, pl. 10, fig. 6; pl. 14, fig. 3.

**Occurrence:** upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone of Hungary, Italy and Yugoslavia.

**Remarks:** The two main spines with twisted ridges are basally connected with ridges.

#### *Gomberellus fissus* n. sp. (Pl. 8, figs. 8–10)

**Derivatio nominis:** According to the side-branches on two of the 3 main spines.

**Holotypus:** The specimen on pl. 8, figs. 8–10; rep.-no. Ko-Mo 1980 I-296.

**Locus typicus:** Passo della Gabiola (Vicentinian Alps, Italy).

**Stratum typicum:** Sample MD 9, middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 3 specimens.

**Diagnosis:** Shell slightly ellipsoidal, spongy. At one pole area 3 tricarinate, robust main spines are present. At the base the ridges are subdivided by a central furrow. From two main spines one or two side spines branch off (from one or two ridges) that are also carinate. The ridges of the main spines are only a little twisted or even straight.

On the opposite polar area 1–3 slender, often long, basally tricarinate, distally round spines are present.

#### **Dimensions:**

Long axis of shell = 163–175 µm

Short axis of shell = 150–159 µm

Length of the main spines = 105–120 µm

Maximum length of the spines around the opposite pole = 148 µm

**Occurrence:** Middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Remarks:** In the Lower to Middle Fassanian *Gomberellus trispinosus* n. sp. the 3 main spines are strongly twisted and undivided.

#### *Gomberellus longobardicus* n. sp. (Pl. 7, fig. 10; pl. 8, figs. 1, 3, 6)

**Derivatio nominis:** According to the occurrence in the Longobardian.

**Holotypus:** The specimen on pl. 8, fig. 6; rep.-no. CK 1 88 VII-65.

**Locus typicus:** Köveskál (Balaton Highland, Hungary), section at the cemetery.

**Stratum typicum:** Sample 7/29/12/87, Middle Longobardian *Budurovignathus mungoensis* A.Z.

**Material:** 53 specimens.

**Diagnosis:** Shell globular, spongy. Only one polar spine present. In 3 ridges are twisted and subdivided by a distinct central furrow that is considerably shallower than the furrows between the ridges. Other 7–9 spines tricarinate, distally round, long and proximally rather robust.

**Measurements:**

Diameter of shell = 130–148  $\mu\text{m}$

Length of main spine (polar spine) = 94–140  $\mu\text{m}$

Length of other spines = 60–120  $\mu\text{m}$

**Occurrence:** Longobardian of Köveskál (Hungary).

**Remarks:** In the Lower Fassanian *Gomberellus unispinosus* n.sp. the shell is more elongated and the spines are concentrated to both pole areas.

***Gomberellus trispinosus* n.sp.**

(Pl. 8, figs. 2, 4, 5, 7)

**Derivatio nominis:** According to the 3 twisted main spines at one pole

**Holotypus:** The specimen no pl. 8, figs. 4, 5, 7; rep.-no. KoMo 1980 I-300

**Locus typicus:** Passo della Gabiola section, Vicentian Alps (Italy).

**Stratum typicum:** Sample MD 11, middle subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 31 specimens.

**Diagnosis:** Shell ellipsoidal, spongy. 3 twisted, tricarinate, robust main spines with strong, rounded ridges are situated at one pole. Near the opposite pole 2–4 robust or needle-like spines are present. A further additional spine may be present in the equatorial region.

**Dimensions:** See under the subspecies.

**Occurrence:** Middle subzone of the Lower Fassanian *Spongosilicarmiger italicus*-Zone up to Middle Fassanian *Ladinocampe multiperforata* Zone of European Tethys.

**Remarks:** In *Gomberellus fissus* n. sp. one or two main spines are branched.

***Gomberellus trispinosus trispinosus* n. subsp.**

(Pl. 8, figs. 4, 5, 7)

**Holotypus, locus typicus and stratum typicum:** as for the species.

**Material:** 25 specimens.

**Diagnosis:** As for the species. The 3 main spines are widely separated, the 2–4 spines at the opposite side are robust and tricarinate. No additional spines are present.

**Dimensions:**

Long axis of the shell = 165–200  $\mu\text{m}$

Short axis of the shell = 140–165  $\mu\text{m}$

Length of the main spines = 100–120  $\mu\text{m}$

Length of spines on the opposite polar area = 80–100  $\mu\text{m}$

**Occurrence:** Middle and upper, probably not uppermost Lower Fassanian *Spongosilicarmiger italicus* Zone of the Southern Alps.

**Remarks:** *Gomberellus trispinosus posterus* displays slender, to a longer part roundish spines on the lower pole. The main spines are closely spaced.

***Gomberellus trispinosus posterus* n. subsp.**

(Pl. 8, fig. 2)

**Derivatio nominis:** successor of *Gomberellus trispinosus trispinosus*.

**Holotypus:** The specimen on pl. 8, fig. 2; rep.-no. KoMo 1980 I-731.

**Locus typicus:** Road cut San Ulderico-Pallé, Vicentian Alps (Italy).

**Stratum typicum:** Sample TT 7, upper subzone of Middle Fassanian *Ladinocampe multiperforatus* Zone.

**Material:** 6 specimens.

**Diagnosis:** With the character of the genus. The 3 main spines are densely spaced around the upper pole. In the equatorial area one or two additional tricarinate spines are present.

**Measurements:**

Long axis of shell = 179–193  $\mu\text{m}$

Short axis of shell = 144–149  $\mu\text{m}$

Length of main spines from the upper polar area = 98–113  $\mu\text{m}$

Length of spines on the lower polar area = 74–78  $\mu\text{m}$

**Occurrence:** Upper subzone of Middle Fassanian *Ladinocampe multiperforata* zone. Southern Alps.

**Remarks:** *Gomberellus trispinosus trispinosus* n. subsp. from the middle and upper part of Lower Fassanian has no spines in the equatorial area. Moreover, the main spines around the upper pole are wider spaced.

***Gomberellus unispinosus* n. sp.**

(Pl. 7, fig. 11)

**Derivatio nominis:** According to the single stout main spine

**Holotypus:** The specimen on pl. 7, fig. 11; rep.-no. KoMo 1980.

**Locus typicus:** Section at the road between Mte. Spitz and Mte. Fallison, Vicentinian Alps (Italy).

**Stratum typicum:** Sample FD 6, Fassanian.

**Material:** 4 specimens.

**Diagnosis:** Shell ellipsoidal, spongy. Single main polar spine at the upper pole stout, tricarinate, twisted. The high ridges are in their proximal part subdivided by a basally deep, then shallow median furrow. Opposite pole with 3-4 tricarinate, distally needle-like, round spines. Their proximal part is rather broad.

**Dimensions:**

Long axis of shell = 142–148  $\mu\text{m}$

Short axis of shell = 115–119  $\mu\text{m}$

Length of the main polar spine = 100–112  $\mu\text{m}$

Length of the opposite spines = 45–62  $\mu\text{m}$

**Occurrence:** Fassanian of the locus typicus.

**Remarks:** The other *Gombarrellus* species with a single main spine, the Longobardian *G. longobardicus* n.sp. is clearly distinguished by the distribution of the spines that are not concentrated to the polar areas. Moreover, the spongy meshwork is considerably coarser.

**Genus *Karnospongella* KOZUR & MOSTLER, 1981**

**Type species:** *Karnospongella bispinosa* KOZUR & MOSTLER, 1981

**Remarks:** GORIČAN (1990) placed *Karnospongella* KOZUR & MOSTLER (1981) into synonymy of *Gombarrellus* DUMITRICĂ, KOZUR & MOSTLER, 1980. She pointed out, that both genera display two twisted main spines at the upper pole and some additional spines at the lower pole. However, this view is only based on the comparison of *Gombarrellus hircicornus* DUMITRICĂ, KOZUR & MOSTLER, 1980 and *Karnospongella trispinosa* LAHM, 1984 erroneously determined as *Gombarrellus bispinosus* (KOZUR & MOSTLER) by GORIČAN (1990). *Karnispongella bispinosa* KOZUR & MOSTLER, the type species of *Karnospongella*, displays no spines on the lower pole. Typical Carnian *Karnospongella* display a subcylindrical or very elongated subellipsoidal shell, 2 strongly twisted main spines on the upper pole and no or

few needle-like spines around the lower pole, were is an area with loose spongy shell or even a pylom-like opening.

Typical Fassanian *Gomberellus* have an ellipsoidal to slightly elongated subglobular shell and 1-3 slightly to moderately twisted main spines. The spines around the lower pole are either robust or needle-like, but in the latter case always with broader, tricarinate base, never present in these spines (if present) in *Karnospongella*.

Transitional forms between both genera are known from the upper part of Lower Fassanian up to the upper Fassanian. In these forms the 2 main spines are only a little to moderately twisted and the shell is ellipsoidal. Needle-like spines on the lower polar area may be present or missing.

Regarding all known *Gomberellus* species this genus is clearly distinct from *Karnospongella* and transitional forms occur in stratigraphic order. Below the upper subzone of Lower Fassanian *S. italicus* Zone *Gomberellus* is well documented, but *Karnospongella* is missing. In the Carnian *Karnospongella* is frequent, but *Gombarrellus* is missing. In the Longobardian *Gomberellus* is only represented by one species with one main spine on the upper pole, different from the contemporaneous *Karnospongella* species with a subcylindrical shell.

***Karnospongella transita* n.sp.**

(Pl. 9, figs. 1–2)

**Derivatio nominis:** According to the transitional character between the genera *Gomberellus* DUMITRICĂ, KOZUR & MOSTLER and *Karnospongella* KOZUR & MOSTLER.

**Holotypus:** The specimen on pl. 9, fig. 1; rep.-no. KoMo 1980 I-263

**Locus typicus:** Road cut San Ulderico-Pallé, Vicentinian Alps (Italy).

**Stratum typicum:** Sample TT 7, lower subzone of Middle Fassanian, *Ladinocampe multiperforata* Zone.

**Material:** 17 specimens.

**Diagnosis:** Shell ellipsoidal, spongy, at the lower pole often somewhat looser meshwork than in the remaining shell. The 2 main spines at the upper pole are stout, tricarinate, slightly to moderately strongly twisted. Terminal a needle-like spine is present. Lower pole without spines.

**Dimensions:**

Long axis of shell = 154–166  $\mu\text{m}$

Short axis of shell = 112–134  $\mu\text{m}$

Length of polar spines = 96–100  $\mu\text{m}$

**Occurrence:** Upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone to lower subzone of the *Ladinocampe multiperforata* Zone.

**Remarks:** Most primitive *Karnospongella* species. The higher evolved *Karnospongella* species from the Longobardian and Carnian display a very elongated ellipsoidal or subcylindrical shell and the main spines are stronger twisted.

*Gomberellus* species with 2 main spines display a few elongated shell with distinct spines around the lower pole.

### Genus *Kulacella* KOZUR & MOSTLER, 1981

**Type species:** *Kulacella recoaroensis* KOZUR & MOSTLER, 1981

**Remarks:** The type species with a subcylindrical shell, 3 polar spines and few needle-shaped spines on the opposite pole is near related to the Gomberellidae. However, *Paurinella* ? *longispinosa* n. sp. with subglobular shell and 3 main spines situated somewhat below the equator is also very similar to *Kulacella*. Maybe that *Kulacella* is an aberrant representative of the Intermediellidae LAHM, 1984 that display a similar shell structure, round main spines, but their main spines are arranged in the equatorial plane. Only in *Katorella* KOZUR & MOSTLER, 1981 the spines are irregularly distributed on the whole shell surface.

*Paurinella* ? *longispinosa* n. sp. is seemingly a transitional form between *Paurinella* KOZUR & MOSTLER, 1981 (typical Intermediellidae) and *Kulacella* KOZUR & MOSTLER, 1981.

### *Kulacella recoaroensis* KOZUR & MOSTLER, 1981

(Pl. 9, fig. 3)

1981 *Kulacella recoaroensis* n. gen. n. sp. - KOZUR & MOSTLER, p. 45, pl. 43, fig. 3.

**Occurrence:** Rare species from the upper subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone of Southern Italy.

### Genus *Praegomberellus* n. gen.

**Type species:** *Praegomberellus pulcher* n. gen. n. sp.

**Diagnosis:** Subglobular spongy shell. Spines large, tricarinate. 3 spines are closely spaced around one pole. The other 5–8 spines are irregularly distributed on the shell, but mostly on the opposite pole one or two spines are located.

**Occurrence:** Illyrian (*Paraceratites trinodosus*-Zone up the Lower Fassanian).

**Assigned species:**

*Pragomberellus pulcher* n. gen. n. sp.

*Gomberellus mocki* DUMITRICA, KOZUR & MOSTLER, 1981

**Remarks:** Most primitive representative of the Gomberellidae KOZUR & MOSTLER, 1981. The position of the 3 closely spaced spines near one pole remembers already to *Gomberellus* DUMITRICA, KOZUR & MOSTLER, 1981, but these spines are not separated in size and form from the other spines, like in *Gomberellus*. Moreover, the shell is still subglobular and not ellipsoidal.

### *Praegomberellus pulcher* n. gen. n. sp.

(Pl. 9, figs. 6, 8)

**Derivatio nominis:** pulcher (lat.) according to the nice shape

**Holotypus:** The specimen on pl. 9, fig. 8; rep.-no. KoMo 1980 I-128.

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Bed 87, Illyrian (*Paraceratites trinodosus* Zone).

**Material:** 37 specimens.

**Diagnosis:** Shell subglobular to globular, spongy. Spines large, tricarinate. 3 spines closely spaced around one pole. On the opposite pole a spine may be present. The other 6–8 spines are irregularly distributed. All spines have about the same size, but the three spines around the pole are mostly somewhat smaller or more slender.

**Dimensions:**

Diameter of shell = 140–148  $\mu\text{m}$

Length of spines = 100–144  $\mu\text{m}$

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone) of Hungary.

**Remarks:** The Lower Fassanian *Praegomberellus mocki* (DUMITRICĂ, KOZUR & MOSTLER, 1981) displays on one pole 2 bifurcated or 4 closely spaced spines, on the other side a bunch of 3–4, rarely 5 spines. Except these spines mostly only 2 additional spines are present.



**Family Oertlispongidae**  
**KOZUR & MOSTLER, 1980**  
**Genus *Oertlisponcus* DUMITRICĂ,**  
**KOZUR & MOSTLER, 1980**

**Type species:** *Oertlisponcus inaequispinosus* DUMITRICĂ, KOZUR & MOSTLER 1980

**Remarks:** LAHM (1984, p. 47) pointed out: "Nach der Definition von DUMITRICĂ, KOZUR & MOSTLER (1980) ist bei der Gattung *Oertlisponcus* nur einer der beiden Polarstacheln gebogen, somit muß *Oertlisponcus cornubovis* in eine neue Gattung gestellt werden." However, *O. cornubovis* DUMITRICĂ, KOZUR & MOSTLER, 1980 is one of the two originally included species of the genus *Oertlisponcus*. Therefore it is impossible that according to the original definition only such forms were included into *Oertlisponcus*, in which only one spine is curved. DUMITRICĂ, KOZUR & MOSTLER (1980, p. 5) wrote in the original diagnosis of *Oertlisponcus*: 'At least one of these spines is characteristically bended'. Even in the type species of *Oertlisponcus*, *O. inaequispinosus*, the thinner second polar spine is sometimes curved. Also in *Oertlisponcus longispinosus* n. sp. specimens with straight and curved second polar spine are present.

***Oertlisponcus inaequispinosus* DUMITRICĂ,**  
**KOZUR & MOSTLER, 1980**

(Pl. 10, figs. 1-4, ? 5, 6, 7, 11, 13;  
 pl. 11, figs. 2, 6, 7, 9, ? 11; pl. 47, figs. 6, 7)

**Occurrence:** See under the subspecies.

**Remarks:** This species with 4 subspecies is highly variable, but the straight part of the first (main) polar spine is always shorter than the diameter of the shell.

***Oertlisponcus inaequispinosus inaequispinosus***  
**DUMITRICĂ, KOZUR & MOSTLER, 1980**

(Pl. 10, figs. 1, 4, 7, 13, pl. 47, fig. 6)

1980 *Oertlisponcus inaequispinosus* n. gen. n. sp. – DUMITRICĂ, KOZUR & MOSTLER, p. 5, pl. 10, fig. 7

**Occurrence:** Upper part of upper subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone and Middle Fassanian *Ladinocampe multiperforata* Zone. World-wide.

**Remarks:** The three to numerous by-spines are mostly arranged in a bunch that is situated in different positions from the equator to near the second polar spine. The by-spines are mostly restricted to those side of the lower shell hemisphere, where the bunch is present, rarely also on the other side a single by-spine is present. One spine of the by-spine bunch, mostly situated at the upper margin of the bunch may be considerably larger than the other by-spines, but also this spine is considerably thinner and shorter than the second polar spine.

The second polar spine is considerably thinner than the first (main) polar spine, needle-like and very long. Mostly it is situated in the axis of the main polar spine, but sometimes also obliquely to this axis. The second polar spine is mostly straight but in some specimens distally distinctly curved.

The recurvation of the main polar spine is always strong; its distal end lies at least in the level of the lower shell hemisphere, but mostly below the shell level.

In *Oertlisponcus primitivus* n. sp. the long, straight part of the main polar spine is at least as long as the diameter of the shell, mostly even longer.

Differences to the other subspecies see there.

***Oertlisponcus inaequispinosus longispinosus* n. subsp.**  
 (Pl. 10, figs. ? 5, 11; pl. 11, figs. 2, 6, ? 7, ? 11)

**Derivatio nominis:** According to the one-two long by-spines.

**Holotypus:** The specimen on pl. 10, fig. 11; rep.-no. Ko-Mo 1980 I-397.

**Locus typicus:** Passo della Gabiola, Vicentinian Alps.

**Stratum typicum:** Sample MD 18, middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 19 specimens.

**Diagnosis:** Shell globular to subglobular, spongy, consisting of several (mostly 7-9) layers with small pores. Microsphere very small. Straight proximal part of first (main) polar spine shorter than diameter of shell. The distal end of the first polar spine lies above, below or in the level of the shell. A subhorizontal, slightly curved middle part of the main polar spine is not present. Second polar spine thin, needle-shaped, straight. It is situated in the lower hemisphere, but not always opposite to the main polar spine. Mostly two by-spines (rarely one by-spine) needle-shaped, mostly as large as the second polar spine, situated on one side of the lower hemisphere. If two by-spines are present, mostly one is situated near to the equator, the other one near to the second polar spine.

**Measurements:**

Diameter of shell = 120–167  $\mu\text{m}$

Length of straight proximal part of main polar spine = 65–116  $\mu\text{m}$

Length of second polar spine = 169–342  $\mu\text{m}$

Length of by-spines = 165–285  $\mu\text{m}$

**Occurrences:** Middle subzone and lower part of upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone. Southern Alps.

**Remarks:** *Oertlispongos inaequispinosus longispinosus* n. subsp. belongs to the main line of *Oertlispongos*: *O. primitivus* n. sp. - *O. inaequispinosus longispinosus* - *O. inaequispinosus tumidospinosus* n. subsp. with only one or two, but mostly rather strong by-spines. In *O. primitivus* n. sp. the proximal straight part of the main polar spine is as long as, mostly longer than the shell diameter. *O. inaequispinosus tumidospinosus* n. subsp. is distinguished by a very short tumid straight proximal-part of the main polar spine.

*Oertlispongos inaequispinosus inaequispinosus* DUMITRICĂ, KOZUR & MOSTLER, 1980 is distinguished by the presence of three to numerous by-spines, arranged in a bunch. Those by-spines are small, needle-like, but one of them is mostly larger. However, also this larger by-spine is by far thinner and shorter than the second polar spine and it lies at the (mostly upper) margin of a bunch of smaller spines.

Although *O. inaequispinosus inaequispinosus* and *O. inaequispinosus longispinosus* occur both in the upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone, they have not been found together in one profil or even in one sample. *O. inaequispinosus inaequispinosus* is known from Val di Creme (single sample VCB, not from a profil) and from red modular limestone immediately above the Pietra Verde in the San Ulderico section. From this section no further radiolarian-bearing samples have been investigated. Both samples with *O. inaequispinosus inaequispinosus* have yielded the same radiolarian fauna that can be placed into the upper subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone.

In the Passo della Gabiola section the lowermost sample (MD 1) is characterized by rich occurrence of *Oertlispongos primitivus* n. sp. together with radiolarians from the middle subzone of the Lower Fassanian *S. italicus* Zone that is clearly older than the fauna with *O. inaequispinosus inaequispinosus*. Then a 3 m thick interval follows that has not yielded *Oertlispongos*. In the upper part of the section from samples MD18 to MD25 *Oertlispongos inaequispinosus longispinosus* n. sp. is present. This part belongs to the upper part of the middle and to the

upper subzone of *Spongosilicarmiger italicus* Zone. Only 25 cm higher, in sample MD27, *O. inaequispinosus tumidospinosus* begins. This level belongs to the topmost *Spongosilicarmiger italicus* Zone. Transitional forms between *O. inaequispinosus longispinosus* and *O. inaequispinosus inaequispinosus* occur above all in the upper part of the *Spongosilicarmiger italicus* Zone. The characteristic tripartite subdivision of the main polar spine into a short straight proximal part, a subhorizontal middle part of different length and a slightly curved, backward directed distal part is present in the most specimens of *O. inaequispinosus inaequispinosus* and in all specimens of *O. inaequispinosus tumidospinosus* n. subsp., but not yet in *O. inaequispinosus longispinosus*.

***Oertlispongos inaequispinosus tumidospinosus* n. sp.**  
(Pl. 10, fig. 6; pl. 11, fig. 9)

**Derivatio nominis:** According to the tumid straight proximal part of the main polar spine.

**Holotypus:** The specimen on pl. 10, fig. 6; rep.-no. KoMo 1980 I-390.

**Locus typicus:** Passo della Gabiola, Vicentinian Alps.

**Stratum typicum:** Sample MD 27, uppermost part of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 6 specimens.

**Diagnosis:** Shell globular, spongy, consisting of several (mostly 6–7) layers with small pores. Straight part of main polar spine very short and tumid. Distal part strongly recurvated. Distal end in the level of lower shell hemisphere or below it. Between the straight proximal part and the backward directed distal part a slightly curved subhorizontal part of various length is present. Second polar spine considerably thinner, needle-like, straight or slightly curved, situated in the axis of main polar spine.

One needle-like, but long by-spine is present, situated in different positions between the equator and the second polar spine.

**Measurements:**

Diameter of shell = 142–157  $\mu\text{m}$

Length of the tumid, straight proximal part of the main polar spine = 55–80  $\mu\text{m}$

Length of the second polar spine = 130–260  $\mu\text{m}$

Length of the by spine = 85–120  $\mu\text{m}$

**Occurrence:** Uppermost part of Lower Fassanian *Spongosilicarmiger italicus* Zone and basal part of Middle Fassanian *Ladinocampe multiperforata* Zone. Southern Alps.

**Remarks:** *Oertlispongos inaequispinosus longispinosus* n. subsp. from the middle and upper subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone has no tumid proximal part of the main polar spine. The subhorizontal middle part of the main polar spine is missing. *Oertlispongos inaequispinosus inaequispinosus* DUMITRICĂ, KOZUR & MOSTLER, 1980 has a bunch of mostly small by-spines and the short, straight proximal part of the main polar spine is not or only a little widened.

***Oertlispongos inaequispinosus unispinosus* n. subsp.**  
(Pl. 10, figs. 2, 3)

**Derivatio nominis:** According the presence of only one polar spine

**Holotypus:** The specimen on pl. 10, fig. 3; rep.-no. KoMo 1980 I-622

**Stratum typicum:** Sample VCB, upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 6 specimens.

**Diagnosis:** Shell globular, spongy, consisting of 7–9 concentrically arranged layers with small pores around a tiny microsphere. Straight proximal part of the main polar spine somewhat shorter than diameter of shell, remaining part strongly recurvated. Second polar spine replaced by several small needle-like by-spines. A bunch of numerous needle-like by-spines is present on one side of the lower hemisphere, in general nearer to the lower pole than to the equator.

**Measurements:**

Diameter of shell = 155–80 µm

Length of straight proximal part of polar spine = 107–115 µm

Maximum length of by-spines = 45–87 µm

**Occurrence:** Upper part of Lower Fassanian *Spongosilicarmiger italicus* Zone. Southern Alps (Italy).

**Remarks:** The replacement of the second polar spine, by several small needle-like spine distinguishes *Oertlispongos inaequispinosus unispinosus* from all other *Oertlispongos*. In all other features the new subspecies is identical with *inaequispinosus* DUMITRICĂ, KOZUR & MOSTLER, 1980.

***Oertlispongos aspinosus* n. sp.**

(Pl. 10, figs. 9, 12; pl. 47, fig. 8)

1982 *Oertlispongos inaequispinosus* DUMITRICĂ, KOZUR et MOSTLER, pars - DUMITRICĂ, p. 64–65, pl. 1, figs. 2, 4 non! figs. 6, 7, 9

**Derivatio nominis:** According to the missing by-spines

**Holotypus:** The specimen on pl. 10, fig. 9; rep.-no. KoMo 1980 I-392B

**Locus typicus:** Passo della Gabiola section, Vicentinian Alps.

**Stratum typicum:** Sample MD 1, middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone

**Material:** 17 specimens.

**Diagnosis:** Shell globular, spongy, consisting of several layers with small pores around a tiny microsphere. Main polar spine hook-like, to scythe-like, with long proximal straight part (longer than or as long as the diameter of shell) and sharply recurvated distal part that ends somewhat above or in the level of the shell. Second polar spine somewhat narrower than main polar spine, long, straight or curved, situated mostly somewhat obliquely to the axis of the main polar spine. By-spines missing or one needle-like, very small by-spine is present.

**Measurements:**

Diameter of shell = 110–135 µm

Length of straight proximal part of main polar spine = 131–160 µm

Length of second polar spine = 305–328 µm

**Occurrence:** Middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone. Southern Alps (Italy) and Northern Calcareous Alps (Austria).

**Remarks:** The long, straight proximal part of the main polar spine (longer than shell diameter) distinguishes this species from *Oertlispongos inaequispinosus* DUMITRICĂ, KOZUR & MOSTLER, 1980 that has, moreover, either a bunch of small by-spines or one to two long by-spines. The second polar spine in this species is more delicate.

Transitional forms to the forerunner of the genus *Oertlispongos* with very long straight part of the main polar spine occur in the lower *S. italicus* Zone. The distal part of the main spine is only slightly curved to slightly recurvated. These most primitive representatives of the genus *Oertlispongos* begin at the base of the *reitzei* Oppel Zone (base of the *Kellnerites* fauna).

***Oertlispongos aspinosus aspinosus* n. subsp.**

(Pl. 10, fig. 9)

**Holotypus:** Holotypus of the species.

**Diagnosis:** With the character of the species. Second polar spine straight.

**Occurrence:** As for the species.

**Remarks:** *Oertlispongos aspinosus curvatus* n. subsp. is distinguished by its distally distinctly curved second polar spine.

***Oertlispongos aspinosus curvatus* n. subsp.**

(Pl. 10, fig. 12)

**Derivatio nominis:** According to the distally curved second polar spine.

**Holotypus:** The specimen on pl. 10, fig. 12; rep.-no. KoMo 1980 I-394

**Locus typicus:** Passo della Gabiola section, Vicentinian Alps.

**Stratum typicum:** Sample MD 1, middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Diagnosis:** With the character of the species. Distal part of second polar spine distinctly curved.

**Occurrence:** Middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone. Southern Alps (Italy).

**Remarks:** *Oertlispongos aspinosus aspinosus* n. subsp. displays a straight second polar spine.

***Oertlispongos bispinosus* n. sp.**

(Pl. 11, fig. 1)

**Derivatio nominis:** According to the two main polar spines.

**Holotypus:** The specimen on pl. 11, fig. 1; rep.-no. KoMo 1980 I-624.

**Locus typicus:** Passo della Gabiola section, Vincentinian Alps.

**Stratum typicum:** Sample MD 1, middle subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone

**Material:** 1 specimen

**Diagnosis:** Shell spherical, spongy, consisting of several layers with small pores. Two main polar spines originate adjacent to each other in one pole region. Their straight part is a little shorter than the shell diameter. The curvature is rather symmetrical, but the recurvation is only

weak. The distal end lies considerably above the shell level. Second polar spine very fragile, not fully preserved, but surely not very long. The by-spine in the lower shell hemisphere has seemingly the same shape and size as the second polar spine, but only the proximal part is preserved.

**Measurements:**

Diameter of shell = 105 µm

Length of the straight proximal part of the two main polar spines = 90 µm and 95 µm

**Occurrence:** Only known from the stratum typicum.

**Remarks:** Only one, but well preserved specimen is present. The possibility of a pathologic form can be therefore not excluded. However, the *Oertlispongos* species from the same sample have all a robust, large second polar spine and the proximal straight part of the main polar spine is shorter than the diameter of shell.

Similar is *Oertlispongos inaequispinosus longispinosus* n. subsp. from the upper subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone, distinguished by the missing second main polar spine and the robuster, mainly two by-spines.

Most similar, perhaps identical, in *Oertlispongos* sp. from the upper subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone. This form is only distinguished by the robuster second polar spine and the missing second main polar spine. The form of the main polar spine is identical, its straight main part is a little longer in *Oertlispongos* sp. The by-spine is in both taxa delicate.

***Oertlispongos primitivus* n.sp.**

(Pl. 11, figs. 4, 10)

**Derivatio nominis:** According to the primitive features for the genus *Oertlispongos*.

**Holotype:** The specimen on pl. 11, fig. 10, rep.-no. KoMo 1980 I-392C.

**Locus typicus:** Passo della Gabiola section, Vincentinian Alps.

**Stratum typicum:** Sample MD 1, middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 11 specimens.

**Diagnosis:** Shell subglobular, spongy, consisting of 6-8 layers with small pores around a microsphere. Main polar spine scythe-like. The long, straight proximal part is longer than or as long as the diameter of shell. Distal part moderately to strongly recurved. The distal end of the main polar spine lies somewhat above to considerably below the shell level. Second polar spine rather robust, large, straight, situ-

ated somewhat obliquely to the axis of the main polar spine. By-spine large, situated in different positions between the equator and the second polar spine. On the opposite hemisphere a second small, needle-like by-spine may be present.

**Measurements:**

Diameter of shell = 125-132  $\mu\text{m}$

Length of the straight proximal part of the main polar spine = 135-154  $\mu\text{m}$

Length of the second polar spine (not fully preserved in any specimen) = more than 200  $\mu\text{m}$

Length of the by-spine = 195-213  $\mu\text{m}$

**Occurrence:** Middle subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone. Southern Alps (Italy).

**Remarks:** The similar *Oertlispongos aspinosus* n. sp. is distinguished by the missing or very small by-spine.

In *Oertlispongos inaequispinosus* DUMITRICĂ, KOZUR & MOSTLER, 1980 the straight proximal part of the main polar spine is shorter than the diameter of the shell.

In the upper subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone very rarely a similar form occurs (*Oertlispongos* sp. pl. 10, fig. 8), in which the main polar spine is distally curved, but not recurved. The by-spine is only small. Only two specimens (one of it well preserved) have been found that represent perhaps a further new species or subspecies.

**Genus *Baumgartneria* DUMITRICĂ, 1982**

**Type species:** *Baumgartneria retrospina* DUMITRICĂ, 1982

***Baumgartneria retrospina* DUMITRICĂ, 1982**

(Pl. 12, figs. 1, 4-6, 8, 9)

1982 *Baumgartneria retrospina* n.sp., pars – DUMITRICĂ, p. 70, pl. 9, figs. 4, 5, 7, 8; non! figs. 3, 6; pl. 10, figs. 1, 2; pl. 12, fig. 3

**Occurrence:** Middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone up to lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone. Hungary, Italy, Yugoslavia.

**Remarks:** Forms with triangular, broad axial spine are here regarded as independent species.

The occurrence in the Longobardian and Tuvalian (because of the occurrence of *Halobia styriaca* really Lower Norian), reported by DUMITRICĂ (1982) cannot be confirmed.

***Baumgartneria retrospina hemicircularis* n. subsp.**

(Pl. 12, fig. 3)

1982 *Baumgartneria retrospina* n. sp., pars – DUMITRICĂ, p. 70, only the specimen on pl. 12, fig. 3.

**Derivatio nominis:** According to the half circle formed by the lateral branches

**Holotypus:** The specimen on pl. 12, fig. 3; rep.-no., KoMo 1980 I-345

**Locus typicum:** Road cut San Ulderico-Palle, Vincentinian Alps

**Stratum typicum:** Sample TT 4, lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 3 specimens.

**Diagnosis:** Shell globular, spongy, consisting of 7-9 layers with small pores around a microsphere. Main polar spine very large. Stem slender, with round cross section, shorter than shell diameter. Axial spine long, needle-shaped. Lateral branches very long, with round cross section, forming a half circle with the shell in the centre. No other spines are present.

**Measurements:**

Diameter of shell = 175-183  $\mu\text{m}$

Length of stem = 117-125  $\mu\text{m}$

Length of axial spine = 180-250  $\mu\text{m}$

Distance between the ends of the lateral branches = 500-525  $\mu\text{m}$

**Occurrence:** Middle Fassanian *Ladinocampe multiperforata* Zone of Southern Alps (Italy) and Eastern Carpathians (Romania).

**Remarks:** *Baumgartneria retrospina retrospina* DUMITRICĂ, 1982 displays always a more or less long, distinct, slightly upward curved or straight inner part of the lateral branches.

*Baumgartneria curvisipina* DUMITRICĂ, 1982 from the Longobardian displays similarly shaped lateral branches, but lacks an axial spine. Moreover, the stem is shorter.

***Baumgartneria bifurcata* DUMITRICĂ, 1982**

(Pl. 13, figs. 3, 5, 6, 10)

1982 *Baumgartneria bifurcata* n. sp. – DUMITRICĂ, p. 71, pl. 10, figs. 3, 4

**Occurrence:** Middle and upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone. Southern Alps and Sosio Valley (Italy), Dinarides (Yugoslavia), Eastern Carpathians (Romania), Balaton Highland and Darnóhegy area (Hungary).

**Remarks:** There are two morphotypes: One with slightly recurved lateral branches of the main polar spine and another one with straight branches, perpendicular to the stem. In our material the first morphotype occurs in the middle and upper subzone, the second morphotype in the upper subzone of Lower Fassanian.

The occurrence of typical *Baumgartneria bifurcata* DUMITRICĂ and *B. retrospina* DUMITRICĂ already in the lower part of the middle subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone indicates that the genus *Baumgartneria* was possibly present already in the lower part of this zone, probably already before the genus *Oertlispongia* DUMITRICĂ, KOZUR & MOSTLER.

***Baumgartneria lata* n. sp.**

1982 *Baumgartneria retrospina* n. sp., pars – DUMITRICĂ, p. 71–72, only the specimens on pl. 9, figs. 3, 6

**Derivatio nominis:** According to the broad, triangular axial spine.

**Holotypus:** The specimen figured by DUMITRICĂ, 1982 on pl. 9, fig. 3.

**Locus typicus:** Eastern end of the klippe of Piatra Zimbru-lui, Rarău Mountain, Eastern Carpathians, Romania.

**Stratum typicum:** Sample R 78/1 (see DUMITRICĂ, 1982, p. 62), grey, micritic cherty limestone, Middle Fassanian *Ladinocampe multiperforata* Zone.

**Diagnosis:** Shell spongy, consisting of 7–10 layers. Main polar spine very robust, somewhat flattened. Stem relatively broad, with oval to roundish oval cross section. Axial spine short, flattened, triangular with broad base. Lateral branches slightly downward curved, distally a little to moderately recurved.

**Measurements:**

Length of stem = 100–147 µm

Length of axial spine = 105–130 µm

Basal width of axial spine = 67–93 µm

**Occurrence:** Middle Fassanian *Ladinocampe multiperforata* Zone. Southern Alps (Italy) and Eastern Carpathians (Romania).

**Remarks:** Only 3 broken specimens are present in our material. Therefore the holotype has been chosen from the well preserved material of this species figured by DUMITRICĂ (1982).

*Baumgartneria retrospina* DUMITRICĂ, 1982 is distinguished by the needle-like axial spine (basal width 20–46 µm, mostly around 30 µm) with roundish cross section. Only in few specimens the axial spine is somewhat flattened. Transitional forms from the higher part of Lower Fassanian displays a somewhat flattened, slender triangular axial spine. These forms display still a distinct, straight or slightly upward curved inner part of the lateral branches.

***Baumgartneria stellata* DUMITRICĂ, 1982**

(Pl. 13, fig. 1)

1982 *Baumgartneria stellata* n. sp. – DUMITRICĂ, p. 72, pl. 10, fig. 5, pl. 11, figs. 1–3.

**Occurrence:** Middle subzone (upper part) of Lower Fassanian *Spongosilicarmiger italicus* Zone up to Lower Longobardian. Italy, Romania. In our material this rare species occurs in the higher part of Lower Fassanian.

***Baumgartneria transita* n. sp.**

(Pl. 13, figs. 2, 9)

**Derivatio nominis:** According to the transitional character between *B. bifurcata* and *B. trifurcata*.

**Holotypus:** The specimen on pl. 13, fig. 9; rep.-no. KoMo 1980 I-331.

**Locus typicus:** Passo della Gabiola section, Vicentinian Alps.

**Stratum typicum:** Sample MD 23, upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

Material: 7 specimens.

**Diagnosis:** Spongy shell displays 7–9 layers. Main polar spine stout, differentiated. Stem robust. Side branches straight, perpendicularly to the spine axis, distally on one side bifurcated, on the other side trifurcated. Axial spine long, needle-shaped.

**Measurements:**

Total length of spine = 300–430 µm

Length of stem = 130–195 µm

Length of axial spine = 133-200  $\mu\text{m}$

Length of side branches = 120-140  $\mu\text{m}$

**Occurrence:** Upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone. Southern Alps (Italy).

**Remarks:** In *Baumgartneria bifurcata* DUMITRICĂ, 1982 both side branches are terminally bifurcated, in *B. trifurcata* DUMITRICĂ, 1982 both side branches are terminally trifurcated.

***Baumgartneria trifurcata* DUMITRICĂ, 1982**

(Pl. 13, fig. 7)

1982 *Baumgartneria trifurcata* n. sp. – DUMITRICĂ p. 71, pl. 10, fig. 6, pl. 11, figs. 4–7.

**Occurrence:** ? Upper part of middle subzone, upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone. CSFR, Hungary, Italy, Romania, Yugoslavia.

**Remarks:** In our material *Baumgartneria trifurcata* DUMITRICĂ begins after *B. bifurcata* DUMITRICĂ that is seemingly the forerunner of *B. trifurcata*. Because of the straight side branches in *B. trifurcata*, this species derived from the morphotype with straight side branches within *B. bifurcata*.

***Baumgartneria yehae* n. sp.**

(Pl. 12, figs. 2, 11)

**Derivatio nominis:** In honour of Dr. Kuei-Yu YEH, Taichung, Taiwan

**Holotypus:** The specimen on pl. 12, fig. 11; rep.-no. Ko-Mo 1980 I-371.

**Locus typicus:** FD section between Mte. Fallison and Mte. Spitz, Vicentinian Alps (Italy).

**Stratum typicum:** Sample FD 17.

**Material:** 8 specimens.

**Diagnosis:** Shell globular, spongy, consisting of several concentric layers around a microsphere. Only one polar spine is present. Its stem is slender, round, moderately long. Lateral branches only a little downward curved, ending above the shell. Axial spine moderately long, slender.

**Dimensions:**

Diameter of shell = 122–29  $\mu\text{m}$

Total length of spine = 200–250  $\mu\text{m}$

Length of stem = 80–116  $\mu\text{m}$

Length of axial spine = 120–131  $\mu\text{m}$

Length of lateral branches = 330–445  $\mu\text{m}$

**Occurrence:** Fassanian, Vicentinian Alps (Italy).

**Remarks:** This species is distinguished by the only slightly recurved lateral branches that end considerably above the shell level.

**Genus *Falcispongos* DUMITRICĂ, 1980**

**Type species:** *Falcispongos falciformis* DUMITRICĂ, 1980

**Remarks:** Already DUMITRICĂ (1982) recognized that common morphogenetic trends can be observed in the genera *Oertlispongos* and *Falcispongos*, especially among the most primitive species *Falcispongos calcaneus*. In our material further phylomorphogenetic trends have been observed that are common in both genera. Stratigraphically older *Oertlispongos* species have a long, straight proximal part (stem) of the main polar spine, as long as or longer than the diameter of shell. Contemporaneous specimens of *Falcispongos calcaneus* DUMITRICĂ, 1982 display the same feature. Stratigraphically younger *Oertlispongos* species display a short stem of the main polar spine, contemporaneous successors of *Falcispongos calcaneus* display also here the same features.

The morphologic differences between *Oertlispongos* and *Falcispongos* are only minimal (development of lateral wings on the main polar spine in *Falcispongos*). In general, this is not a generic feature. However, *Falcispongos* is the first representative of Oertlispongidae with strongly differentiated main polar spines. For this reason we follow here DUMITRICĂ (1982) and regard *Falcispongos* as independent genus.

***Falcispongos falciformis* DUMITRICĂ, 1982**

(Pl. 14, figs. 2, 6, 12)

1982 *Falcispongos falciformis* n. sp., pars – DUMITRICĂ, p. 66, pl. 2, fig. 7; pl. 3, figs. 5, 6, non! pl. 1, fig. 5; pl. 2, figs. 1, 3; pl. 3, figs. 2, 3

**Occurrence:** Middle Fassanian *Ladinocampe multiperforata* Zone of Sosio Valley and Southern Alps (both Italy) and Eastern Carpathians (Romania). First primitive forms begin in the higher part of the upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Remarks:** In the forerunner *Falcispongos praefalciformis* n. sp. from the Lower Fassanian the outer wing widens proximally gradually and tapers distally stronger. Transi-

tional forms, in which the proximal widening and the distal narrowing of the outer wing are of the same degree (sub-hemicircular outline of the outer wing) are here placed into *F. falciformis*.

The Longobardian occurrence of *Falcispongus falciformis* in the Darnóhegy area (Hungary) reported by DE WEVER (1984) cannot be confirmed. DE WEVER figured under this species on pl. 3, fig. 8 a still undescribed new species. In this form half of the subhorizontally to slightly downward curved part of the spine is broad and flattened, whereas this part of the spine is needle-shaped in real *F. falciformis*.

***Falcispongus calcaneus* DUMITRICĂ,  
1982 nom. corr.**

1982 *Falcispongus calcaneus* n. sp., pars – DUMITRICĂ, p. 65–66, pl. 1, fig. 1; pl. 2, figs. 5 (?), 6, non! figs. 2, 4, 8 (?)

**Occurrence:** Middle to upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone. Italy (Southern Alps, Sicily, Lagonegro Basin), Hungary.

**Remarks:** Most primitive forms of the *F. calcaneus* group have a very long, slender stem of the main polar spine that is considerably longer than the shell diameter. The angle between the stem and the slightly recurved distal part of the main polar spine is rather large and the distal end of the main polar spine lies above the level of the shell. This shape of the main polar spine corresponds to *Falcispongus falciformis* DUMITRICĂ, 1982 that is only distinguished by the presence of an narrow inner flattened wing on the main polar spine and by the shorter stem. These primitive forms of the *F. calcaneus* group, here described as *F. prisucs* n. sp. are characteristic for the middle subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone.

Somewhat higher evolved are the holotype and the topotype specimens figured by DUMITRICĂ (1982) from sample Rc4. In these forms the stem of the main polar spine is still slender and long (as long as the shell diameter or a little longer), but the distal part is already strongly recurved and it ends in the level of the shell, mostly below it. These forms occur in the (higher part of) middle subzone and (or) in the lower part of the upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

In the Middle Fassanian *Ladinocampe multiperforata* Zone and in the Upper Fassanian only specimens with short stem of the main polar spine occur in which the recur-

vation is as strong as in the holotype. These forms are here separated from *F. calcaneus* as independent species *F. postcalcaneus* n. sp. The occurrence of *F. calcaneus* in the Longobardian of the Darnóhegy area (DE WEVER, 1984) cannot be confirmed. DE WEVER (1984, pl. 3, fig. 1) figured under this species a badly preserved *F. hamatus* DUMITRICĂ, 1980.

***Falcispongus postcalcaneus* n. sp.  
(Pl. 14, figs. 5, 8, 9)**

1982 *Falcispongus calcaneus* n. sp., pars – DUMITRICĂ, p. 65, pl. 2, figs. 2, 4, 8 (?), non! pl. 1, fig. 1; pl. 2, figs. 5, 6

1990 *Falcispongus calcaneus* DUMITRICĂ, pars – GORIČAN, p. 144–145, pl. 3, figs. 5 (?), 6, non! fig. 4

**Derivatio nominis:** According to the occurrence after *F. calcaneus* DUMITRICĂ.

**Holotypus:** The specimen on pl. 14, fig. 8; rep.-no. KoMo 1980 I-627.

**Locus typicus:** Road cut San Ulderico-Pallé, Vicentinian Alps.

**Stratum typicum:** Sample TT 7, lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 53 specimens.

**Diagnosis:** Shell subglobular, spongy, consisting of 7–10 layers with small pores around a microsphere. Main polar spine with short, relatively broad stem that is somewhat to considerably shorter than the diameter of the shell. Distal part moderately to strongly recurved, its end lies mostly in the level of the shell, rarely immediately above it or below it. Outer wing on the distal part of the stem and on the flexuose part of the main polar spine rounded subtriangular to subhemicircular. A bunch of small needle-like by-spines is situated in the lower hemisphere of the shell, obliquely to the axis of the main polar spine.

**Measurements:**

Diameter of shell = 135–187 µm

Length of stem = 100–144 µm

**Occurrence:** Middle Fassanian *Ladinocampe multiperforata* Zone to Upper Fassanian.

**Remarks:** In the Lower Fassanian *Falcispongus calcaneus* DUMITRICĂ, 1982 the stem is as long as the diameter of shell or longer.

In the Lower to Middle Fassanian *Falcispongus prisucs* n. sp. the stem is longer than the diameter of shell and the distal part of the main polar spine is only a little recurved or horizontally.



***Falcispongus praefalciformis* n. sp.**

(Pl. 14, fig. 1)

1982 *Falcispongus falciformis* n. sp., pars – DUMITRICĂ, p 66, pl. 1, fig. 5; pl. 3, fig. 2, 3, non! pl. 2, figs. 1, 3, 7; pl. 3, figs. 5, 6

**Holotype:** The specimen, figured by DUMITRICĂ (1982) on pl. 3, fig. 3.

**Locus typicus:** 550 m northeast of Monte Anghebe, along the road descending to Recoaro, Vicentinian Alps.

**Stratum typicum:** Sample Rc 4, Buchenstein Formation, middle subzone or lower part of upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 12 specimens.

**Diagnosis:** Shell spongy, consisting of 6–9 layers with small pores. Main polar spine sickle-shaped with wings on both sides along the upper part of the stem and at the beginning of the flexuose portion. Inner wing very narrow, sometimes indistinct. Outer wing widens gradually and slowly in its proximal part and narrows faster in its distal part. Distal part of the spine long, needle-shaped, straight or a little curved, only a little or not backward directed. Angle between the proximal and distal part of the polar spine large, partly about 90°. Several needle-like short by-spines are present, often arranged in a bunch near the pole opposite to main polar spine but they are never situated directly in the axis of the main polar spine. Further very small by-spines may be present, above all near the equator.

**Occurrence:** Middle and upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone of Southern Alps and Sosio Valley (Italy).

**Measurements:**

Diameter of shell = 161–172 µm

Length of stem of main polar spine = 215–253 µm

**Remarks:** In *Falcispongus falciformis* DUMITRICĂ 1982 the proximal widening is stronger and not so gradual than the distal narrowing. In continuation of this development the Upper Fassanian *Falcispongus uncus* GORICAN, 1990 evolved, in which the proximal widening is abrupter.

***Falcispongus priscus* n. sp.**

(Pl. 14, figs. 3, 4, 7, 11)

**Derivatio nominis:** Oldest known representative of the genus *Falcispongus*.

**Holotypus:** The specimen on pl. 14, fig. 3; rep.-no. KoMo 1980 I-625.

**Locus typicus:** Passo della Gabiola section, Vicentinian Alps

**Stratum typicum:** Sample MD 1, middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 34 specimens.

**Diagnosis:** Shell spherical, spongy, consisting of several layers with small pores. Main polar spine with slender, very long stem that is in stratigraphically older forms considerably longer, in stratigraphically younger forms somewhat longer than the shell diameter. Distal part of the main polar spine only slightly or not recurved. It ends considerably above the shell level. Angle between the stem and the distal part of the main polar-spine therefore rather large, partly 90°. On the outer side of the flexuose portion of the spine a rounded triangular to hemicircular flattened wing is present.

Second polar spine missing. A bunch of very small needle-like spines is mostly present, situated in the lower hemisphere of the shell.

**Measurements:**

Diameter of shell = 110–168 µm

Length of stem of the main polar spine = 135–192 µm

**Occurrence:** Middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone to lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone. Southern Alps (Italy), Hungary.

**Remarks:** *Falcispongus calcaneus* DUMITRICĂ, 1982 has a stronger recurved main polar spine that ends in or below the level of the shell. The angle between the proximal and distal parts of the main polar spine is therefore in *F. calcaneus* smaller. Moreover, the stem of the main polar spine is somewhat shorter in this species.

*Falcispongus falciformis* DUMITRICĂ, 1982 displays the same shape of the main polar spine with a similar angle between the proximal and distal part and a similar degree of recurvation. However, the stem of the main polar spine is shorter and also on the inner side of the stem a narrow wing is present.

***Falcispongus transitus* n. sp.**

**Derivatio nominis:** According to the morphological transition between the *F. calcaneus* and *F. falciformis* group

**Holotypus:** The specimen figured by DUMITRICĂ (1982) on pl. 2, fig. 1.

**Locus typicus:** 500 m northeast of Monte Anghebe, along the road descending to Recoaro, Vicentinian Alps.

**Stratum typicum:** Sample Rc 4, Buchenstein Formation, middle subzone or lower part of upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Diagnose:** Shell spongy, consisting of 7–9 layers. Main polar spine sickle-shaped, distal part long, needle-shaped, nearly straight, somewhat downward directed. Distal end somewhat above the shell level. Inner and outer wing developed in the distal parts of the stem and along the flexuose portion of the spine. Inner wing narrow, with concave, in the lower part oblique margin. Outer wing in its distal part also narrow, in its proximal part with rounded subtriangular to subcircular lobe.

**Occurrence:** Middle subzone or lower part of upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone of Southern Alps.

**Remarks:** This species was originally placed into *Falcispongius falciformis* DUMITRICĂ, 1982, in which all forms with two undifferentiated wings and long, needle-like, only a little recurved distal part of the main polar spine have been united. They were differentiated from *Falcispongius calcaneus* DUMITRICĂ, 1982 s. l. by the form of the main polar spine, the rounded subtriangular to subcircular lobe-like outer wing and the missing inner wing in the latter species. However, the oldest species of the *F. calcaneus* group, *F. prisus* n. sp. displays the same spine outline as the *F. calcaneus* group and *Falcispongius transitus* n. sp. displays a subtriangular or subhemicircular lobe on the outer wing as in the *calcaneus* group, the typical spine shape of the *falciformis* group and wings on the inner and outer side of the spine. In these stratigraphically oldest *Falcispongius* species characters both of *F. calcaneus* and of *F. falciformis* are present.

*Falcispongius prisus* n. sp. from the middle subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone is distinguished by the missing inner wing; *Falcispongius calcaneus* DUMITRICĂ, 1982 additionally by the strongly recurved spine.

*Falcispongius falciformis* DUMITRICĂ, 1982 and *F. praefalciformis* n. sp. display no lobe on the outer wing.

### ***Falcispongius* n. sp.**

1990 *Falcispongius hamatus* DUMITRICĂ, 1982a - GORIČAN, p. 145, pl. 3, fig. 7

**Occurrence:** Upper Fassanian of Yugoslavia and Hungary.

**Remarks:** This new species is characterized by a hemicircular outline of the outer wing and a relatively broad inner

wing. Both wings are present on large parts of the stem and on the flexion part of the main polar stem.

The Middle Fassanian *Falcispongius falciformis* DUMITRICĂ, 1982 is distinguished by the larger size of the main polar spine and by a longer stem.

The Longobardian *Falcispongius hamatus* DUMITRICĂ 1982 is distinguished by the abrupt widening of the outer wing in its proximal part.

### **Genus *Paroertlispongius* KOZUR & MOSTLER, 1981**

**Type species:** *Paroertlispongius multispinosus* KOZUR & MOSTLER, 1981

#### **Synonyma:**

*Acaeniospongius* KOZUR & MOSTLER, 1981

*Flexispongius* LAHM, 1984

*Pararchaeospongioprimum* LAHM, 1984

*Pseudoertlispongius* LAHM, 1984

**Remarks:** Nodes on the shell may be present in typical *Paroertlispongius*. Therefore *Acaeniospongius* KOZUR & MOSTLER, 1981 is regarded as synonym of *Paroertlispongius* KOZUR & MOSTLER, 1981.

In *Flexispongius* LAHM, 1984 both polar spines are curved, but not recurved. Bending of different degree without recurvation is typical for several typical *Paroertlispongius* species. Therefore *Flexispongius* LAHM, 1984 is a younger synonym of *Paroertlispongius* KOZUR & MOSTLER, 1981.

In *Pseudoertlispongius* LAHM, 1984 (only one species with two badly preserved specimens) the main polar spine is terminally slightly curved. This is only a species character. In some specimens also the second polar spine is somewhat curved, like in "*Flexispongius*". All transitions between forms with straight polar spines and forms with terminally totally curved polar spine(s) are present. Recurvation, as in the main polar spine of *Oertlispongius* KOZUR & MOSTLER, 1981 is never present. Both in forms with straight and curved polar spine(s) forms with and without nodes on the shell surface are present. Therefore between the genera *Acaeniospongius*, *Flexispongius*, *Paroertlispongius* and *Pseudoertlispongius* all transitions are present. Because they have all the same stratigraphic range, they are here regarded as synonymous.

*Pararchaeospongioprimum* LAHM, 1984 is a typical *Paroertlispongius*, in which the base of one or both polar spines is carinate. The largest part of the polar spines is round. Only one species is present that may be near related

to primitive forms of the Oertlispongidae. A separation from *Paroertlispongius* is not possible. All transitions to typical *Paroertlispongius* species with throughout round spines are present. Even within *P. hermi*, the only "*Pararchaeospongoprimum*" species, all transitions are present. There are forms, in which both polar spines are at their basis carinate, in other ones only one polar spine displays a carinate base and in some specimens both polar spines display a round cross section throughout their length.

***Paroertlispongius multispinosus***

**KOZUR & MOSTLER, 1981**

(Pl. 12, fig. 10; pl. 13, figs. 4, 11)

1981 *Paroertlispongius multispinosus* n. gen. n. sp. – KOZUR & MOSTLER, p. 48, pl. 44, fig. 2; pl. 45, fig. 1

**Occurrence:** Upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Remarks:** Some specimens of *P. multispinosus* display distinct nodes around the base of the needle-like by-spines. In other specimens these nodes are indistinct.

***Paroertlispongius hermi* (LAHM, 1984)**

(Pl. 10, fig. 10; pl. 11, figs. 3, 5; pl. 47, fig. 11)

1984 *Pararchaeospongoprimum hermi* n. gen. n. sp. – LAHM, p. 42, pl. 7, fig. 1

**Occurrence:** Middle and upper subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone. Alps, Hungary, Sosio Valley (Sicily, Italy), Yugoslavia.

**Remarks:** Some specimen display a subglobular shell. Perhaps they can be later separated from the typical *P. hermi* with elongated ellipsoidal shell as separate taxon.

***Paroertlispongius obliquus* n. sp.**

(Pl. 11, fig. 8)

**Derivatio nominis:** According to the arrangement of the polar spines.

**Holotypus:** The specimen on pl. 11, fig. 8; rep.-no. KoMo 1980 I-729.

**Locus typicus:** Road cut San Ulderico - Pallé, Vicentinian Alps (Italy).

**Stratum typicum:** Sample TT 13, upper subzone of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 7 specimens.

**Diagnosis:** The ellipsoidal shell consists of 10 or more spongy layers around a microsphere. One polar spine is robust, broad, but short. Its distal part is needle-like. The opposite polar spine lies obliquely to the other polar spine. It is long, slender. Several tiny, short, needle-like by-spines are present. The shell displays no nodes around the base of the by-spines.

**Measurements:**

Long axis of shell = 215–223  $\mu\text{m}$

Short axis of shell = 185–189  $\mu\text{m}$

Length of the short polar spine = 142–166  $\mu\text{m}$

Length of the long polar spine = 200–231  $\mu\text{m}$

**Occurrence:** Upper subzone of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** The similar *Paroertlispongius hermi* (LAHM, 1984) from the Lower Fassanian displays only a little ex-centric polar spines. By-spines are missing.

***Paroertlispongius rarispinosus***

**KOZUR & MOSTLER, 1981**

(Pl. 12, figs. 7)

1981 *Paroertlispongius rarispinosus* n.sp. – KOZUR & MOSTLER, p. 48, pl. 1, fig. 3

**Occurrence:** Upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone to lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** Primitive forms display an ellipsoidal shell. In these forms the second polar spine is small, but distinctly larger than the by-spines. All other forms display a spherical shell and the second polar spine displays about the same size as the by-spines.

***Paroertlispongius weddigei* (LAHM, 1984)**

(Pl. 12, figs. 12–14)

1984 *Pseudoertlispongius weddigei* n. gen. n. sp. – LAHM, pp. 46–67, pl. 8, fig. 10

**Occurrence:** Uppermost part of Lower Fassanian *Spongosilicarmiger italicus* Zone and lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone. Hungary, Italy (Southern Alps and Sosio Valley, Sicily).

**Remarks:** The length of the bent distal end of the main cusp varies, but the angle of this part against the stem is nearly constant. The distal end of the main polar spine is therefore always obliquely upward directed. The distal end of the second polar spine may be also slightly curved. Bending of different degree, but never recurvation is characteristic for several *Paroertlispongia* species. It is only a species character. Therefore the monotypic *Pseudoertlispongia* LAHM, 1984 is a younger synonym of *Paroertlispongia* KOZUR & MOSTLER, 1981.

*Paroertlispongia weddigei* displays especially well developed nodes around the by-spines on the shell surface. It belongs therefore to the *Acaeniospongia* morphotype.

### Genus *Turospongia* n. gen.

**Type species:** *Turospongia trispinosus* n. gen.

**Diagnosis:** Shell spherical, consisting of 7–11 layers of spongy meshwork around a microsphere. Only one polar spine is present. Distally 3 recurvated branches in triangular arrangement and an axial spine are present.

**Occurrence:** Lower subzone of Middle Fassinian *Ladinocampe multiperforata* zone of the Southern Alps.

**Remarks:** *Baumgartneria* DUMITRICĂ, 1982 displays only 2 recurvated side-branches at the stem end of the polar spine. These side branches are situated in one plane.

### *Turospongia trispinosus* n. gen. n. sp.

(Pl. 13, fig. 8; pl. 14, fig. 10)

**Derivatio nominis:** According to the 3 lateral branches of the polar spine.

**Holotypus:** The specimen on pl. 13, fig. 8; pl. 14, fig. 10; rep.-no. KoMo 1980 I-262.

**Locus typicus:** Road cut San Ulderico-Pallé (Vincentian Alps, Italy).

**Stratum typicum:** Sample TT 7, lower part of Middle Fassinian an *Ladinocampe multiperforata* Zone.

**Material:** 4 specimens.

**Diagnosis, occurrence and remarks:** As for the genus.

#### **Dimensions:**

Diameter of shell = 170–175 µm

Length of stem = 132–138 µm

Length of lateral branches = 220–250 µm

### Family Intermediellidae LAHM, 1984

**Remarks:** The genus *Paurinella* KOZUR & MOSTLER, 1981 comprises both forms with subspherical and with subdiscoidal shell. All transitions between these shell shape are present. The type species *P. curvata* KOZUR & MOSTLER, 1981 comprises forms with subspherical to inflated discoidal shell.

LAHM (1984) introduced for a form with (inflated) discoidal shell the new genus *Intermediella* LAHM, 1984 that is a younger synonym of *Paurinella* KOZUR & MOSTLER, 1981. He introduced also a new family Intermediellidae LAHM, 1984 that is according to his opinion transitional between the families Oertlispongiidae KOZUR & MOSTLER, 1980 and Relindellidae KOZUR & MOSTLER, 1980. There are really near relations to the family Oertlispongiidae, but no relations to the Relindellidae.

KOZUR & MOSTLER (1981) placed forms of the Intermediellidae in the Oertlispongiidae. However, forms with 3 or more spines, not in polar arrangement as in the Oertlispongiidae, may be separated as independent family from the Oertlispongiidae. In spite of the synonymy of the nominate genus, the family Intermediellidae can be used after emendation.

**Emended diagnosis:** Shell subspherical to discoidal, spongy, consisting of a microsphere surrounded by numerous concentric shells of spongy meshwork. Mostly 3 and 4 main spines are present that do not show polar arrangement. In forms with 3 spines one spine can be replaced by a pylom, surrounded by smaller spines. The main spines may be situated in one plane, but they may be also in tetrahedral arrangement, rarely irregularly spaced on the shell surface. Additional by-spines may be present.

**Occurrence:** Ladinian to Rhaetian, worldwide.

#### **Assigned genera:**

*Paurinella* KOZUR & MOSTLER, 1981

Synonym: *Intermediella* LAHM, 1984

*Katorella* KOZUR & MOSTLER, 1981

*Neopaurinella* KOZUR & MOSTLER, 1981

*Discokatorella* n. gen.

*Tetrapaurinella* n. gen.

**Remarks:** The similar Oertlispongiidae KOZUR & MOSTLER, 1980 display always polar arrangement of the two main spines. One of the polar spines may be reduced.

The genus *Recoaroella* LAHM, 1984 originally placed into the Intermediellidae LAHM, 1984, is here regarded as a representative of the Relindellidae KOZUR & MOSTLER, 1980 with basally carinate, thin round spines.

The Gomberellidae KOZUR & MOSTLER, 1981 emend. displays a polar arrangement of 2–3 spines around one pole. Moreover, they tend to get an ellipsoidal shell.

### Genus *Paurinella* KOZUR & MOSTLER, 1981

**Type species:** *Paurinella curvata* KOZUR & MOSTLER, 1981

**Synonym:** *Intermediella* LAHM, 1984

#### *Paurinella curvata spinosa* n. subsp.

(Pl. 15, fig. 1,8)

**Derivatio nominis:** According to the presence of by-spines.

**Holotypus:** The specimen on pl. 15, fig. 1; rep.-no. KoMo 1980 I-339.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy).

**Stratum typicum:** Sample TT 2, lower subzone of Middle Fassanian *Ladinocampe multiperforata* zone.

**Material:** 12 specimens.

**Diagnosis:** Shell subsphaerical to inflated discoidal, consisting of numerous concentric layers of spongy meshwork around a microsphere. The 3 round main spines are situated in one plane, but each curved out from this plane in different directions. Two of the main spines are always curved against each other. Short, needle-like by-spines always present.

**Dimensions:**

Largest diameter of shell = 156–163  $\mu\text{m}$

Length of main spine = 200–215  $\mu\text{m}$

Length of by-spines = 12–20  $\mu\text{m}$

**Occurrence:** Lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** *Paurinella curvata curvata* KOZUR & MOSTLER, 1981 from the upper subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone has no by-spines.

In *Paurinella tornata* n. sp. the 3 main spines are curved in the same direction.

#### *Paurinella curvata tenispinosa* n. subsp.

(Pl. 15, figs. 2–3)

**Derivatio nominis:** According to the slender spines

**Holotypus:** The specimen on pl. 15, fig. 2; rep.-no. KoMo 1980 I-338.

**Locus typicus:** Passo della Gabiola, section II, Vicentinian Alps (Italy).

**Stratum typicum:** Sample MD 32, Fassanian.

**Material:** 14 specimens.

**Diagnosis:** Shell spongy, inflated discoidal, lateral outline rounded subrectangular. The shell consists of numerous layers of spongy network around a microsphere. The 3 main spines are slender with round cross section. They are each curved in different directions from the plane, in which they start, but there are not 2 main spines, curved against each other. No by-spines.

**Dimensions:**

Largest diameter of the shell = 144–156  $\mu\text{m}$

Length of the main spines = 139–183  $\mu\text{m}$

**Occurrence:** Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Remarks:** *Paurinella curvata curvata* KOZUR & MOSTLER, 1981 from the upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone displays robust, stronger curved main spines, two of which are strongly curved against each other.

#### *Paurinella acutispinosa* n. sp.

(Pl. 16, fig. 5)

**Derivatio nominis:** According to the needle-like main spines.

**Holotypus:** The specimen on pl. 16, fig. 5; rep.-no. KoMo 1980 I-790.

**Locus typicus:** Köveskál (Balaton Highland, Hungary), section at the cemetery.

**Stratum typicum:** Sample Köveskál 6, Middle Longobardian part of *Budurovignathus mungoensis* Zone

**Material:** 12 specimens.

**Diagnosis:** Shell subspherical, spongy, consisting of several layers of spongy meshwork. The 3 main spines are straight, situated in one plane, arranged different angles to each other. Two of the main spines are very long, broadly needle-shaped. The third main spine is considerably smaller, slender needle-shaped. The gracile, needle-like by-spines are relatively long.

**Dimensions:**

Diameter of shell = 185–200 µm

Length of the long main spines = 269–300 µm

Length of the small main spine = 177–192 µm

Length of the by-spines = 38–46 µm

**Occurrence:** Longobardian of Balaton Highland.

**Remarks:** The Lower Fassanian *Paurinella mesotriasica* KOZUR & MOSTLER, 1981 displays considerably thicker and shorter main spines.

The Middle Fassanian *Paurinella trettoensis* n. sp. displays also needle-like, slender main spines, but one of them is larger than the other two ones. If by-spines are present, they are very short.

***Paurinella aequispinosa***

**KOZUR & MOSTLER, 1981**

(Pl. 15, figs. 9, 11)

1981 *Paurinella aequispinosa* n. sp. - KOZUR & MOSTLER, p. 50, pl. 42, fig. 1; pl. 43, fig. 1

**Occurrence:** Upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone. Tethys.

***Paurinella balatonica* n. sp.**

(Pl. 15, fig. 10)

**Derivatio nominis:** According to the occurrence in the Balaton Highland.

**Holotypus:** The specimen on pl. 15, fig. 10; rep.-no. KoMo 1980 I-86.

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Bed 104, 'Xenoprotrachyceras' reitzi Oppel Zone.

**Material:** 5 specimens.

**Diagnosis:** Shell inflated discoidal to subsphaerical, spongy, consisting of numerous concentric layers around a tiny microsphere. The 3 main spines of about equal size start from one plane, but are a little downward directed, partly in different degree. No by-spines.

**Dimensions:**

Longest diameter of shell = 169–175 µm

Shortest diameter of shell = 150–161 µm

Length of main spines = 156–200 µm

**Occurrence:** Middle part of Lower Fassanian *Spongosilicarmiger italicus* Zone (beds with 'X.' reitzi) of the Balaton Highland.

**Remarks:** In the similar *N. aequispinosa* KOZUR & MOSTLER, 1981 from the upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone all 3 main spines are situated along their whole length in one plane.

***Paurinella ? inaequispinosa* n. sp.**

(Pl. 15, figs. 13, 14)

**Derivatio nominis:** According to the different length of the main spines.

**Holotypus:** The specimen on pl. 15, fig. 14; rep.-no. KoMo 1980 I-200.

**Locus typicus:** Val di Cremo (Vicentinian Alps, Italy).

**Stratum typicum:** VCB, isolated sample of Buchenstein Formation, upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 39 specimens.

**Diagnosis:** Shell subspherical, spongy, consisting of numerous concentric layers around a microsphere. 3 main spines of different shape and size are situated in the equatorial plane of the shell. One main spine is long, strong, slightly curved. The second, considerably smaller main spine lies about opposite of the large one. The third main spine is rather small, needle-shaped. It is situated in different distance from the other 2 main spines. The 2 smaller main spines are straight. Tiny by-spines may be present or absent.

**Dimensions:**

Largest diameter of shell = 205–211 µm

Smallest diameter of shell = 171–179 µm

Length of the longest main spine = 268–300 µm

Length of the smallest main spine = 78–93 µm

**Occurrence:** Upper part of Lower Fassanian. Tethys.

**Remarks:** In *Paurinella trettoensis* n. sp. the biggest main spine is straight and no other main spine lies opposite to this cusp.

Two of the three main cusp are in subpolar arrangement. *Paurinella inaequispinosa* n. sp. is therefore a transitional form to the Oertlispongidae. It could be also regarded as an extreme *Paroertlispongus*.

***Paurinella latispinosa* n. sp.**

(Pl. 15, fig. 4)

**Derivatio nominis:** According to the broad spines.

**Holotypus:** The specimen on pl. 15, fig. 4; rep.-no. KoMo 1980 I-792.

**Locus typicus:** Köveskál (Balaton Highland, Hungary), section at the cemetery.

**Stratum typicum:** Sample Köveskál 6, Middle Longobardian part of the *Budurovignathus mungoensis* Zone.

**Material:** 3 specimens.

**Diagnosis:** Small spongy shell with rounded triangular lateral outline. The 3 main spines display the same shape, size and they are situated equidistant under the same angle in the equatorial plane of the shell. Compared with the small size of the shell, the spines are tumid in their mid-length. After their broadest part they taper rapidly to a needle-like terminal part. No by-spines.

**Dimensions:**

Largest diameter of shell = 98–105 µm

Length of spines = 94–100 µm

**Occurrence:** Middle Longobardian of Balaton Highland.

**Remarks:** This species is distinctly different from all other known *Paurinella* species.

***Paurinella ? longispinosa* n. sp.**

(Pl. 16, fig. 1)

**Derivatio nominis:** According to the long by-spines.

**Holotypus:** The specimen on pl. 16, fig. 1; rep.-no. KoMo 1980 I-186.

**Locus typicus:** Passo della Gabiola section, Vicentinian Alps (Italy).

**Stratum typicum:** Sample MD 6, middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 4 specimens.

**Diagnosis:** Shell subcircular, spongy, consisting of several layers surrounding a microsphere. The 3 round, distally needle-shaped main spines start from a plane a little below the equator and they are somewhat downward directed. By-spines very large.

**Dimensions:**

Longest diameter of shell = 152–160 µm

Length of the main spines = 150–178 µm

Length of the by-spines = 34–68 µm

**Occurrence:** Middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Remarks:** *Paurinella ? longispinosa* n. sp. is a transitional form to the genus *Kulacella* KOZUR & MOSTLER, in which the shell is ellipsoidal, the 3 main spines are still near to one pole and they are still stronger downward directed.

The Intermediellidae LAHM, 1984 are therefore not only connected by transitional forms with the Oertlispongidae KOZUR & MOSTLER, 1981, but also with the Gomberellidae.

***Paurinella mesotriassica***

**KOZUR & MOSTLER, 1981**

(Pl. 15, fig. 7; pl. 16, figs. ? 2, 4)

1981 *Paurinella mesotriassica* n. sp. – KOZUR & MOSTLER, p. 50, pl. 44, fig. 1

**Occurrence:** Upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone of Southern Alps.

**Remarks:** One of the 3 main spines in typical *P. mesotriassica* KOZUR & MOSTLER, 1981 is more slender than the remaining two ones. It is situated at the margin of a spot with looser spongy structure than the remaining shell. This species is a transitional form to *Neopaurinella* KOZUR & MOSTLER, 1981, in which the third spine is still more or totally reduced and the field with looser shell structure finally changed into a pylome.

***Paurinella tornata* n. sp.**

(Pl. 16, fig. 3)

**Derivatio nominis:** According to the curved main spines

**Holotypus:** The specimen on pl. 16, fig. 3; rep.-no. KoMo 1980 I-11

**Locus typicus:** Sample MD 13, middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 5 specimens.

**Diagnosis:** Shell subspherical, spongy, consisting of numerous shells around a microsphere. The 3 main spines of equal length are round, thin, in the upper view all clockwise curved. Short by-spines are present.

**Dimensions:**

Diameter of shell = 185–201 µm

Length of main spines = more than 200 µm

Length of by-spines = 11–17 µm

**Occurrence:** Middle part of Lower Fassanian. Southern Alps.

**Remarks:** The similar *Paurinella curvata spinosa* n. subsp. from the upper part of Lower Fassanian and lower part of Middle Fassanian is distinguished by main spines curved in different directions, 2 of which are always curved against each other.

***Paurinella trettoensis* n. sp.**

(Pl. 15, fig. 15)

**Derivatio nominis:** According to its occurrence.

**Holotypus:** The specimen on pl. 15, fig. 15; rep.-no. KoMo 1980 I-791.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy).

**Stratum typicum:** Sample TT 13, upper subzone of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 9 specimens.

**Diagnosis:** Shell subspherical, spongy, consisting of numerous layers around a microsphere. 3 main spines needle-like, one of them is very long, the other 2 are shorter, thinner. By-spines mostly missing, sometimes 1-2 tiny by-spines are present.

**Dimensions:**

Diameter of shell = 185–192 µm

Length of large main spine = 294–315 µm

Length of small main spines = 130–185 µm

**Occurrence:** Upper subzone of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** *Paurinella aequispinosa* KOZUR & MOSTLER, 1981 from the upper subzone of Lower Fassanian *Spongosilicarmiger italicus* zone displays thicker spines of equal length.

The Longobardian *Paurinella acutispinosa* n. sp. displays rather long by-spines and one of the main spines is shorter and thinner than the other two.

***Paurinella trispinosa* (LAHM, 1984)**

(Pl. 17, fig. 1-2)

1984 *Intermediella trispinosa* n. gen. n. sp. - LAHM, p. 53–54, pl. 9, fig. 4.

**Occurrence:** Upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone to Lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone of Southern Alps.

**Remarks:** Our specimens from the highest Lower Fassanian displays broader main spines than the holotype. Because only the holotype was figured by LAHM (1984) and no remarks to the intraspecific variability were made, we cannot decide, whether the broader and shorter main spines of our material indicate intraspecific variability or differences in subspecies character.

**Genus *Discokatorella* n. gen.**

**Derivatio nominis:** According to the discoidal shell with 4 furcated spines in the equatorial plane.

**Type species:** *Discokatorella tetraspina* n. gen. n. sp.

**Diagnosis:** Shell discoidal, spongy, with numerous concentric layers around a microsphere. Lateral outline of the shell quadratic to rectangular. 4 round main spines in cross-position are terminally trifurcated, partly bifurcated. No by-spines.

**Occurrence:** Middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone. Southern Alps.

Assigned species:

*Discokatorella tetraspina* n. gen. n. sp.

**Remarks:** *Katorella* KOZUR & MOSTLER, 1981 displays more main spines irregularly distributed on the shell surface.

***Discokatorella tetraspina* n. gen. n. sp.**

(Pl. 16, fig. 11)

**Derivatio nominis:** According to the 4 cross-like arranged spines.

**Holotypus:** The specimen on pl. 16, fig. 11; rep.-no. KoMo 1980 I-172.

**Locus typicus:** Passo della Gabiola section, Vicentinian Alps (Italy).

**Stratum typicum:** Sample MD 1, middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 17 specimens.

**Diagnosis, occurrence and remarks:** As for the genus.

**Dimensions:**

Equatorial diameter of shell = 90–125 µm

Length of spines = 75–100 µm



**Genus *Katorella* KOZUR & MOSTLER, 1981**

**Type species:** *Katorella bifurcata* KOZUR & MOSTLER, 1981

***Katorella trifurcata* n. sp.**

(Pl. 16, figs. 10, 12)

**Derivatio nominis:** According to the tri-branched main spines.

**Holotypus:** The specimen on pl. 16, fig. 10; rep.-no. KoMo 1980 I-210.

**Locus typicus:** Valle di Creme, Vicentinian Alps (Italy).

**Stratum typicum:** Limestone of Buchenstein Formation, single sample VCB, upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 29 specimens.

**Diagnosis:** Shell subspherical with rounded polygonal equatorial outline, spongy, consisting of several layers around a microsphere. Main spines situated in different positions on the shell. 3 of them start from one plane but may be inclined against this plane in different degree. They are distally trifurcated, one may be also bifurcated. Further needle-like, unbranched main spines start partly from the same plane, partly from different positions on the shell including perpendicularly to the plane of the branched spines. No by-spines.

**Dimensions:**

Diameter of shell = 126–140 µm

Length of spines = 70–118 µm

**Occurrence:** Upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone. Southern Alps (Italy), Balaton Highland (Hungary).

**Remarks:** *Katorella bifurcata* KOZUR & MOSTLER, 1981 (pl. 16, fig. 8) displays only bifurcated and unbranched spines.

In *Discokatorella tetraspina* n. gen. n. sp. only 4 main spines are present, all situated in one plane. Moreover, the shell is discoidal.

**Genus *Neopaurinella* KOZUR & MOSTLER, 1981**

**Type species:** *Neopaurinella sevatica* KOZUR & MOSTLER, 1981

***Neopaurinella ladinica* n. sp.**

(Pl. 15, figs. 5, 6; pl. 16, fig. 6)

**Derivatio nominis:** According to the occurrence in the Ladinian.

**Holotypus:** The specimen on pl. 16, fig. 6; rep.-no. KoMo 1980 I-198.

**Locus typicus:** Valle di Creme, Vicentinian Alps (Italy).

**Stratum typicum:** Limestone bed from the Buchenstein Formation, single sample VCB, upper subzone of *Spongosilicarmiger italicus* Zone.

**Material:** 15 specimens.

**Diagnosis:** Shell subspherical to subellipsoidal, a little flattened in the short axis, spongy, consisting of several layers. 3 round main spines. Two of them are rather tumid, broadest about in their midlength. The third main spine is considerable longer, thinner, needle-shaped. The angle between the thicker spines is smaller than between the thicker spines and the long, needle-like spine. This latter spine is situated opposite to the midline between the thicker spines at the margin of a flattened, mostly slightly depressed field with loose spongy meshwork. Around this field also some tiny by-spines may be present.

**Dimensions:**

Diameter of shell (along the long axis) = 218–230 µm

Diameter of shell (along the short axis) = 191–200 µm

Length of the thick main spines = 200–220 µm

Length of the slender, needle-like main spine = 280–300 µm

Length of the by-spines = maximally 20 µm

**Occurrence:** Upper subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone. Southern Alps.

**Remarks:** *Neopaurinella sevatica* KOZUR & MOSTLER, 1981 displays a spherical shell and the third needle-like spine is shorter than the 2 tumid main spines or at least not distinctly longer. It is always situated at the margin of a pylom.

*Neopaurinella lahmi* n. sp. displays a distinct pylom. The two thicker main spines are also very long and needle-like.

*Neopaurinella tumidospina* n. sp. displays a pylom, surrounded by rather long by-spines, but a distinct third main spine is missing.

*Neopaurinella lahmi* n. sp.

**Derivatio nominis:** In honour of Dr. B. LAHM, who figured this form for the first time.

1984 *Neopaurinella sevatica* KOZUR & MOSTLER  
1981 - LAHM, p. 51, pl. 8, fig. 10

**Holotypus:** The specimen figured by LAHM (1984, pl. 8, fig. 10).

**Locus typicus:** Section Recoaro A by LAHM (1984), Vicentinian Alps (Italy).

**Stratum typicum:** Sample Rec. A 12 (see LAHM, 1984, p. 10), Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 4 specimens

**Diagnosis:** Shell subspherical to subelliptical, spongy, consisting of several layers. 3 equidistant, round main spines.

All 3 main spines are long, needle-like of similar length. One is more slender than the other two main spines. This narrower main spine is situated at the margin of a distinct pylom. By-spines short, situated around the pylom, but rarely also as high as the equator.

**Occurrence:** Middle and upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone. Southern Alps.

**Remarks:** In our material all 3 main spines are fragmentary. Therefore the well preserved specimen figured by LAHM (1984) has been selected as holotype and no dimensions for the main spines can be given. However, the length of the thicker spines of the holotype is in full preservation about 270  $\mu\text{m}$ , considerably longer than in all other known *Neopaurinella* species.

LAHM (1984) placed *Neopaurinella lahmi* n. sp. into *N. sevatica* KOZUR & MOSTLER, 1981. However, this species displays 2 tumid, short main spines and a third, likewise short slender spine.

In *Neopaurinella ladinica* n. sp. 2 of the main spines are tumid and relatively short. The third is needle-like and considerably longer than the tumid spines. Moreover, no distinct pylom is present. However, this may be a preservationally controlled difference, because in *N. ladinica* n. sp. the area beside the third, slender, long main spine is slightly flattened and consists of looser spongy meshwork than the remaining shell.

*Neopaurinella tumidospina* n. sp.

(Pl. 16, fig. 7)

**Derivatio nominis:** According the 2 tumid main spines.

**Holotypus:** The specimen on pl. 16, fig. 7; rep.-no. KoMo 1980 I-199.

**Locus typicus:** Val di Creme.

**Stratum typicum:** Isolated limestone sample VCB from the Buchenstein Beds, upper subzone of Lower Ladinian *Spongosilicarmiger italicus* Zone.

**Material:** 3 specimens.

**Diagnosis:** Shell subspherical, spongy, consisting of several concentric layers. Two short, tumid main spine. Opposite to the mid-line between the 2 main spines a rather large pylom is present. It is surrounded by several, needle-like, rather long by-spines. Further shorter by-spines are present on the remaining shell surface, mostly situated below the equator. The third main spine is missing or so thin and small that it is not differentiated from the largest by-spines.

**Dimensions:**

Diameter of shell = 165–174  $\mu\text{m}$

Length of tumid main spines = 150–165  $\mu\text{m}$

Length of the by-spines = maximally 60  $\mu\text{m}$

**Occurrence:** Upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone of Southern Alps.

**Remarks:** Most similar is *Neopaurinella sevatica* KOZUR & MOSTLER, 1981 that has still shorter tumid main spines and the third, slender main spine is distinct.

Genus *Tetrapaurinella* n. gen.

**Derivatio nominis:** According to the 4 spines and the similarity with *Paurinella* KOZUR & MOSTLER, 1981.

**Diagnosis:** Shell discoidal, inflated discoidal or subspherical, consisting of several spongy layers around a microsphere. 4 needle-like main spines in cross-like arrangement, situated in one plane or with slightly tetrahedral arrangement.

**Assigned species:**

*Tetrapaurinella discoidalis* n. gen. n. sp.

*Tetrapaurinella tetrahedrica* n. sp.

**Distribution:** Middle and upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone of Southern Alps.

**Remarks:** *Paurinella* KOZUR & MOSTLER, 1981 displays only 3 main spines.

***Tetrapaurinella discoidalis* n. gen. n. sp.**

(Pl. 16, fig. 9; pl. 17, figs. 4, 6)

**Derivatio nominis:** According to the discoidal shell.

**Holotypus:** The specimen on pl. 16, fig. 9; rep.-no. CK 1980 I-201.

**Locus typicus:** Val di Cremo, Vicentinian Alps, Italy

**Stratum typicum:** Limestone of Buchenstein Formation, sample VCB, upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 17 specimens.

**Diagnosis:** Shell flat, discoidal, spongy, consisting of several layers around a microsphere. The 4 needle-like main spines with round cross section are cross-like arranged and situated in one plane. In general one spine is distinctly longer than the other three ones.

**Measurements:**

Diameter of shell = 140–158 µm

Length of main spines = 156–220 µm

**Distribution:** Upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone. Southern Alps.

**Remarks:** In the Lower Fassanian *Tetrapaurinella tetrahedrica* n. sp. the 4 main spines are not situated in one plane, but slightly tetrahedrally arranged.

***Tetrapaurinella tetrahedrica* n. sp.**

(Pl. 15, fig. 12; pl. 17, figs. 3, 5)

**Derivatio nominis:** According to the slightly tetrahedral arrangement of the main spines.

**Holotypus:** The specimen on pl. 17, fig. 3; rep.-no. KoMo 1980 I-202.

**Locus typicus:** Val di Cremo, Vicentinian Alps.

**Stratum typicum:** Limestone of Buchenstein Formation, sample VCB, upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 29 specimens.

**Diagnosis:** Shell inflated discoidal to subspherical, spongy, consisting of numerous layers around a microsphere. The 4, needle-like main spines with round cross section are cross-like arranged. However, they are not situated in one plane, but slightly tetrahedrally arranged.

**Measurements:**

Diameter of shell = 157–173 µm

Length of main spines = 144–233 µm

**Distribution:** Middle and upper subzone of *Spongosilicarmiger italicus* Zone, Southern Alps.

**Remarks:** *Tetrapaurinella discoidalis* n. sp. displays a flat, discoidal shell. Moreover, all 4 main spines are situated in one plane.

Most probably this species is the transition form to *Paurinella* KOZUR & MOSTLER, 1981. 3 of the 4 main spines are often arranged in one plane, whereas the fourth lies in tetrahedral position.

**Entactinaria or Spumellaria, fam. inc.**

**Genus *Sarla* PESSAGNO, 1979**

**Type species:** *Sarla prietoensis* PESSAGNO, 1979

***Sarla ? anisica* n. sp.**

(Pl. 17, figs. 7, 8)

**Derivatio nominis:** According to the occurrence in the Anisian (Illyrian).

**Holotypus:** The specimen on pl. 17, fig. 7; rep.-no. KoMo 1980 I-155.

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** 12 specimens.

**Diagnosis:** Cortical shell globular, with relatively large, high, predominantly pentagonal pore frames bearing small to distinct nodes on the joints. Inner layer with small pores not observed but small, fragile short bars are present that do not join each other or with the opposite wall of the pore frames. They could be the remnants of very fragile inner pore frames.

3 tricarinate spines are present displaying strong torsion. Their distal part is needle-like. The angles between the spines are somewhat different each other.

Inner structure unknown.

**Dimensions:**

Diameter of cortical shell = 144–150 µm

Length of spines = 145–172 µm

**Occurrence:** *Paraceratites trinodosus* Zone (Illyrian) of Balaton Highland, Hungary.

**Remarks:** The inner structure of the Upper Triassic *Sarla* PESSAGNO, 1979 is still unknown. It is used in North America as a collective genus for radiolaria with spherical or subspherical double-layered shell and 3, mostly twisted tricarinate spines in one plane. A part of this forms, e.g.

*Sepsagon longispinosus* (KOZUR & MOSTLER, 1979) are Entactinaria with well known inner structure (medullary shell as part of modified paleoscenidiid pentactine spicular system). From all species that are only known from the Upper Triassic of North America, including the type species, the inner structure is either unknown or the presence of a medullary shell is known, but without any data, whether it is part of a pentactine spicular system of Entactinaria or a spumellarian medullary shell.

Norian *Sarla* species of Sicily have either an eptingioid Entactinaria spicular system or an double medullary shell, of which the inner one is part of a modified pentactine palaeoscenidiid Entactinaria spicular system. However, none of these species is identical with the North American *Sarla* species and they do not belong to the *Sarla prietoensis* group. Therefore the taxonomic position of *Sarla* PESSAGNO, 1979 remains furthermore open. If the type species would be really related to *Capnuhosphaera* DE WEVER, 1979 than *Sarla* sensu str. would be a Spumellarian Radiolaria.

Most similar to our species is *Sarla natividadensis* PESSAGNO, 1979 that has no long needle-like distal part of the main spines.

#### Suborder Nassellaria EHRENBERG, 1875

**Remarks:** The Nassellaria families are arranged in alphabetic order.

#### Family Anisicyrtiidae KOZUR & MOSTLER, 1981 Genus *Anisicyrtis* KOZUR & MOSTLER, 1981

**Type species:** *Anisicyrtis hungarica* KOZUR & MOSTLER, 1981

#### *Anisicyrtis hungarica* KOZUR & MOSTLER, 1981 (Pl. 17, figs. 9, 10; pl. 18, figs. 1–4, 8)

1981 *Anisicyrtis hungarica* n. gen. n. sp. – KOZUR & MOSTLER, p. 105, pl. 13, fig. 2

**Occurrence:** Upper Illyrian (*Paraceratites trindosus* Zone) of Balaton Highland.

**Remarks:** Very rich new material (several 100 specimens) from the stratum typicum shows variability in

the length of the abdomen and of the postabdominal segment. The hoop-like abdomen may be as long as or even somewhat shorter than the thorax. However, it can be also considerably longer than the thorax. In this latter case often an indistinct constriction is present in the distal part of the abdomen that separates a partial segment.

The postabdominal segment is in full preservation longer than the abdomen. In specimens with very long postabdominal segment the middle part of this segment is widest. If the postabdominal segment is somewhat shorter, its widest part is at the end of this segment.

Most characteristic for *Anisicyrtis hungarica* is the long postabdominal segment separated by a very shallow and broad constriction from the abdomen. The widest parts of the abdomen and of the postabdominal segments have always the same width (maximum width of the test).

Thorax and abdomen are covered by an outer layer consisting of elevations around the pores of the inner layer. At the joints of this outer pore frames short spines and nodes are present. At the postabdominal segment this outer layer is missing, only in its proximal part shallow elevations around the pores are present.

Differences to other species see under the new species.

#### *Anisicyrtis conica* n. sp. (Pl. 18, fig. 12)

**Derivatio nominis:** According to the conical test.

**Holotype:** The specimen on pl. 18, fig. 12; rep.-no. KoMo 1980 I-77.

**Locus typicus and stratum typicum:** as for *Anisicyrtis mocki* n. sp.

**Material:** 17 specimens.

**Diagnosis:** Test conical. Cephalis large, hemiglobular, smooth, poreless, with stout, moderately long apical horn. Spicular system with Mb, A, V, 2l, D, 2l. In prolongation of V lies always a long tricarinate horn. In prolongation of 2l, there are also relatively long spines, situated in the stricture below the cephalis. In prolongation of D and 2L small spines on the thorax are present.

Thorax and following segments become continuously broader, but are shorter than the cephalis. The strictures are deep and smooth. Only the stricture between the 2 postabdominal segments may be shallow and partly overgrown by the outer layer. All postcephalic segments display small, widely and irregularly scattered pores. In all these segments an outer layer with irregular pore frames at

nodes or short spines at the joints is present. In the strictures pores are missing. Only the stricture between the 2 postabdominal segments may have partly pores and may be there overgrown by the outer layer (see above).

**Dimensions:**

Length of test = 168–175 µm

Maximum width of test = 86–94 µm

**Occurences:** Beds 87–100 D (*Paraceratites trinodus* Zone to lower *K. felsoeoersensis* Subzone of 'Xenoprotrachyceras' *reitzei* Oppel Zone). Illyrian to basal Fassanian.

**Remarks:** In the Illyrian *Anisicyrtis hungarica* KOZUR & MOSTLER the thorax is about as high as or higher than the cephalis. The postabdominal segment is long and even, if it is subdivided into 2 segments, these segments are considerably higher than the postabdominal segments in *Anisicyrtis conica* n. sp. Moreover, the postabdominal segment displays either no outer layer or only slight elevations around the pores of the inner layer in the proximal part.

The Illyrian *Anisicyrtis mocki* n. sp. displays higher segments and the abdomen to second postabdominal segment built up a subcylindrical part of test without distinct distalward broadening of the segments.

In the basal Fassanian *Anisicyrtis postillyrica* n. sp. the thorax to first postabdominal segments are similarly low as in *A. conica* n. sp. The second postabdominal segment, however, is high and inflated.

***Anisicyrtis foremanae* n. sp.**

(Pl. 18, figs. 5, 6, ? 11)

**Derivatio nominis:** In honour of the late H. FOREMAN.

**Holotypus:** The specimen on pl. 18, fig. 6; rep.-no. KoMo 1980 I-357.

**Locus typicus:** Road cut San Ulderico-Pallé (Vicentinian Alps, Italy).

**Stratum typicum:** Sample TT 6, *Ladinocampe multiperforata* Zone, Middle Fassanian.

**Material:** 23 specimens.

**Diagnosis:** Shell subconical, in the lower half mostly more cylindrical. Cephalis moderately large, mostly slightly asymmetrically subhemispherical with moderately large to large apical horn. Cephalic spicular system with Mb, A, V, 2L, D, 2l. A short spine in prolongation of V is always, a short spine in prolongation of D is mostly present. Very short spines in prolongation of V, 2l and 2l may be present.

Thorax hoop-like distinctly separated by deep strictures. It is considerably broader, but shorter than cephalis. Abdomen cylindrical, in its middle part slightly constricted, considerably longer and somewhat wider than thorax. First postabdominal segment about as wide as abdomen, separated from the abdomen by a shallow, partly indistinct stricture and from the second postabdominal segment by an indistinct, very shallow stricture. Second postabdominal segment somewhat wider than the foregoing 2 segments.

The inner layer has widely scattered small pores, like the primitive *Anisicyrtis* species. These pores are irregularly scattered, only partly arranged in irregular rings. In the thorax and abdomen these pores are closed by a layer of microgranular silica. In the abdomen few tiny pores remains open. In the thorax this outer layer displays short indistinct vertical ribs, in the proximal part of the abdomen irregular, indistinct shallow nodes are present. In the postabdominal segments the area around the inner pores is slightly elevated and the pores narrowed, but mostly not closed by a thin layer of microgranular silica.

**Dimensions:**

Length of test = 257–301 µm

Maximum width of test = 100–109 µm

**Occurrence:** Upper *Silicarmiger italicus* A.Z. to *Ladinocampe multiperforata* Zone. Upper part of Lower Fassanian to Middle Fassanian.

**Remarks:** This species remembers to the primitive Illyrian *Anisicyrtis hungarica* n. sp. In this species, however, the abdomen is hoop-like or otherwise inflated and its pores of the inner layer are open, surrounded by elevations (outer layer), but not closed.

In the topmost *X. reitzei* Oppel Zone of the Balaton Highland a primitive form exists that has already a cylindrical abdomen, but with open pores. Also the pores of the thorax are not covered by a layer of microgranular silica. It is here designated as *Anisicyrtis* cf. *foremanae* n. sp.

***Anisicyrtis goricanae* n. sp.**

(Pl. 18, fig. 9; pl. 19, figs. 1, 2)

1990 *Anisicyrtis* sp. A, pars - GORICAN; p. 140, pl. 12, only fig. 11

**Derivatio nominis:** In honour of Dr. S. GORIČAN, Ljubljana, who figured this form for the first time

**Holotypus:** The specimen on pl. 18, fig. 9; rep.-no. KoMo 1980 I-457.

**Locus typicus:** Road cut between Mte. Spitz and Mte. Fallison, Vicentinian Alps (Italy).

**Stratum typicum:** Sample FD 6, Fassanian.

**Material:** 5 specimens.

**Diagnosis:** Test conical, cephalis subhemispherical, smooth. Few pores near the base of the lateral horns may be present, otherwise poreless. Cephalic spicular system with Mb, A, V, 2L, D, 2I. Apical horn moderately large, tricarinate. Lateral horns relatively large, broad, at least basally carinate. Horn in prolongation of D distally needle-like. Horns V and 2I situated on the cephalis, horns D and 2I situated on the thorax.

Thorax hoop-like, considerably broader than cephalis. Its height is variable, but always lower than cephalis.

Abomen hoop-like always relatively high, broader and somewhat to considerably higher than thorax.

First postabdominal segment about as high as or a little higher than the abdomen and always somewhat broader than the abdomen. The broadest and highest segment is the second postabdominal segment. Mostly it has a somewhat lower proximal part and a higher, inverted frustum-like or subcylindrical distal part. Third postabdominal segment incomplete.

Thorax, abdomen and first postabdominal segment display on the inner layer small, roundish to oval pores of different size. On the first postabdominal segment few pores are larger. On the thorax and abdomen the pores are irregularly spaced or arranged in irregular rings. In the first postabdominal segments most pores are arranged in 2 irregular rings. Some widely scattered pores occur between these rings. The second postabdominal segment displays in its lower proximal part a pore ring with small pores and some tiny pores below it. The wide distal part displays one pore ring with pores of different size (tiny to large) and shape and below it irregularly spaced, mostly small pores of different size and shape are present.

Thorax and abdomen are covered by an outer layer with irregular pore frames that narrow or cover part of the inner pores. The outer pore frames of the first postabdominal segments are mostly also high, but consists exclusively of elevations around the inner pores that are not narrowed or covered. The same type, but generally lower outer pore frames exist on the proximal part of the second postabdominal segment. The distal part of the second postabdominal segment displays no outer layer. From the thorax to the first postabdominal segment the outer pore frames display few, but relatively large spines.

**Dimensions:**

Length of test = 222–270  $\mu\text{m}$

Maximum width of test = 94–120  $\mu\text{m}$

**Occurrence:** Upper part of Lower Fassanian *Spongosilicarmiger italicus* Zone. Hungary, Italy.

**Remarks:** The hoop-like, relatively high segments remember to the Illyrian *Anisicyrtis mocki* n. sp. However, this species has either no outer layer or the low outer pore frames consist of low elevations around the pores of the inner layer that are never narrowed or overgrown by the outer pore frames.

The contemporaneous or somewhat younger Lower Fassanian *Anisicyrtis recoaroensis* n. sp. displays considerably lower abdomen, first and second postabdominal segments and only the third postabdominal segment is large.

***Anisicyrtis italicica* n. sp.**

(Pl. 19, figs. 5, 7)

**Derivation nominis:** According to the occurrence in the Southern Alps (Italy).

**Holotypus:** The specimen on pl. 19, fig. 5; rep.-no. KoMo 1980 I-455.

**Locus typicus:** Passo della Gabiola near Recoaro (Vicentinian Alps, Italy).

**Stratum typicum:** Sample MD 12, middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 3 specimens.

**Diagnosis:** Shell conical. Cephalis moderately large, poreless, smooth. Apical horn stout, moderately long. Cephalic spicular system with Mb, A, V, 2L, D, 2I. In prolongation of V, 2L, and 2I short, broad, carinate horns are present.

Thorax narrow, shorter than or as high as cephalis. Abdomen slightly inflated, subglobular. 2 postabdominal segments inverted trapezoidal to nearly hoop-like, proximally more distinctly contrasted against the stricture than distally. Strictures between the segments always distinct.

Pore frames of inner layer relatively large. Pores arranged in often irregular rings. Outer layer consists of ridges around the pores of inner layer that are therefore well visible and not narrowed in unrecrystallized material. Joints of outer pore frames with small nodes, subordinately also with small spines. On the second postabdominal segment the outer layer is already indistinct.

**Dimensions:**

Length of test = 283–301  $\mu\text{m}$

Maximum width of test = 100–109  $\mu\text{m}$

Occurrence: Middle to upper subzone of Lower Ladinian *Spongosilicarmiger italicus* Zone. Italy.

Remarks: Forerunner of *Anisicyrtis nodosa* n. sp. This species is distinguished by a thicker outer layer with distinct broad nodes on the joints of the outer pore frames that are at least on the thorax and abdomen distinctly thickened narrowing or overgrowing by this the inner pores.

***Anisicyrtis mocki* n. sp.**

(Pl. 17, fig. 11; pl. 18, figs. 7, 10, 13;  
pl. 47, ? figs. 12, 13)

**Derivatio nominis:** In honour of Dr. R. MOCK, Bratislava.

**Holotypus:** The specimen on pl. 17, fig. 11; rep.-no. KoMo 1980 I-56.

**Locus typicus:** Felsöörs (Balaton Highland, Hungary) Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian)

**Material:** 32 specimens.

**Diagnosis:** Multicyrtid. Test proximally subconical, in the postabdominal part subcylindrical. Cephalis moderately large, subconical to elongated subhemispherical, smooth and with exception of an often present pore above horn V poreless. Cephalic spicular system with Mb, A, V, 2L, D, 2l. The spicule D is short, delicate and often broken away. Apical horn moderately long, tricarinate. Horn in prolongation of V on the cephalis rather large, slender. The slender, rather large horns in prolongation of 2L, D, 2l are situated on the upper part of the thorax (D, 2L) and in the collar stricture (2l). All lateral horns are proximally carinate, distally round.

Thorax, abdomen and the 2 postabdominal segments are hoop-like, separated by distinct, pore-less, smooth strictures. Thorax considerably broader than cephalis, abdomen distinctly broader than cephalis. First abdominal segment as wide as or a little shorter than the abdomen. Second postabdominal segment as wide as or a little wider than the abdomen. A third, delicate, thin-walled third postabdominal segment is only fragmentary preserved. It is distinctly broader than the foregoing segments.

The thorax displays widely scattered small pores. Abdomen and postabdominal segments display scattered pores of different size and shape (round, oval, triangular, irregular shape). Outer layer missing or slight elevations around the pores are present on the thorax, abdomen, sometimes also on the postabdominal segments.

**Dimensions:**

Length of test = 193–245  $\mu\text{m}$

Maximum width of test = 82–100  $\mu\text{m}$

Occurrence: Illyrian (*Paraceratites trinodosus* Zone) of Balaton Highland (Hungary).

Remarks: The Illyrian *Anisicyrtis hungarica* KOZUR & MOSTLER, 1981 displays a long postcephalic segment, partly subdivided into 2 segments. Thorax and abdomen display distinct outer pore frames with nodes and short spines.

The Illyrian *Anisicyrtis conica* n. sp. displays low, but relatively broad postcephalic segments that become until the second postabdominal segment continuously broader. All postcephalic segments display a distinct outer layer. Elevations around the pores of the inner layer in the thorax, abdomen and first abdominal segment rather high with nodes and short spines at the joints of the outer pore frames.

All Ladinian *Anisicyrtis* species display at least on the thorax, abdomen and first postabdominal segment a distinct outer pore frame with nodes or small spines on the joints that covers the inner pore frames, partly even the strictures.

***Anisicyrtis nodosa* n. sp.**

(Pl. 19, figs. ? 3, 6, 8, 9)

**Derivatio nominis:** According to the nodes on the joints of the outer pore frames.

**Holotypus:** The specimen on pl. 19, fig. 6; rep.-no. KoMo 1980 I-450.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy.)

**Stratum typicum:** Sample TT5, lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 81 specimens.

**Diagnosis:** Cephalis rounded conical to elongated subhemispherical, smooth, poreless. Cephalic spicular system with Mb, A, V, 2L, D, 2l. Apical horn moderately large to large, tricarinate. Vertical horn small.

Thorax small, lower than or as high as cephalis, but broader than it. The thorax is covered by a nodose outer layer, only few small pores remain open.

Abdomen considerably larger (higher and broader) than thorax, subglobular to hoop-like, often somewhat inflated sometimes a low partial segment is indistinctly separated in the lower part of the abdomen.

Following postabdominal segments separated by distinct, narrow, poreless strictures. They are considerably lower, but somewhat wider than the abdomen and their width increases distalwards.

Pores of the inner layer small, arranged in often irregular rings. With exception of the third postabdominal segment there is a thick outer layer. It consists of a high pore frame around the inner pores, considerably broadened and node-like elevated at the joints. At the thorax and abdomen these outer pore frames narrow and partly overgrow the inner pores. If present, the lower partial segment of the abdomen displays especially high pore frames and nodes.

The nodes on the outer pore frames are arranged into partly irregular rings. Sometimes they are also connected by indistinct, short, irregular vertical ribs.

In the third postabdominal segment the outer layer is only thin, partly even missing (especially in the distal part).

**Dimensions:**

Length of test = 312–350 µm

Maximum width of test = 111–117 µm

**Occurrence:** Frequent in the Middle Fassanian *Ladinocampe multiperforata* Zone. Italy.

**Remarks:** The Middle Fassanian *Anisicyrtis trettoensis* n. sp. displays the same kind of outer layer and an inflated abdomen. However, the postabdominal part is conical to subcylindrical without distinct strictures. The outer layer is only present in the upper third of this postabdominal portion of the test. In the subspecies *A. trettoensis postera* n. subsp. from the higher Middle Fassanian the thick nodose outer layer covers also most of the postabdominal portion of the test. In contrast to *A. nodosa* n. sp., abdomen, first and second postabdominal segments are not separated each other by distinct strictures on the outer surface.

*Anisicyrtis italicus* n. sp. from the upper subzone of the Lower Fassanian *S. italicus* Zone is the forerunner of *A. nodosa* n. sp. In this species the outer pore frames are not so high and not distinctly thickened at the joints. Therefore also on the thorax and abdomen no narrowing of the inner pores is present.

***Anisicyrtis postillyrica* n. sp.**

(Pl. 19, fig. 4)

**Derivatio nominis:** According to its occurrence after the Illyrian.

**Holotypus:** The specimen on pl. 19, fig. 4; rep.-no. KoMo 1980 I-76.

**Locus typicus:** Felsőörs, Forráshegy section (Balaton Highland, Hungary).

**Stratum typicum:** Limestone bed 100 D, basal part of the '*Xenoprotrachyceras*' *reitzei* Oppel Zone (*Kellnerites* fauna).

**Material:** 7 specimens.

**Diagnosis:** Test conical. Cephalis rounded conical, moderately large, poreless, with stout, moderately long carinate apical horn. Cephalic spicular system with Mb, A, V, 2L, D, 2l. Horns in prolongation of V (big, always present), D, 2L, 2l (smaller) are present.

Thorax trapezoidol, broader, but not longer than cephalis. Abdomen broader than thorax, but also low, hoop-like. First postabdominal segment of the same size and shape as abdominal segment. All these segments are separated by narrow, but deep and distinct smooth strictions. The following stricture is broader. The second postabdominal segment is considerably higher and broader than the other segments.

All post-cephalic segments are covered by an outer layer with distinct pore frames that have until the first postabdominal segment short spines at the joints. All pores are small, roundish to triangular. They are widely scattered and in the outer pore frame often ringlike arranged around a central node.

Further segments seemingly present, but not preserved.

**Dimensions:**

Length of test = 263–275 µm

Maximum width of test = 110–121 µm

**Occurrence:** Lower to middle subzone of Lower Ladinian *Spongosilicarmiger italicus* Zone. Hungary.

**Remarks:** *A. postillyrica* n. sp. is the first representative of the Lower Fassanian *Anisicyrtis recoarensis* group, characterized by a low abdomen and first postabdominal segment with narrow separating stricture that is in higher evolved forms more and more overgrown by the strong outer pore frame. *A. postillyrica* n. sp. is distinguished from *A. recoaroensis* n. sp. (middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone to lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone) by the somewhat weaker outer pore frames, the never overgrown stricture between abdomen and first



postabdominal segment and above all by the inflated second postabdominal segment from which the proximal part is not yet separated as low independent segment.

***Anisicyrtis recoaroensis* n. sp.**

(Pl. 20, figs. 3–5)

1990 *Anisicyrtis* sp. A, pars-GORIČAN, p. 140, only pl. 12, fig. 10

**Derivatio nominis:** According to the occurrence in the Recoaro area (Italy).

**Holotypus:** The specimen on pl. 20, fig. 4; rep.-no. KoMo 1980 I-161.

**Locus typicus:** Val di Creme near Recoaro (Vicentinian Alps, Italy).

**Stratum typicum:** Sample VCB, limestone from the Buchenstein Beds, upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 29 specimens.

**Diagnosis:** Test subconical. Cephalis moderately large, elongated subhemispherical, poreless. Apical horn moderately large, tricarinate. Cephalic spicular system with Mb, A, V, 2L, D, 2I. Short horns are present in prolongation of V, 2L, D and 2I (horns V and 2I on the cephalis, horns D and 2L on the thorax). Thorax considerably broader, but shorter than or as long as the cephalis. The post-thoracic segments increase slowly and continuously in width. Abdomen and first postabdominal segment low, separated by a very narrow, shallow constriction that is in stratigraphically older forms partly, in stratigraphically younger forms always overgrown by the thick outer pore frames and then not recognizable. Second postabdominal segment also low, third postabdominal segment long, with fragile velum or remnant of an incomplete fourth postabdominal segment.

Pores in the inner layer from the thorax until the second postabdominal segment small, in the third postabdominal segment of different size. In the proximal part of the segments the pores are arranged into often irregular rings, in the distal parts the pores are more irregularly distributed.

Thorax, abdomen and first postabdominal segment always covered by thick outer pore frames with short spines on the joints. These outer pore frames narrow or totally cover the pores of the inner layer. Especially in stratigraphically younger forms also the low, narrow stricture between the abdomen and first postabdominal segment is covered by this outer layer and on the outer surface not more recognizable.

The second postabdominal segment displays only in stratigraphically younger forms thick outer pore frames that cover partially the inner pores. In stratigraphically older forms only the margin of the inner pores are elevated or some short ridges and spines are present around the pores of the inner layer.

The third postabdominal segment displays no outer layer or only low outer pore frames around the pores of the inner layer in the proximal part of the third postabdominal segment are present.

**Dimensions:**

See under the subspecies.

**Occurrence:** Middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone to lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone. Italy, Yugoslavia.

**Remarks:** Successor of *Anisicyrtis postillyrica* n. sp. from the lower to middle subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone. In this species the outer pore frames are lower and have only tiny spines. The stricture between the abdomen and the first postabdominal segment is somewhat broader and never overgrown by the outer pore frames. The second postabdominal segment is high and inflated.

The Middle Fassanian *Anisicyrtis spinosa* n. sp. is the successor of *A. recoaroensis* n.sp. In this species all postcephalic strictures with exception of the last one are overgrown by the thick outer pore frames and not or only very indistinctly visible on the outer surface. The spines on the outer pore frames are as large as the lateral horns in prolongation of the cephalic spines.

***Anisicyrtis recoaroensis recoaroensis* n. subsp.**

(Pl. 20, figs. 4, 5)

**Holotypus:** Holotypus of the species.

**Material:** 17 specimens.

**Diagnosis:** With the character of the species. Narrow, shallow stricture between abdomen and first postabdominal segment not or only partly covered by the thick outer pore frames. Outer pore frames of the second postabdominal segment low, consisting only of ridges around the pores of the inner layer, sometimes still incomplete, but also with single small spines.

**Dimensions:**

Length of test = 241–267 µm

Maximum width of test = 90–107 µm

**Occurrence:** Middle and upper subzone of *Spongosilicarmiger italicus* Zone. Italy, Yugoslavia.

**Remarks:** See also under the species. *Anisicyrtis trettoensis deweveri* n. subsp. from the lower subzone of the Middle Fassanian *Ladinocampe multiperforata* Zone displays also on the second postabdominal segment high outer pore frames that narrow and overgrow the pores of the inner layer. The stricture between the abdomen and the first postabdominal segment is always totally overgrown by the outer pore frames and therefore outside not visible. Therefore these 2 segments look from outside as a large abdomen.

***Anisicyrtis recoaroensis deweveri* n. subsp.**  
(Pl. 20, fig. 3)

**Derivatio nominis:** In honour of P. DE WEVER, Paris.  
**Holotypus:** The specimen on pl. 20, fig. 3; rep.-no. KoMo 1980 I-243.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy).

**Stratum typicum:** Sample TT 7, lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 12 specimens.

**Diagnosis:** With the character of the species. Shallow stricture between the abdomen and first postabdominal segment totally overgrown by the thick, spinose outer pore frames that covers also the second postabdominal segment and narrow or overgrown here, like on the thorax to first postabdominal segments, the pores of the inner layer.

**Dimensions:**

Length of test = 233–243 µm

Maximum width of test = 98–101 µm

**Occurrence:** Lower part of Middle Fassanian *Ladinocampe multiperforata* Zone. Italy.

**Remarks:** See also under the species. *Anisicyrtis recoaroensis recoaroensis* n. subsp. from the upper subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone is distinguished by the low and often still incomplete outer layer on the second postabdominal segment that never overgrows or narrows the pores of the inner layer. Moreover, the narrow and low stricture between the abdomen and the first postabdominal segment is never totally overgrown by the outer pore frames.

***Anisicyrtis spinosa* n. sp.**  
(Pl. 19, figs. 11–14)

1990 *Anisicyrtis* sp. A, pars - GORIČAN, p. 140, only pl. 12, fig. 9

**Derivatio nominis:** According to the spinose outer layer

**Holotypus:** The specimen on pl. 19, fig. 12; rep.-no. KoMo 1980 I-244.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy).

**Stratum typicum:** Sample TT 7, Middle Fassanian, *Ladinocampe multiperforata* Zone.

**Material:** More than 100 specimens.

**Diagnosis:** Test conical. Cephalis hemiglobular, smooth, moderately large. Apical horn stout, tricarinate, moderately large spicular system with Mb, A, V, 2L, D, 2I. Tricarinate, rather small vertical horn always present. Further small spines in prolongation of 2I mostly present.

Thorax trapezoidal, abdomen cylindrical. On the outer side these segments are not or only indistinctly to distinguish, because the stricture between them is overgrown. First postabdominal segment of about the same size as abdomen, often well separated on the outer shell surface by a narrow stricture. Second postabdominal segment may be present.

Pores in the thorax small, in the abdomen and postabdominal segments relatively large and here arranged in often indistinct rings. Thorax, abdomen and at least proximal part of the last postabdominal segment overgrown by an outer layer, thickest on the thorax and thinner distally. The joints of the pore frames bears spines that may be on the thorax as large as the horns in prolongation of V and 2I. On the abdomen the spines are sometimes shorter and partly replaced by nodes. On the first postabdominal segment the outer layer is low and has mostly no elevation on the joints, but some nodes or spines may be here present as well. The second postabdominal segment, if present, has no elevations at joints or only low nodes. The outer layer overgrows also the stricture between the thorax and abdomen that can be therefore often not separated on the outer shell surface. Sometimes the outer layer overgrows also the stricture between the abdomen and the postabdominal segments. In this case all postcephalic segments are unseparable or nearly unseparable on the outer shell surface.

**Dimensions:**

Length of test = 250–290 µm

Maximum width of test = 109–118 µm

**Occurrence:** Widely distributed in the Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** The Anisian *Anisicyrtis* species have either no outer layer or this layer is thin and does not overgrow the strictures.

The Fassanian *Anisicyrtis* species are distinguished by the following features:

*Anisicyrtis nodosa* n. sp. has strong nodes at the pore frame joints of the outer layer, but no spines. The apical horn is longer. The strictures are narrow but well visible.

*Anisicyrtis italica* n. sp. has well defined strictures between all segments. Spines at the joints of the outer pore frame are only very small.

*Anisicyrtis recoaroensis* n. sp. has often also relatively large spines on the joints of the outer pore frames, but most of the strictures are not overgrown and the last segment has often no outer layer. Only the narrow and shallower stricture between the abdomen and first abdominal segments is often overgrown.

*Anisicyrtis trettoensis* n. sp. displays a subglobular abdomen and no spines at the joints of the outer pore frames.

***Anisicyrtis trettoensis* n. sp.**

(Pl. 19, figs. 10, 15; pl. 20, figs. 1, 2)

**Derivatio nominis:** According to the occurrence in Tretto.

**Holotype:** The specimen on pl. 20, fig. 1; rep.-no. KoMo 1980 I-247.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy).

**Stratum typicum:** Sample TT 7, Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 37 specimens.

**Diagnosis:** Shell conical, in the lower part sometimes cylindrical. Cephalothorax conical with large tricarinate apical horn. Upper part of cephalothorax (cephalis) smooth, poreless, lower part (thorax), covered by a layer of microgranular silica that is fine pustulose or displays irregular outer pore frames with nodes at the joints. By this outer layer most of the pores on the inner layer of the thorax are closed. Cephalic spicular system with Mb, A, V, 2L, D, 2I. Small vertical horn always present. Additionally small spines in prolongation of D and 2I may be present.

Abdomen inflated, distinctly larger than adjacent segments. Postabdominal segment long, conical, slowly widening distally, but in typical forms only distal part may be broader than abdomen. Partly the postabdominal segment is cylindrical.

The pores of the inner layer are small and arranged in irregular rings. On the abdomen, the inner layer is covered by a thick outer layer that narrows and partly covers the pores of the inner layer. Distinct nodes are present at the joints of the outer pore frames. They are arranged in irregular rings, but may be also vertically connected by low ridges.

On the proximal, mostly slightly elevated part of the postabdominal segment the same structure of outer layer may be present. This part may be separated by a shallow stricture as separate segment from the following postabdominal part. Sometimes the outer layer is nearly missing on the postabdominal part and in these specimens only indistinct elevations around the pores of the inner layer are present. In *A. trettoensis postera* n. subsp. the outer layer covers more than half of the postabdominal portion. The distal part of the postabdominal portion has no outer layer.

**Dimensions:** see under the subspecies.

**Occurrence:** Middle Fassanian *Ladinocampe multiperforata* Zone of Southern Alps.

**Remarks:** Most similar is the Middle Fassanian *Anisicyrtis nodosa* n. sp. that is distinguished by postabdominal segments separated by distinct deep strictures.

***Anisicyrtis trettoensis trettoensis* n. subsp.**

(Pl. 19, fig. 15; pl. 20, figs. 1, 2)

**Holotypus** = Holotypus of the species.

**Material:** 31 specimens.

**Diagnosis:** With the characters of the species. Abdomen distinctly contrasted against the postabdominal portion. Only the proximal third of the postabdominal portion of test is covered by a thick outer layer, narrowing or closing the inner pores. In the remaining part the inner pores are free and only few node-like elevations may be present between some pores.

**Dimensions:**

Length of test = 271–309 µm

Maximum width of test = 100–135 µm

**Remarks:** See also under the species. *Anisicyrtis trettoensis postera* n. subsp. from the upper subzone of the Middle Ladinian *L. multiperforata* Zone displays a distinct outer layer on the proximal half of the postabdominal portion. It is so thick that the abdomen is not more distinctly contrasted against the postabdominal portion.

***Anisicyrtis trettoensis postera* n. subsp.**

(Pl. 19, fig. 10)

**Derivatio nominis:** According to the stratigraphic succession of the 2 subspecies.

**Holotypus:** The specimen on pl. 19, fig. 10; rep.-no. KoMo 1980 I-453.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** Sample TT 16, upper part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 6 specimens.

**Diagnosis:** With the character of the species. The proximal half of the postabdominal portion is covered by the same thick outer pore frames than the abdomen that is only indistinctly or not separated from the postabdominal portion on the outer surface.

**Dimensions:**

Length of test = 345–357 µm

Maximum width of test = 119–124 µm

**Occurrence:** Upper part of Middle Fassanian *Ladinocampe multiperforata* Zone. Italy.

**Remarks:** See also under the species. *Anisicyrtis trettoensis* n. subsp. from the lower part of the Middle Fassanian *Ladinocampe multiperforata* Zone displays only in the proximal third of the postabdominal portion outer pore frames that may be here so thick as on the abdomen. However, the abdomen is always well differentiated from the postabdominal portion on the outer surface.

**Family Deflandrecyrtiidae**

**KOZUR & MOSTLER, 1979**

**Genus *Goestlingella* KOZUR & MOSTLER, 1979**

**Type species:** *Goestlingella cordevolica* KOZUR & MOSTLER, 1979

***Goestlingella toempeae* n. sp.**

(Pl. 20, figs. 6, 7)

**Derivatio nominis:** In honour of Dr. Zs. TÖMPE, Budapest, wife of one of the authors (H. KOZUR).

**Holotypus:** The specimen on pl. 20, figs. 6, 7; rep.-no. KoMo I-252.

**Locus typicus:** Passo della Gabiola section near Recoaro, Italy.

**Stratum typicum:** Sample MD 8, middle *Spongossilicarmiger italicus* Zone, highest Lower Fassanian

**Material:** 18 specimens.

**Diagnosis:** Shell bell-shaped. Cephalis moderately large, elongated subhemispherical, with big round apical horn. Cephalic spicular system with Mb, A, V, 2L, 2l. Short slender, slightly carinate horn in prolongation of V. Surface of cephalis microgranular, almost poreless, often with ring pores in prolongation of L and l.

Thorax considerably broader than cephalis, but not inflated. Upper part conical, with numerous small round pores, lower part cylindrical, only with few, small, widely scattered round pores. Abdomen indistinctly separated from thorax, long, bell-shaped, upper part cylindrical, lower part flaring to a skirt, moderately wide for the genus. Whole abdomen including skirt with large, round, diagonally arranged pores.

**Dimensions:**

Length of test = 205–211 µm

Maximum width of test (without skirt) = 73–77 µm

Width of skirt = 138–142 µm

**Occurrence:** Middle part of Lower Fassanian of Southern Alps.

**Remarks:** The shape of test resembles *Deflandrecyrtium* KOZUR & MOSTLER, 1979. However, the cephalic spicular system without D and the presence of a vertical horn is typical for *Goestlingella* KOZUR & MOSTLER, 1979.

The Carnian representatives of *Goestlingella* have one segment more than the Middle Triassic one, but are otherwise similar.

The Illyrian *Goestlingella illyrica* KOZUR, 1984 displays a large, globular thorax with large pores.

*Goestlingella* n. sp. aff. *illyrica* KOZUR, 1984 (= *Goestlingella illyrica* sensu GORIČAN, 1990) has a long abdomen as *G. toempeae* n. sp., but the thorax is globular inflated and displays throughout large pores, as in *G. illyrica* KOZUR, 1984.

**Family Monicastericidae n. fam.**

**Diagnosis:** Test spindle-shaped, multicyrtid. Segments mostly indistinctly separated each other. Cephalis large, conical, with large tricarinate apical horn and short carinate spines in prolongation of V and 2l. Cephalic spicular system with Mb, A, V, 2L, D, 2l. Following segments

cylindrical, last segment inversely conical. Distal a short to long smooth, poreless tube is present. At the distal end in primitive forms 3 unreduced, later rudimentary feet are present. In higher evolved forms feet are absent.

Wall latticed, small pores arranged in irregular rings. Cephalis with few tiny, irregularly scattered pores. Smooth or nodose rings on the surface mostly present. In the proximal half or third of the test often an outer layer is present, displaying irregular pore frames with nodes or short, broad spines on the joint.

**Occurrence:** Fassanian. Japan, Italy.

**Assigned genera:**

*Monicasterix* n. gen.

*Tubotriassocyrtis* n. gen.

**Remarks:** This family has evolved from *Hozmadia longispinosa* n. sp. by further prolongation and segmentation of the long cephalis. The feet in this species are already on the upper side round, on the inner side excavated as in *Monicasterix* n. gen., but unlike other *Hozmadia* species.

*Pseudoeucyrtis* PESSAGNO, 1977 has a similar shape, but no smooth tubus. Feet, horns V, 2l and a large tricarinate apical horn are never present. The cephalis is very small. This genus represents probably a homoeomorph form.

In the Syringocapsidae FOREMAN, 1973 the tubus displays pores, has never feet or rudimentary feet and an inflated first postabdominal segment is present.

### Genus *Monicasterix* n. gen.

**Derivatio nominis:** In honour of the secretary of the Institut für Geologie und Paläontologie, Innsbruck, Mrs. Monika Tessadri-Wackerle, who likes Asterix stories.

**Type species:** *Monicasterix alpina* n. gen. n. sp.

**Diagnosis:** Test spindle-shaped to subcylindrical. Cephalis large, conical to subhemispherical, with few, widely scattered tiny pores. Spicular system with Mb, A, V, 2L, D, 2l. Broad, but short carinate spines in prolongation of A and l situated on the distal part of the cephalis and on the proximal part of the thorax. Surface of cephalis with distinct ridges in the place of the arches AV and Al. In the distal part also short ridges may be present reaching upward from the secondary outer layer of the thorax. Following segments cylindrical, last segment inversely conical. Segments in primitive forms almost unseparable, in stratigraphic younger forms at least the 2–4

postabdominal segments are mostly well separated by rings and shallow strictures. Distal smooth tubus short. The 3 feet are in primitive forms still long, in higher evolved forms rudimentary and very short.

**Occurrence:** Middle part of *Spongosilicarmiger italicus* Zone to lower part of *Ladinocampe multiperforata* Zone (upper part of Lower Fassanian to Middle Fassanian)

Assigned species:

*Monicasterix alpina* n. gen. n. sp.

*Monicasterix brevituba* n. sp.

*Monicasterix gabiolaensis* n. sp.

*Monicasterix prisca* n. sp.

**Remarks:** *Monicasterix prisca* n. sp. has still unreduced feet and nearly unseparable segments. Both remembers to the forerunner *Hozmadia longicephalis* n. sp., which has, however, not yet a smooth distal tubus and a considerably shorter test.

*Tubotriassocyrtis* n. gen. has no feet or rudimentary feet at the end of the long distal tubus.

### *Monicasterix alpina* n. gen. n. sp.

(Pl. 21, figs. 1–3, 5, 7)

**Derivatio nominis:** According to its occurrence in the Alps.

**Holotypus:** The specimen on pl. 21, figs. 1–3, 5, 7; rep.-no. KoMo 1980 I-253.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** Sample TT 7, lower part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 5 specimens.

**Diagnosis:** Test elongated subcylindrical. Cephalis large, subhemiglobular to subconical. Cephalic spicular system with Mb, A, V, 2L, D, 2l. Apical horn very large, tricarinate, carinae basally bifurcated. Multicarinate horns in prolongation of V, 2L and 2l very broad, rather large. Surface of cephalis with ridges in the place of arches AV and Al and VL. Remaining surface with imperfect, indistinct reticulum. Only very few, widely scattered tiny pores are present. Sometimes the cephalis is poreless.

Thorax, abdomen cylindrical, not well separable each other, with small pores on the inner layer, covered by an outer layer with irregular large pore frames (with nodes or short spines at the joint). 1–2 postabdominal segments with small pores, arranged in irregular rings on the inner layer. At one postabdominal segment a narrow slightly nodose ring is present. Also the postabdominal segments,

that become narrower in distal direction, are covered by a secondary outer layer with irregular larger pore frames.

Smooth distal tubus relatively long, broad, with 3 short, triangular feet that are on the outer side slightly convex, on the inner side excavated. Aperture relatively broad, rounded triangular.

**Dimensions:**

Length of test = 211–226  $\mu\text{m}$

Maximum width of test = 67–73  $\mu\text{m}$

**Occurrence:** Lower part of Middle Fassanian *Ladinocampe multiperforata* Zone of Southern Alps.

**Remarks:** *Monicasterix prisca* n. sp. has still unreduced, large feet and no distinct outer layer with different pores frames than on the inner layer.

*Monicasterix gabiolaensis* n. sp. has 3 rings on the 3 postabdominal segments that displays outer pore frames arranged in irregular rings.

*Monicasterix brevituba* n. sp. has a very short smooth distal tubus with very small strongly rudimentary feet. The rings on the 4 postabdominal segments are distinct, the outer layer is only indistinct or missing.

***Monicasterix brevituba* n. sp.**

(Pl. 20, fig. 9)

**Derivatio nominis:** According to the very short distal tube

**Holotypus:** The specimen on pl. 20, fig. 9; rep.-no. KoMo 1980 I-526.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** Sample TT 3, lower part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 3 specimens.

**Diagnosis:** Test elongated spindle-shaped. Cephalis large, hemiglobular. Cephalic spicular system unknown. Apical horn large, tricarinate. Vertical horn carinate. 2 short carinate horns lie probably in prolongation of 2l.

Thorax and abdomen cylindrical. Inner pore frames with small pores arranged in irregular rings. Pore frames of outer layer irregular; on the thorax with nodes or short spines at the joints. The 3 following postabdominal segments are narrow, subcylindrical to inversely trapezoidal, proximally with a slightly nodose narrow ring, irregular and indistinct in the first postabdominal segment. The inner layer consists in these segments of 1-2 irregular pore rings with small pores. The outer layer is there indistinct and consists only of elevations of the pore frames around the inner pores. The last postabdominal segment is

inversely conical and considerably higher than the foregoing ones. It has also a narrow proximal ring and an irregular pore ring below it. The other small pores are rather irregularly spaced.

Smooth distal tubus very short, with 3 tiny, broadly triangular rudimentary feet with slightly elevated margin.

**Dimensions:**

Length of test = 209–237  $\mu\text{m}$

Maximum width of test = 72–78  $\mu\text{m}$

**Occurrence:** Lower part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** By the very short distal tubus and the very small rudimentary feet this species is well distinguished from all other known *Monicasterix* species.

***Monicasterix gabiolaensis* n. sp.**

(Pl. 21, figs. 4, 6)

**Derivatio nominis:** According to the occurrence in the Passo della Gabiola section.

**Holotypus:** The specimen on pl. 21, figs. 4, 6; rep.-no. KoMo 1980 I-527.

**Locus typicus:** Passo della Gabiola section near Recoaro

**Stratum typicum:** Sample MD 9, middle part of *Spongosilicarmiger italicus* Zone, middle part of Lower Fassanian.

**Material:** 5 specimens.

**Diagnosis:** Test subcylindrical. Cephalis large, subhemiglobular. Cephalis spicular system with Mb, A, V, 2L, D, 2l. Broad, but short multicarinate horn in prolongation of V lies on the cephalis. Broad, but very short multicarinate horns in prolongation of 2l lie on the proximal part of thorax. Arches AV and Al well visible on the cephalis as ridges. Some low ridges of the outer layer reaches from the thorax on the lower part of the cephalis. Remaining cephalis surface smooth. Only very few widely scattered pores are present on the cephalis.

Thorax cylindrical, widest segment of the test. Abdomen and following 3 postabdominal segments subcylindrical. Their width decreases continuously and very slowly.

The small pores of the inner layer are arranged into regular to irregular pore rings. The thick outer layer of the thorax and abdomen displays irregular pore frames, especially on the thorax with high walls. On the postabdominal segments the outer pore frames follow the inner pore frames, but are larger. Therefore also the outer pore frames are arranged in indistinct rings. In the first postabdominal

segment one complete and one incomplete ring are present, in the following 2 postabdominal segments only one pore ring in each segment is present.

Smooth distal tubus relatively long for the genus, broad, narrowest in its middle part. The 3 feet are rudimentary, short, broadly triangular, outer side convex, inner side excavated.

**Dimensions:**

Length of test = 201–219  $\mu\text{m}$

Maximum width of test = 65–73  $\mu\text{m}$

**Occurrence:** Middle part of Lower Fassanian *Spongosilicarmiger italicus* Zone, Southern Alps.

**Remarks:** *Monicasterix alpina* n. sp. from the lower part of the *Ladinocampe multiperforata* A.-Z. is similar, but it has only 1-2 postabdominal segments with only one distinct ring, the horns in prolongation of V and 2l are larger and the outer pore frames are also on the postabdominal segments irregular.

*Monicasterix brevituba* n. sp. has a short distal tubus and strongly rudimentary, very small feet. The test is elongated spindle-shaped.

*Monicasterix prisca* n. sp. has long, unreduced feet and a spindle-shaped test.

***Monicasterix prisca* n. sp.**

(Pl. 20, figs. 8, 10–12)

**Derivatio nominis:** Oldest known *Monicasterix* species

**Holotypus:** The specimen on pl. 20, figs. 10, 11; rep.-no. KoMo 1980 I-528.

**Locus typicus:** Val di Crema section near Recoaro.

**Stratum typicum:** Sample VCB, upper part of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 14 specimens.

**Diagnosis:** Test spindle-shaped, segments almost inseparable. Cephalis large, rounded conical. Cephalic spicular system with Mb, A, V, 2L, D, 2l. Apical horns large, tricarinate; horns in prolongation of V and 2l broad, short, multicarinate.

Following part (thorax or thorax and abdomen subcylindrical). Last segment inversely conical, separated by a distinct narrow, slightly nodose ring from the foregoing segment.

Cephalis with few, widely scattered, very small pores. partly poreless. Other segments with small pores, below the ring of the last segment arranged in an irregular pore ring, in the remaining test irregularly spaced.

Distal smooth tubus short. Terminal feet unreduced, long for the genus. Their outer side is convex, their inner side excavated.

**Dimensions:**

Length of test = 175–262  $\mu\text{m}$

Maximum width of test = 68–77  $\mu\text{m}$

**Occurrence:** Upper part of Lower Fassanian *Spongosilicarmiger italicus* Zone

**Remarks:** *Monicasterix prisca* n. sp. is by its large, unreduced distal feet easily to distinguish from all other *Monicasterix* species.

**Genus *Tubotriassocyrtes* n. gen.**

**Derivatio nominis:** According the presence of a long, smooth, poreless distal tubus and the occurrence in the Triassic.

**Type species:** *Tubotriassocyrtes angustituba* n. gen. n. sp.

**Diagnosis:** Test small, elongated spindle-shaped to subcylindrical. Cephalis large, conical to subhemispherical, with big tricarinate apical horn. Cephalic spicular system with Mb, A, V, 2L, D?, 2l. Short carinate horns are present in prolongation of V, 2L and 2l.

Following segments cylindrical, last segment inversely conical, followed by a long, narrow to broad, smooth poreless tubus with small to moderately wide round aperture.

Thorax and abdomen often covered by an outer layer with irregular moderately coarse pore frame. The postabdominal segments consist of an alteration of straps with small pores, closed or partly closed by an outer layer of microgranular silica and straps with 1-2 rings of somewhat larger pores that are not closed by an outer layer of microgranular silica. In higher evolved forms this type of wall structure is also present in the thorax and abdomen, where the outer layer with coarse pore frames is missing. In the most primitive forms the above described type of wall structure is still missing in all segments.

**Occurrence:** Middle part of Lower Fassanian to Upper Fassanian.

**Assigned species:**

*Tubotriassocyrtes angustituba* n. gen. n. sp.

*Tubotriassocyrtes annulata* n. sp.

*Tubotriassocyrtes latotuba* n. sp.

*Tubotriassocyrtes* n. sp. A (= *Eucyrtes* ? sp. H sensu YAO, 1982 = *Stichomitra* ? *triassica* DUMITRICĂ sensu KIDO, 1982)

*Tubotriassocyrtis* n. sp. B (= *Eucyrtis* ? sp. sensu KOJIMA & MIZUTANI, 1987)

**Remarks:** *Monicasterix* n. gen. is distinguished by the presence of feet at the end of the distal tubus. In higher evolved forms of this genus the feet are strongly reduced. *Monicasterix* n. gen. is seemingly the forerunner of *Tubotriassocyrtis* n. gen.

*Pseudoeucyrtis* PESSAGNO, 1977 is a homoeomorph form distinguished by the missing distal tubus. Moreover, the cephalis is distinctly smaller. Between the last occurrence of *Tubotriassocyrtis* n. gen. (Lower Ladinian) and the first occurrence of *Pseudoeucyrtis* PESSAGNO, 1977 (Middle Jurassic), there is a long time interval, where similar forms are missing. This indicate that *Pseudoeucyrtis* PESSAGNO, 1977 is a homoeomorph form that evolved iteratively from multicyrtid Jurassic radiolarians. However, our knowledge about the Upper Triassic and Lower Jurassic radiolarians is not yet well enough to exclude any relations between *Tubotriassocyrtis* n. gen. and *Pseudoeucyrtis* PESSAGNO, 1977. Independent from this question the morphologic differences are large enough to place both groups into different genera.

***Tubotriassocyrtis angustituba* n. gen. n. sp.**  
(Pl. 22, fig. 1)

**Derivatio nominis:** According to the narrow distal tubus. Holotypus: The specimen on pl. 22, fig. 1; rep.-no. KoMo 1980 I-530.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy).

**Stratum typicum:** Sample TT 3, lower part of Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 7 specimens.

**Diagnosis:** Test small, elongated spindle-shaped. Cephalis large, subhemispherical to broadly conical with large, tricarinate apical horn. The cephalis displays few, widely scattered tiny pores. Its surface is coarsely reticulated by an secondary outer layer with irregular, large pore frames. Cephalic spicular system as for the genus. Short multicarinate horns are present in prolongation of V, 2L and 2I. Horn V is situated on the cephalis, horns 2I at the boundary between cephalis and thorax and horns 2L upper part of the thorax.

Thorax cylindrical. Inner layer with very small pores totally covered by an outer layer with coarse, irregular pore frames. Abdomen outside not separated,

cylindrical and about as wide as thorax, with very small pores in its distal part, closed or partly closed by a layer of microgranular silica. The proximal part of the abdomen is (like the thorax and cephalis) covered by an outer layer displaying irregular larger pore frames. The following 2-3 postabdominal segments built up an at first cylindrical then inversely hemiglobular part of the test. The first postabdominal segment consists of a strap with 2 somewhat irregular rings of small open pores and of a strap with tiny pores, to the largest part closed by a layer of microgranular silica. In each of the two following smaller postabdominal segments beside the strap with closed or mostly closed tiny pores there exists a strap with one irregular pore ring of small pores.

Distal tubus smooth, poreless, narrow, slowly tapering against the distal end. Aperture small, round.

**Dimensions:**

Length of test = 251–263 µm

Maximum width of test = 66–74 µm

**Occurrence:** Lower part of Middle Fassanian *Ladinocampe multiperforata* Zone of Southern Alps.

**Remarks:** *Tubotriassocyrtis latotuba* n. sp. is clearly distinguished by its broader distal tubus that becomes distally somewhat broader.

*Tubotriassocyrtis annulata* n. sp. has only one postabdominal segment with strong proximal ring.

In *Tubotriassocyrtis* n. sp. A and *Tubotriassocyrtis* n. sp. B (synonyma see under the genus, assigned species) also the thorax and abdomen display straps of open and closed pores not covered by an outer layer with irregular large pore frames.

***Tubotriassocyrtis annulata* n. sp.**  
(Pl. 21, figs. 9, 11)

**Derivatio nominis:** According to the strong narrow smooth ring at the beginning of the postabdominal segment.

**Holotypus:** The specimen on pl. 21, figs. 9, 11; rep.-no. KoMo 1980 I-532.

**Locus typicus:** Val di Creme near Recoaro (Vicentinian Alps, Italy).

**Stratum typicum:** Sample VCB, upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 3 specimens.

**Diagnosis:** Test very small, subcylindrical with 2 conical ends. Cephalis large, with big tricarinate apical horn. Cephalic spicular system as for the genus. Short, broad,



carinate horns are present in prolongation of V, 2L and 2I. Horn V lies on the cephalis, horns 2I in the collar stricture, horns 2L in the upper part of the thorax. Surface of cephalis smooth or with indistinct ridges AV and AI. Cephalis poreless or with very few tiny, widely scattered pores.

Thorax cylindrical, outer layer displays irregular, moderately large pore frames. Abdomen separated from thorax by a low, indistinct smooth ridge. It is considerably lower than thorax, proximally of the same width, distally a little narrower. Outer layer displays moderately large to small pore frames. The postabdominal segment begins with a distinct, high, narrow smooth ring of about the same diameter as thorax and proximal part of abdomen. Below it lies a ring of small pores. Remaining part smooth, poreless, rapidly tapering into the long, smooth, moderately wide, poreless distal tubus.

**Dimensions:**

Length of test = 173–180  $\mu\text{m}$

Maximum width of test = 73–77  $\mu\text{m}$

**Occurrence:** Upper part of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Remarks:** By the high, narrow smooth ring at the beginning of the postabdominal segment *Tubotriassocyrtis annulata* n. sp. is easily to distinguish from the 4 other known *Tubotriassocyrtis* species. The primitive character of *T. annulata* n. sp. is indicated by the absence of the wall structure with straps of open and closed pores, present in all higher evolved *Tubotriassocyrtis* species.

*Tubotriassocyrtis latotuba* n. sp.

(Pl. 21, figs. 8, 10)

**Derivatio nominis:** According to the presence of a broad distal tubus.

**Holotypus:** The specimen on pl. 21, figs. 8, 10; rep.-no. KoMo 1970 I-531.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps)

**Stratum typicum:** Sample TT 3, lower part of the Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 5 specimens.

**Diagnosis:** Test very small, spindle-shaped. Cephalis large, subhemiglobular, with big, tricarinate apical horn. Cephalic spicular system as for the genus. 2 small, carinate horns on the boundary between cephalis and thorax are probably continuations of 2I. Two big, carinate spines in the middle part of the thorax are probably continuations of 2L. Very small horn V sometimes present. Cephalis

covered by an outer layer with coarse pore frames, displaying small nodes or even short spines on the joints. Pores of inner layer tiny, widely scattered.

Thorax cylindrical, as wide as the broadest (distal most) part of cephalis. Outer pore frames irregular, but partly the relatively small pores are arranged in rings with 6–7 pores. Abdomen and 1–2 postabdominal segments narrower than thorax and continuously tapering distalwards. They consist of a poreless strap and a strap with an irregular open pore ring with small to moderately large pores and display no outer layer. Few additional small pores may be present below the pore ring.

Distal tubus smooth, poreless, long, broad, distalwards slightly broadening. Aperture relatively large, round.

**Dimensions:**

Length of test = 170–185  $\mu\text{m}$

Maximum width of test = 63–70  $\mu\text{m}$

**Occurrence:** Lower part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** By the broad distal tubus easily to distinguish from the otherwise similar *Tubotriassocyrtis angustituba* n. gen. n. sp. that displays a narrow, distalwards tapering tubus.

**Family Planispinocyrtiidae  
KOZUR & MOSTLER, 1981**

**Remarks:** In this family D is absent in the cephalic spicular system.

The genus *Ladinocampe* KOZUR, 1984 was originally placed into the Triassocampidae KOZUR & MOSTLER, 1981. However, *Ladinocampe* evolved from *Planispinocyrtis*, KOZUR & MOSTLER, 1981 by prolongation and downward-bending of the vertical horn. By this the columella-like spine in the upper half of the shell evolved.

**Genus *Ladinocampe* KOZUR, 1984**

**Type species:** *Ladinocampe multiperforata* KOZUR 1984.

***Ladinocampe multiperforata* KOZUR, 1984**

(Pl. 22, figs. 3, 11–14; pl. 23, figs. 1, 2)

1984 *Ladinocampe multiperforata* n. gen. n. sp. –  
KOZUR, p. 73–74, pl. 5, fig. 2

**Occurrence:** *Ladinocampe multiperforata* Zone of Middle Fassanian. In the lower part of this zone the index species is accompanied by *Ladinocampe annuloperforata* n. sp. (frequent) and *Ladinocampe latiannulata* n. sp. (rare). In the upper part of the zone beside the index species *Ladinocampe vicentinensis* n. sp. is present.

**Remarks:** See under the new species.

***Ladinocampe annuloperforata* n. sp.**

(Pl. 22, figs. 2, 4–9; pl. 47, fig. 9)

**Derivatio nominis:** According to the arrangement of the pores in rings.

**Holotypus:** The specimen on pl. 22, figs. 4–6; rep.-no. KoMo 1980 I-491.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy).

**Stratum typicum:** Sample TT 5, lower part of *Ladinocampe multiperforata* Zone, Middle Fassanian

**Material:** 48 specimens.

**Diagnose:** Shell elongated conical. Cephalis small, hemiglobular to subcylindrical, smooth, poreless, with large, tricarinate apical horn. Cephalis spicular system consists of Mb, A, V, 2L, 2I. In prolongation of V a very long, columella-like foot runs until the 3.–5. postabdominal segment downward. On its inner side this blade-like foot is fused with the shell. Small spines are present in prolongation of 2L (situated at the lower part of the thorax) and in prolongation of 2I (situated in the collar stricture).

Thorax hemispherical, distinctly broader, but shorter than cephalis. The following segments increase slowly and continuously in width, but remain narrow (considerably shorter than cephalis). Abdomen mostly narrow hoop-like, with 2–3, partly irregular pore rings. Often the abdomen is already ring-like with one central pore ring like the following postabdominal segments until the end of the vertical columella. Sometimes few additional pores are present below the central pore ring. Rarely still the first postabdominal segment is hoop-like with 2 pore rings. After the end of the columella the segments consist of a high smooth ring with a pore ring below it. Toward the distal end of the shell the pores

become somewhat larger and more elongated, often with slightly elevated ridges between them. Strictures between all postabdominal segments deep, narrow and smooth. The last segment, rarely preserved, is thin-walled, cylindrical and has no ring.

**Dimensions:**

Length of test = 295–370 µm

Maximum width of test = 95–105 µm

**Occurrence:** Very rare in the middle and upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone; frequent in the lower part of *Ladinocampe multiperforata* Zone (Middle Fassanian) of Southern Alps.

**Remarks:** *Ladinocampe multiperforata* KOZUR, 1984 displays rather broad, hoop-like segments until the end of the columella that contains numerous small pores, ring-like arranged in the uppermost parts and more irregular distributed in the remaining parts of the segments.

In *Ladinocampe vicentinensis* n. sp. narrow, ring-like segments with one central pore ring may occur among the first abdominal segments, the first segment after the end of the columella is, however, always broad, inversely trapezoidal and displays many small pores.

In *Ladinocampe latiannulata* n. sp. all segments are hoop-like with numerous small pores.

***Ladinocampe latiannulata* n. sp.**

(Pl. 22, fig. 10)

**Derivatio nominis:** According to the broad hoop-like segments throughout the test.

**Holotypus:** The specimen on pl. 22, fig. 10; rep.-no. KoMo 1980 I-492.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy).

**Stratum typicum:** Sample TT 3, lower part of *Ladinocampe multiperforata* Zone, Middle Fassanian.

**Material:** 4 specimens.

**Diagnosis:** Shell slender conical. Cephalis small, conical, smooth, poreless, with big, tricarinate apical horn. Cephalic spicular system with Mb, A, V, 2L, 2I. In prolongation of V lies a very long spine that is downward-directed and columella-like fused with the segments until the second postabdominal chamber. Short, broad, tricarinate spines are present in prolongation of 2L and 2I.

Thorax subhemiglobular, not separated by a collar stricture. It has tiny irregularly distributed pores. Abdomen hoop-like, stricture against the first postabdominal segment deep. In the upper part of the

abdomen is an irregular ring of tiny pores, remaining pores irregularly scattered. The following 4-5 postabdominal segments are hoop-like (also after the end of the columella) and display numerous tiny pores, in the upper part of each segment arranged in one often somewhat irregular pore ring, in the remaining part of the segments irregularly scattered. Strictures between the postabdominal segments relatively broad, smooth, poreless.

**Dimensions:**

Length of test = 321–339  $\mu\text{m}$

Maximum width of test = 100–110  $\mu\text{m}$

**Occurrence:** Rare in the lower part of *Ladinocampe multiperforata* Zone (Middle Fassanian).

**Remarks:** *Ladinocampe latiannulata* n. sp. is the only *Ladinocampe* species, in which also at least 2 segments below the end of the columella no smooth proximal ring is present.

***Ladinocampe vicentinensis* n. sp.**

(Pl. 23, figs. ? 3, 4, 5)

**Derivatio nominis:** According to the occurrence in the Vicentinian Alps.

**Holotypus:** The specimen on pl. 23, fig. 5; rep.-no. KoMo 1980 I-495.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy).

**Stratum typicum:** Sample TT 16, upper part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 39 specimens.

**Diagnosis:** Shell slender conical. Cephalis small, smooth, poreless, subcylindrical or subconical with big tricarinate apical horn. Cephalic spicular system with Mb, A, V, 2L, 2I. Columella in prolongation of V blade-like, reaching until the third to fifth postabdominal segment, on its inner side fused with the segments. Small carinate spines are present in prolongation of 2L and 2I.

Thorax subhemispherical, considerably broader, but mostly not longer than cephalis, often even shorter. Pores tiny, numerous, irregularly scattered. Abdomen very narrow, ring-like, with 2 rings of pores. Following 2-4 postabdominal segments narrow, ring-like, with 1-2 rings of pores. At the end of the columella or immediately after its end the segments become large, inversely trapezoidal.

They begin abruptly with a smooth ring and become distally narrower until the narrow, deep stricture. These segments display numerous small pores, below the ring of each segment arranged in a pore ring, distally in each seg-

ment irregularly distributed. Most of the "post-columella" segments have irregular vertical ribs between the pores. Only in the last segment they are missing. These ribs are only exceptionally missing in primitive specimens (*L. cf. vicentinensis*).

**Dimensions:**

Length of test = 300–400  $\mu\text{m}$

Maximum width of test = 97–110  $\mu\text{m}$

**Occurrence:** Restricted to the upper part of the *Ladinocampe multiperforata* Zone (Middle Fassanian).

**Remarks:** The first postabdominal segments in *Ladinocampe multiperforata* KOZUR, 1984 are broad and hoop-like with numerous small pores. Toward the end of the columella or after its end the segments become shorter, ring like with fewer pores, finally with one pore ring below the smooth proximal ring of these segments. Vertical ribs in the "post-columella" segments are only present in some highly evolved representatives of *L. cf. multiperforata* n. sp. They may represent a new subspecies of this species.

The first postabdominal segments of *Ladinocampe annuloperforata* n. sp. may have the same shape and arrangement of pores as in *L. vicentinensis* n. sp. However, in this species the segments at the end or immediately below the columella become ring-like (one proximal smooth ring with one pore ring below it).

**Genus *Planispinocyrtis* KOZUR & MOSTLER, 1981**

**Type species:** *Planispinocyrtis baloghi* KOZUR & MOSTLER, 1981

***Planispinocyrtis baloghi***

**KOZUR & MOSTLER, 1981**

(Pl. 23, figs. 6–9, 12)

1981 *Planispinocyrtis baloghi* n.gen.n.ssp. – KOZUR & MOSTLER, p. 111–112, pl. 10, fig. 2

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone) to Lower Fassanian "*Xenoprotrachyceras*" *reitzei* Zone of Balaton Highland (Hungary).

**Remarks:** In the holotype, refigured here, the last segment was not fully preserved. Fully preserved material show that this segment has no distinct distal broadening and no skirt.

The postabdominal segments are only slightly and irregularly, partly not elevated. In this latter case they look

like a very long stricture with a pore ring, like in the holotype. In oblique view from above or below, the elevation of the postabdominal segments is better to seen, even on specimens where this elevation is not clearly recognizable in lateral view. Therefore here different views of the holotype and other specimens are given.

Mostly only one pore ring is present in each postabdominal segment, but often few additional pores are present below the proximal pore ring. They may be arranged in an incomplete second ring with wide distances between the pores or pore groups.

Very characteristic is the strong downward inclination of the vertical horn. The only other species with this feature, *Planispinocyrtis brevis* n. sp. has a distinct, moderately broad distal skirt.

In the Lower Fassanian *Planispinocyrtis pelsoensis* n. sp. the vertical horn is moderately strong downward inclined. This species is distinguished by differently shaped postabdominal segments with many pores in the first and second postabdominal segment and by a prominent proximal smooth ring in the second and third postabdominal segment.

***Planispinocyrtis ? annulata* n. sp.**

(Pl. 23, figs. 10, 11)

**Derivatio nominis:** According to the narrow smooth rings in the distal postabdominal segments.

**Holotypus:** The specimen on pl. 23, fig. 11; rep.-no. KoMo 1980 I-567.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy).

**Stratum typicum:** Sample TT 13, upper part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 11 specimens.

**Diagnosis:** Test in the apical half slender conical, in the distal half cylindrical. From the cephalis to the second or third postabdominal segment the width increases continuously and slowly, in the following segments the width remains constant. Cephalis small, subhemiglobular to subconical, smooth, poreless, with round apical horn. Cephalic spicular system unknown. In prolongation of V (?) and 2I (?) 3 small (2I) to long (V?) proximally carinate, distally round horns are present that start all on the cephalis or on the collar stricture.

Thorax, abdomen, first and second postabdominal segments hoop-like, the latter more broadly ring-like, separated by deep smooth strictures. The thorax is

generally poreless, but at the junction of the spines 2L (?) with the thoracic wall 3 small pores are present. From the abdomen to the second postabdominal segment only one central ring of small pores is present.

From the third to the eighth postabdominal segment a distinct, smooth, narrow proximal ring is present that arises sharply from the stricture. Immediately below this ring a ring of small pores is present. Remaining segment smooth, inversely trapezoidal.

**Dimensions:**

Length of test = 337-385 µm

Maximum width of test = 91-100 µm

Length of lateral horns = 30-33 µm (V)

13-15 µm (2I)

**Occurrence:** Upper part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** In contrast to all other *Planispinocyrtis* species, where the lateral horns are situated on the thorax, the 3 lateral horns in *Planispinocyrtis ? annulata* n. sp. lie all on the cephalis or on the collar stricture. The thorax is considerably smaller than in the other *Planispinocyrtis* species. The proximal rings in the distal postabdominal segments remembers to *Yeharaia* NAKASEKO & NISHIMURA, 1979, but such rings occur also in some *Triassocampe*, *Ladinocampe* and some other *Planispinocyrtis* species and are therefore not a specific taxonomic feature. *Yeharaia* is distinguished by the always missing lateral horns.

***Planispinocyrtis brevis* n. sp.**

(Pl. 23, fig. 14)

**Derivatio nominis:** According to the relatively small postabdominal part.

**Holotypus:** The specimen on pl. 23, fig. 14; rep.-no. KoMo 1980 I-46.

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** 6 specimens.

**Diagnosis:** Test small, subcylindrical, with short postabdominal part. Cephalis moderately large, subconical with large tricarinate apical horn. Cephalic spicular system with Mb, A, V, 2L, 2I. In prolongation of V, 2L and 2I large carinate horns are present, from which the horn V is the largest and strongly downward directed, whereas all other stand about perpendicular to the shell

surface. Surface of cephalis smooth, poreless or with few widely scattered tiny pores.

Thoraco-abdomen large, subglobular to subcylindrical. Thoracic part of thoraco-abdomen with tiny, irregularly distributed pores, often closed by a layer of microgranular silica. Abdominal part of thoraco-abdomen as broad as thorax, but considerably shorter, with one or two irregular pore rings. Only 2 postabdominal segments are present. The first is shallow hoop-like with one pore ring and very few, widely scattered pores below this ring. The second is proximally cylindrical, with one pore ring, distally widened to a moderately wide skirt with one ring of mostly closed pores. Strictures after the abdomen and after the first postabdominal segment shallow, after the abdomen often moderately deep here often rather broad.

**Dimensions:**

Length of test = 153–185 µm

Maximum width of test (without last segment) = 55–69 µm

Width of skirt = 65–74 µm

**Occurrence:** Illyrian of Balaton Highland.

Remarks: *Planispinocyrtis* <sup>^</sup>*brevis* n. sp. is by its short postabdominal part with only 2 postabdominal segments distinguished from the most other *Planispinocyrtis* species. Most similar is *Planispinocyrtis baloghi* KOZUR & MOSTLER, 1981 which has, however, 4 postabdominal segments that are only slightly and irregularly, partly not elevated. Moreover, this species displays no distal widening skirt.

*Planispinocyrtis ? gabiolaensis* n. sp.

(Pl. 23, fig. 13)

**Derivatio nominis:** According to the occurrence in the Passo della Gabiola section.

**Holotypus:** The specimen on pl. 23, fig. 13; rep.-no. KoMo 1980 I-568.

Locus typicus: Passo della Gabiola near Recoaro, Vicentian Alps (Italy).

**Stratum typicum:** Sample MD 1, lower subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 3 specimens.

**Diagnosis:** Cephalis moderately large, elongated subhemiglobular, smooth, poreless. Apical horn moderately large, tricarinate. Lateral horn in prolongation of V (?) large, basally blade-like high. Upper line with sharp bent downward inclined, lower line perpendicular to the thorax. Lateral horns in prolongation of 2l (?)

moderately large, broad, tricarinate. Thorax inflated, hemiglobular, considerably broader, but not higher than cephalis, with numerous small pores. Pore frames a little elevated, with small nodes on the joints. Two V-shaped (above open) shallow vertical incisions are present between the horns V (?) and 2l (?). At the end of these incisions a small, indistinct node-like elevation may be present. From here indistinct ribs run inside the shell to the upper end of the horns V (?) and 2l (?).

Abdomen considerably lower and narrower than thorax, separated from the thorax by a shallow, smooth, poreless stricture. The abdomen displays a central ring of small pores.

The following 6 postabdominal segments are narrow, sharply contrasted against the deep, smooth, poreless strictures that are partly somewhat broader than the segments. These segments become very slowly and continuously broader. The sixth postabdominal segment is about as broad as the thorax. All these 6 postabdominal segments have a central ring of small round pores that become distalwards a little larger.

The following postabdominal segments are somewhat higher than the foregoing ones and about as wide as the sixth postabdominal segment or a little wider. They display a pore ring of vertically elongated pores and a second, irregular or incomplete pore ring of small round pores below it.

**Dimensions:**

Length of test = 331–346 µm

Maximum width of test = 72–74 µm

Length of horn V (?) = 37–40 µm

**Occurrence:** Lower part of Lower Fassanian *Spongosilicarmiger italicus* Zone, Southern Alps.

**Remarks:** *Planispinocyrtis ? gabiolaensis* n. sp. belongs to a group of *Planispinocyrtis* species (*P. ? longispinosa* n. sp., *P. ? nishimurai* n. sp. and *P. ? thoraciglobulosa* n. sp.) that displays no horns or rudimentary horns in prolongation of 2L. Only in *P. ? longispinosa* n. sp. the cephalic spicular system is known that displays no spicule D, like in typical *Planispinocyrtis* species. By the presence of only 3 lateral horns this group is similar to the genus *Tetraspinocyrtis* n. gen., in which, however, the horns are situated in prolongation of D and 2L and D is never missing in the cephalic spicular system. Forms, in which the spicular system is not yet known, are here placed tentatively to *Planispinocyrtis* KOZUR & MOSTLER, 1981.

The Upper Fassanian *Planispinocyrtis ? longispinosa* n. sp. is distinguished by longer lateral horns, specially also the horns 2l are very long.

The Middle Fassanian *Planispinocyrtis* ? *nishimurai* n. sp. has a globular thorax.

The higher Middle Fassanian *Planispinocyrtis* ? *thoraciglobulosa* n. sp. displays a globular thorax. Abdomen as well as first postabdominal segment display more than one pore ring.

The higher Middle Fassanian *Planispinocyrtis* ? *annulata* n. sp. has a small thorax and the fourth to eighth postabdominal segments have a high, narrow, smooth proximal ring.

In all other *Planispinocyrtis* species there are 5 lateral horns (horns 2L not reduced).

***Planispinocyrtis haeckeli* n. sp.**

(Pl. 24, figs. 1–3)

**Derivatio nominis:** In honour of E. HAECKEL, the most famous pioneer of the radiolarian research.

**Holotypus:** The specimen on pl. 24, figs. 1, 3; rep.-no. KoMo 1980 I-236.

**Locus typicus:** Road cut San Ulderico-Pallé. Tretto (Vicentinian Alps, Italy).

**Stratum typicum:** Sample TT 7, lower part of *Ladinocampe multiperforata* Zone, Middle Fassanian. Southern Alps.

**Material:** 53 specimens.

**Diagnosis:** Test subcylindrical with distal skirt. Cephalis moderately large, subglobular to hemiglobular, with big tricarinate apical horn. Cephalic spicular system with Mb, A, V, 2L, 2I. A very strong and high, carinate, a little downward directed horn lies in prolongation of V; 2 very small horns are present in prolongation of 2L, and 2 small carinate horns are situated in continuation of 2I. All these horns are situated almost in one plane on the thorax, only the horns 2L are situated a little deeper, in the stricture below the thorax. Surface of cephalis poreless, granulate.

Thoraco-abdomen large, subglobular to subcylindrical. Dividing stricture between thorax and abdomen very shallow, very narrow, smooth or with few indistinct ribs, poreless. Abdomen as wide as thorax, but considerably lower. Thoracic part of the thoraco-abdomen with irregularly scattered very small pores with slightly elevated margins of the pore frames. Abdominal part of thoraco-abdomen with one proximal ring of small pores. Few tiny pores of the remaining part closed by a layer of microgranular silica. Following strictures deep, broad, entirely smooth. Three postabdominal segments high, narrow, both proximally and distally steeply dipping,

broadest below a central ring of pores, that are smallest in the first postabdominal segment and largest in the third postabdominal segment. Fourth postabdominal segment considerably larger than the foregoing segments, proximally trapezoidal, with one ring of large pores, distally with a moderately broad skirt displaying a second ring of large pores.

**Dimensions:**

Length of test = 246–260  $\mu\text{m}$

Maximum width of test (without last segment) = 69–73  $\mu\text{m}$

Width of skirt = 131–137  $\mu\text{m}$

**Occurrence:** Lower part of Middle Fassanian. *Ladinocampe multiperforata* Zone.

**Remarks:** In the most *Planispinocyrtis* species at least the first postabdominal segment has numerous small pores beside the pore ring. The species with only one pore ring on the first postabdominal segment are distinguished from *Planispinocyrtis haeckeli* n. sp. as follows:

The Illyrian to deeper Lower Fassanian *P. baloghi* KOZUR & MOSTLER, 1981 has broad, but shallow, sometimes even missing constrictions between the postabdominal segments that are, moreover, not so high and partly even not elevated. All 5 horns on the thorax are large, the cephalic horn is strongly downward directed, the cephalis is longer, subconical.

The Illyrian *Planispinocyrtis pulchra globulata* n. subsp. displays beside the central pore ring in the first postabdominal segment still single, widely scattered pores, the distal skirt is very small and all horns on the thorax are large.

The Illyrian *Planispinocyrtis brevis* n. sp. has a shorter postabdominal part with only 2 postabdominal segments, the first postabdominal segment displays some additional, widely scattered pores below the pore ring, the horns on the thorax are all large and the distal skirt is somewhat smaller and displays smaller pores.

The higher Middle Fassanian *Planispinocyrtis paronai* n. sp. has a globular thorax and the abdomen is distinctly separated.

***Planispinocyrtis illyrica* n. sp.**

(Pl. 24, figs. 4–7)

**Derivatio nominis:** According the frequent occurrence in the Illyrian of the Balaton Highland.

**Holotypus:** The specimen on pl. 24, figs. 4, 6; rep.-no. KoMo 1980 I-43.

**Locus typicus:** Felsöörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffit, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** 29 specimens.

**Diagnosis:** Test subcylindrical with moderately broad distal skirt. Cephalis moderately large, subhemispherical, poreless, with granulate surface. Cephalic spicular system with Mb, A, V, 2L, 2I. In prolongation of V, 2L and 2I large, carinate horns are present, all located on the thorax.

Thoraco-abdomen large, broadest in the thoracic part, here with tiny, mostly irregularly distributed pores, sometimes also arranged in irregular rings. At least in the proximal part an outer layer with somewhat larger, irregular pore frames is present. Abdominal part separated by a narrow, smooth, poreless shallow stricture. It is shorter and somewhat narrower than or as wide as the thoracic part and has one proximal pore ring of small pores. Below this pore ring scattered tiny pores are present, often closed by a layer of microgranular silica. Strictures against the first postabdominal segment and between the postabdominal segments deep, smooth, poreless.

The first 3 postabdominal segments are high, rounded, hoop-like, with one central ring of small, in the second and third postabdominal segment somewhat larger roundish pores. The first postabdominal segment displays often few widely scattered tiny pores below the pore ring. Fourth postabdominal segment bell-shaped, with moderately wide skirt. In the proximal part one ring of vertically elongated pores is present. In the skirt occur a ring of widely scattered, moderately large pores.

**Dimensions:**

Length of test = 200–240 µm

Maximum width of test (without last segment) = 62–68 µm

Width of skirt = 85–98 µm

**Occurrence:** Illyrian of Balaton Highland.

**Remarks:** The Illyrian *Planispinocyrtis pulchra* n. sp. has only a very small skirt.

The Middle Fassanian *Planispinocyrtis haeckeli* n. sp. has with exception of the apical and vertical horns only small horns, the postabdominal segments are not broadly rounded and the distal skirt is larger and has larger pores.

*Planispinocyrtis baloghi* KOZUR & MOSTLER, 1981 has only slightly and irregularly elevated postabdominal segments, the ventral horn is strongly downward directed and the distal end is not widened.

***Planispinocyrtis ? longispinosa* n. sp.**

(Pl. 24, figs. 8, 10, 11)

**Derivatio nominis:** According to the very long lateral horns V and 2I.

**Holotypus:** The specimen on pl. 24, figs. 8, 10, 11; rep.-no. KoMo 1980 I-571.

**Locus typicus:** Köveskál (Balaton Highland, Hungary), section at the cemetery.

**Stratum typicum:** Limestone lenses within tuffites, sample 4b, 10 cm below sample 4, *Budurovignathus truempyi* A.Z., Upper Fassanian.

**Material:** 4 specimens.

**Diagnosis:** Cephalis moderately large, subconical with broadly rounded apical part. Apical horn moderately large, tricarinate, asymmetrically located nearer to horns 2I. Cephalic spicular system with Mb, A, V, 2L, short 2I. The spine A is obliquely upward directed. 3 very long lateral spines are present in prolongation of V and 2I. Horn V is basally very high, and slightly downward directed.

Thorax large, subglobular, between the horns V and 2L incised (V-shaped incision above open), with small pores arranged in irregular rings.

Abdomen considerably lower and narrower than thorax, with one central pore ring. First to fourth postabdominal segments highly elevated, somewhat higher and broader than abdomen, with one proximal pore ring. In the first to third postabdominal segment the outline is trapezoidal in the proximal part of the segments, and inversely trapezoidal in their distal part. The fourth postabdominal segment is narrow ring-like in its proximal part (with pore ring) and inversely trapezoidal in its distal part. The fifth postabdominal segment is again narrower, slowly hoop-like, with central pore ring. Further segment(s) not preserved.

**Dimensions:**

Length of test = 272–285 µm

Maximal width of test = 73–77 µm

Length of lateral horns: 50–61 µm

**Occurrence:** Upper Fassanian of Balaton Highland (Hungary).

**Remarks:** By its unusual long lateral horns in prolongation of V and 2I distinguished from all other *Planispinocyrtis* species. Moreover, only in the Lower Fassanian *Planispinocyrtis ? gabiolaensis* n. sp., in the Middle Fassanian *P. ? nishimurai* n. sp. and in the Middle Fassanian *P. ? thoraciglobulosa* n. sp. that display all large globular to hemiglobular thorax, the horns 2L are missing or rudimentary (*P. ? thoraciglobulosa* n. sp.). From these species *P. ? thoraciglobulosa* n. sp. is easily to

distinguish by the larger abdomen with numerous small pores. In *Planispinocyrtis* ? *nishimurai* n. sp. the segmentation is similar and the pore ring on the post-thoracic segments is similar arranged, but the lateral horns are considerably shorter.

***Planispinocyrtis macrocephalis* n. sp.**

(Pl. 24, figs. 9, 12)

**Derivatio nominis:** According to the large cephalis

**Holotypus:** The specimen on pl. 24, figs. 9, 12; rep.-no. KoMo 1980 I-47.

**Locus typicus:** Felsöör (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** 10 specimens.

**Diagnosis:** Test short subcylindrical. Cephalis very large, with few tiny, widely scattered pores. Surface with few, indistinct, low, narrow ribs between the horns, otherwise smooth. Cephalic spicular system with Mb, A, V, 2L, 2l. Apical horn stout, large, tricarinate. Carinate horns in prolongation of V, 2L, 2l large.

Thoraco-abdomen large, subcylindrical. Thoracic part large, but not or only a little wider and somewhat lower than cephalis. Abdominal part separated by narrow, shallow smooth poreless constriction. Thoracic part with widely scattered small pores. Abdominal part as wide as thoracic part or a little narrower, considerably lower than thoracic part and with 1-2 irregular rings of small pores.

First postabdominal segment low, rounded, with small pores, often arranged into 1-2 rings. Second postabdominal segment large, bell-shaped. In the cylindrical long upper part lies proximally a ring with large pores. Distal skirt narrow to moderately broad, with 6 broadly triangular distal appendages.

**Dimensions:**

Length of test = 165–175 µm

Maximum width of test (without skirt) = 60–63 µm

Width of skirt = 75–79 µm

**Occurrence:** Illyr (*Paraceratites trinodosus* Zone) of Balaton Highland.

**Remarks:** *Planispinocyrtis macrocephalis* n. sp. is easily to distinguish from the other *Planispinocyrtis* species by its very large cephalis and by the triangular distal appendages.

***Planispinocyrtis multiporata* n. sp.**

(Pl. 25, figs. 1, 3, 5, 6, 9)

**Derivatio nominis:** According to the numerous small pores at least in the first postabdominal segment.

**Holotypus:** The specimen on pl. 25, figs. 5, 9; rep.-no. KoMo 1980 I-540.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy).

**Stratum typicum:** Sample TT 7, lower part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 69 specimens.

**Diagnosis:** Test cylindrical with wide distal skirt. Cephalis moderately large, poreless, granulat. Cephalic spicular system with Mb, A, V, 2L, 2l. Apical horn large, carinate, distally roundish. Vertical horn multicarinate, large, somewhat upward directed. Its upper carina begins in the lower part of the cephalis. The other horns are small, broad, carinate and are totally situated on the thorax, the lower ridge of horns 2L may even reaches down until the uppermost part of the abdomen.

Thoraco-abdomen subcylindrical, only slightly divided into thoracic and abdominal part by a narrow, poreless very shallow constriction, near to the horns crossed by low narrow ridges in prolongation of the carinae of the horns. The abdominal part is lower, but a little broader than the thoracic part due to a slight, hoop-like elevation. Both thoracic and abdominal part of the thoraco-abdomen are covered by tiny pores, in the abdominal part at least proximally arranged in a ring, also below it and in the distal thoracic part sometimes arranged in indistinct rings.

Constriction after the abdomen and between the postabdominal segments deep, proximally rather narrow, distally somewhat wider. They are smooth, poreless. The first 2 postabdominal segments are hoop-like and displays numerous small pores, proximally arranged in a pore ring, distally irregularly distributed. In the second postabdominal segment these pores are somewhat larger than in the first one and their number is lower. The third postabdominal segment is, depending from the subspecies either also rounded hoop-like with one proximal pore ring and additional pores, often arranged in a second ring, or it is narrower with one central pore ring and a low, narrow proximal smooth ring. The fourth postabdominal ring is considerably larger with subcylindrical proximal part and large distal skirt. The proximal part has a proximal ring of large pores. Below it a second incomplete ring of pores may be present. The skirt displays one ring of large pores.



**Dimensions:**

Length of test = 257–293  $\mu\text{m}$

Maximum width of test (without last segment) = 67–73  $\mu\text{m}$

Width of skirt = 119–127  $\mu\text{m}$

**Occurrence:** Middle Fassanian *Ladinocampe multiperforata* Zone of Southern Alps.

**Remarks:** In the Illyrian to Lower Fassanian *Planispinocyrtis baloghi* KOZUR & MOSTLER, 1981, in the Illyrian *P. illyrica* n. sp., in the Illyrian *P. brevis* n. sp. and in the Middle Fassanian *P. haeckeli* n. sp. already the first postabdominal segment has only one central pore ring. Moreover, in *P. baloghi* n. sp. and *P. brevis* n. sp. all horns are large, the ventral horn is strongly downward directed. *P. baloghi* n. sp. has no skirt.

The species with numerous pores in a hoop-like first postabdominal segment as in *P. multiporata* n. sp. are distinguished from this species as follows:

The Lower Fassanian *Planispinocyrtis pelsoensis* n. sp. displays a prominent proximal smooth ring on the second and third postabdominal segment. Moreover, the ventral horn is distinctly downward directed.

The basal Fassanian *Planispinocyrtis praecursor* n. sp. has a very high, blade-like vertical horn. Its upper line is strongly downward directed. Moreover, this species has 6 postabdominal segments.

The Illyrian *Planispinocyrtis pulchra* n. sp. has only a minute skirt and all horns on the thorax have the same size.

***Planispinocyrtis multiporata multiporata* n. subsp.**

(Pl. 25, figs. 3, 5, 9)

**Holotypus** = Holotypus of the species.

**Material:** 41 specimens.

**Diagnosis:** With the character of the species. The first 3 postabdominal segments are hoop-like with many small pores that become from the first to the third postabdominal segments somewhat larger. The pores between the proximal pore ring are irregularly distributed. Only in the third pore ring they may be arranged in a second pore ring. Fourth postabdominal ring with additional moderately large pores below the proximal pore ring with moderately large pores.

**Occurrence:** Middle Fassanian *Ladinocampe multiperforata* Zone of Southern Alps.

**Remarks:** See also at the species. In *Planispinocyrtis multiporata annuloporata* n. subsp. the second postabdominal segment is hoop-like to inversely sub-

trapezoidal. Below the proximal ring of small pores lies only an incomplete, irregular second ring of tiny pores. The third segment is inversely subtrapezoidal and has only one ring of moderately large pores. The fourth postabdominal segment has only one proximal ring with large, vertically elongated pores without additional pores.

***Planispinocyrtis multiporata annuloporata* n. subsp.**

(Pl. 25, figs. 1, 6)

**Derivatio nominis:** According to the arrangement of the pores in the single rings in the last 2 postabdominal segments.

**Holotypus:** The specimen on pl. 25, fig. 1; rep.-no. KoMo 1980 I-239.

**Locus typicus:** Road cut San Ulderico-Pallé. Tretto (Vicentinian Alps, Italy).

**Stratum typicum:** sample TT 7, lower part of Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 28 specimens.

**Diagnosis:** With the character of the species. Second postabdominal segment hoop-like to subtrapezoidal, with one proximal pore ring and tiny pores below it that are arranged in a second incomplete ring. Third postabdominal ring inversely subtrapezoidal, with slow, narrow smooth proximal ring followed by pore ring with relatively large pores. No additionally pores. Last segment with proximal ring of large, vertically elongated pores, without additional pores. **Remarks:** See also at the species. In *Planispinocyrtis multiporata multiporata* n. subsp. the first 3 postabdominal segments are hoop-like and display numerous small pores, arranged in a proximal pore ring below which they are irregularly spaced. Also the last segment has still some additional large pores below the proximal pore ring.

***Planispinocyrtis ? nishimurai* n. sp.**

(Pl. 25, figs. 10, 11)

**Derivatio nominis:** In honour of Prof. Dr. A. NISHIMURA, Osaka.

**Holotypus:** The specimen on pl. 25, fig. 11; rep.-no. KoMo 1980 I-570.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy).

**Stratum typicum:** Sample TT 6, lower part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 21 specimens.

**Diagnosis:** Cephalis moderately large, rounded subconical, smooth, poreless. Cephalic spicular system unknown.

Thorax globular, with numerous tiny pores. Horn in prolongation of V (?) large, downward inclined. Horns in prolongation of 2l (?) moderately large.

The abdomen is considerably lower than the thorax, but it has the same width. The following segments increase very slowly in width, whereas their height remains nearly constant. Abdomen to second postabdominal segment in their upper part (with pore ring) with trapezoidal outline, in their lower part (poreless) with inversely trapezoidal outline. Pore ring with small pores. Following third to seventh postabdominal segments high, narrow, sharply contrasted against the deep, smooth, poreless strictures. Their middle part is mostly straight, with a ring of moderately large pores, but some of these segments may be also inversely trapezoidal.

**Dimensions:**

Length of test = 254–285 µm

Maximum width of test = 66–77 µm

Length of horn V (?) = 32–40 µm

Length of horns 2l (=) = About 25 µm

**Occurrence:** Lower part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** In the Lower Fassanian *Planispinocyrtis* ? *gabolaensis* n. sp. already the first 2 postabdominal segments are sharply contrasted against the deep strictures. The thorax is considerably broader than the abdomen and has a hemiglobular shape.

The Upper Fassanian *Planispinocyrtis longispinosus* n. sp. is distinguished especially by its very long horns 2l.

***Planispinocyrtis paronai* n. sp.**

(Pl. 26, fig. 1)

**Derivatio nominis:** In honour of C.F. PARONA, one of the pioneers of the fossil Radiolaria research.

**Holotypus:** The specimen on pl. 26, fig. 1; rep.-no. KoMo 1980 I-571.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** sample TT 13, upper part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 7 specimens.

**Diagnosis:** Cephalis moderately large, smooth, poreless, with asymmetrically situated apical horn. It is tricarinate with broad, deep furrow between the ridges that are sub-

divided by a central relatively deep furrow into 2 ridges. By this the apical horn looks hexacarinata. The uppermost part of the apical horn is round. Cephalic spicular system unknown, but the 5 lateral horns are probably prolongations of V, 2L and 2l. The horns V and 2L are basally high, specially horn V almost blade-like. Horns 2l are shorter, broad, multicarinate.

Thorax large, inflated, globular, considerably wider and higher than cephalis, with numerous tiny irregularly spaced pores.

Abdomen narrower and lower than thorax, distinctly separated by deep, smooth, poreless stricture hoop-like with central ring of very small pores. Following 3 postabdominal segments separated by very deep, broad, smooth, poreless strictures. They are also hoop-like with central pore ring. In the first 2 postabdominal segments the pores are small, in the third postabdominal segment the pores are moderately large, roundish to subrectangular.

The fourth postabdominal segment displays a cylindrical proximal part with a proximal pore ring of large, roundish pores and a distal, moderately wide skirt with a ring of large, elongated pores.

**Dimensions:**

Length of test = 244–278 µm

Maximum width of test (without skirt) = 74–77 µm

Width of skirt = 96–99 µm

**Occurrence:** Upper part of Middle Fassanian *Ladinocampe multiperforata* Zone of Southern Alps.

**Remarks:** The Illyrian *Planispinocyrtis pulchra globulata* n. subsp. displays also a globular cephalis, a distinctly separated hoop-like abdomen and similar postabdominal segments with one pore ring. However, the abdomen displays pores additional to the pore ring, the skirt of the fourth postabdominal segment is very narrow and this segment displays only one pore ring.

Most similar is *Planispinocyrtis haeckeli* n. sp. from the lower part of the Middle Fassanian *Ladinocampe multiperforata* Zone. However, this species has a thoraco-abdomen. The abdominal part is only a little separated from the thoracic part by an indistinct, shallow stricture and it is as wide as the thoracic part.

***Planispinocyrtis pelsoensis* n. sp.**

(Pl. 25, fig. 12)

**Derivatio nominis:** According to the occurrence in the Balaton Highland (lat. Lake Balaton = Pelso).

**Holotypus:** The specimen on pl. 25, fig. 12; rep.-no. KoMo 1980 I-533.

**Locus typicus:** Felsöőrs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone sample FÖ 110, greenish-gray limestone, upper part of the pietra verde, upper 'Xenoprotrachyceras' reitzi Oppel Zone above the last occurrence of the index species. Upper subzone of *Spongosilicarmiger italicus* Zone (Lower Fassanian).

**Material:** 7 specimens.

**Diagnosis:** Test subcylindrical. Cephalis moderately large, subhemiglobular to globular with very big tricarinate apical horn. Surface poreless, smooth to microgranular, with slow ridge AV and AI. Cephalic spicular system unknown. Thorax considerably larger than cephalis, subhemiglobular, with very small, irregularly scattered pores on the inner layer and coarser pore frames of the outer layer. Very strong, tricarinate spine seemingly in prolongation of V obliquely downward directed. 2 distinct carinate horns in opposite position seemingly in prolongation of 2l. Two further smaller spines on the thorax lies seemingly in prolongation of 2L.

Constriction against abdomen relatively broad and deep and therefore no thoraco-abdomen is present. Abdomen hoop-like, about as high and broad as thorax, with numerous small, irregularly spaced pores.

First postabdominal segment about as large as abdomen, in the upper part hoop-like, in the lower part inversely trapezoidal, proximally sharply set off against the stricture by a slightly nodose, narrow, low, often indistinct ring. Below it a pore ring with small pores is present. The numerous other small pores are irregularly spaced.

The next 2 postabdominal segments are inversely trapezoidal, proximally sharply set off against the deep strictures by a narrow, prominent smooth ring. Below this ring lies a pore ring with small pores in the second postabdominal segment and somewhat larger pores in the third postabdominal segment. Below this pore ring small, irregularly scattered pores are present in the second postabdominal segment, whereas the narrower third postabdominal segment is below the pore ring poreless. Last, distally expanded segment not preserved in our material.

**Dimensions:**

Length of test = 263–290 µm

Maximum width of test = 86–95 µm

**Occurrence:** Upper part of *Spongosilicarmiger italicus* Zone (Lower Fassanian), Balaton Highland. In the Middle Fassanian *Ladinocampe multiperforata* Zone a similar form (*P. cf. annulata* n. sp.) occurs, in which the abdomen and first abdominal segment are lower than in typical forms.

**Remarks:** The generic position of this species is somewhat unsure, because the cephalic spicular system is unknown. Because of the position and arrangement of the horns a placement into the genus *Planispinocyrtis* KOZUR & MOSTLER, 1981 is probably.

In the Illyrian *Planispinocyrtis pulchra* n. sp. the thorax and abdomen are not or only slightly separated by a shallow, narrow stricture and the abdomen is considerably lower than the thorax within the thoraco-abdomen. The proximal smooth rings on the postabdominal segments are not so strong and the second postabdominal segment has only few additional tiny pores below the proximal pore ring.

In the Middle Fassanian *Planispinocyrtis multiporata annulopora* n. subsp. the abdomen is only slightly separated from the thorax in the thoraco-abdomen. The smooth proximal ring in the postabdominal segments is not so prominent, in the nominate subspecies of *Planispinocyrtis multiporata* n. sp. missing.

***Planispinocyrtis pulchra* n. sp.**

(Pl. 25, figs. 2, 4, 8; pl. 26, fig. 2)

**Derivatio nominis:** pulcher (-ra, rum) = beautiful (lat.)

**Holotypus:** The specimen on pl. 26, fig. 2; rep.-no. KoMo 1980 I-41.

**Locus typicus:** Felsöőrs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** 31 specimens.

**Diagnosis:** Test subcylindrical. Cephalis moderately large, subconical to subhemiglobular, smooth, poreless, with big tricarinate apical horn. Cephalic spicular system with Mb, A, V, 2L, 2l. Stout tricarinate horns are present in prolongation of V, 2L and 2l, situated in one, often slightly oblique plane in the upper part of the thorax. Upper edge of horn V begins in the lower part of cephalis, upper edge of horns 2l begins in the collar stricture.

Thoraco-abdomen large, globular to elongated subglobular, either subdivided by a very shallow, indistinct, poreless, smooth stricture into higher thorax and narrow abdomen or undivided. Pores small, on the thoracic part irregularly distributed, overlain, but not closed by an outer layer with larger pore frames. In the abdominal part one pore ring is present, regular in forms with divided thoraco-abdomen and indistinct, irregular in forms with undivided thoraco-abdomen. First postabdominal segment rather

broad, hoop-like, with indistinct smooth or slightly nodose, narrow proximal ring, followed by a pore ring with small pores, below it with tiny irregularly and widely spaced pores. Stricture against thoraco-abdomen and against the second postabdominal segment deep, rather narrow. The following strictures are also deep and mostly broader.

Following 2-3 postabdominal segments high, either narrow hoop-like (especially the second postabdominal segment) or inversely trapezoidal, with one pore ring below a narrow, indistinct to distinct smooth proximal ring. Pores become somewhat larger in the distal segments. Few single widely scattered tiny pores may be present between or below the larger pores of the pore ring.

Last postabdominal segment is proximally cylindrical, distally a little skirt-like broadened. It has one ring of vertically elongated large pores.

**Dimensions:**

Length of test = 253–285  $\mu\text{m}$

Maximum width of test = 70–73  $\mu\text{m}$

Maximum width of skirt = 77–81  $\mu\text{m}$

Occurrence: Illyrian of Balaton Highland (Hungary).

**Remarks:** The Lower Fassanian *Planispinocyrtis pelsoensis* n. sp. has a clearer separated hoop-like abdomen as large as the thorax. The proximal ring on the second and following postabdominal segments is prominent.

In the Lower to Middle Fassanian *Planispinocyrtis multiperforata*, the first 2-3 postabdominal segments are broad, hoop-like, with numerous pores arranged only proximally in a ring. The skirt is large.

In the Illyrian *Planispinocyrtis illyrica* n. sp. all postabdominal segments with exception of the last one are hoop-like, also the segments with only one pore ring. The distal skirt is moderately broad.

In *Planispinocyrtis baloghi* KOZUR & MOSTLER, 1980 the strictures between the postabdominal segments are broader, shallower, partly even missing and the postabdominal segments are lower, partly even not elevated, all with only one pore ring and without smooth proximal narrow ring.

The Illyrian *Planispinocyrtis brevis* n. sp., has a shorter postabdominal test and a broader skirt.

***Planispinocyrtis pulchra pulchra* n. subsp.**

(Pl. 26, fig. 2)

**Holotype:** as for the species.

**Diagnosis:** With the character of the species. Elongated subglobular thoraco-abdomen subdivided by a narrow, shallow, smooth, poreless stricture into a larger thorax and a narrow abdomen, as broad as the thorax. The abdomen has one proximal pore ring with small pores. Other pores tiny and irregularly scattered as on the thorax. Proximal slightly nodose ring on the postabdominal segments rather distinct.

**Remarks:** See also at the species. *Planispinocyrtis pulchra globulata* n. subsp. has an undivided globular thoraco-abdomen. The proximal, narrow, slightly nodose ring on the postabdominal segments is indistinct, if present.

***Planispinocyrtis pulchra globulata* n. subsp.**

(Pl. 25, figs. 2, 4, 8)

**Derivatio nominis:** According to the undivided, globular thoraco-abdomen.

**Holotypus:** The specimen on pl. 25, figs. 2, 4, 8; rep.-no. KoMo 1980 I-42.

**Locus typicus and stratum typicum:** as for the species.

**Diagnosis:** With the character of the species. The thoraco-abdomen is globular and undivided. Thorax and abdomen only differentiated by their sculpture. The thoracic part of the thoraco-abdomen has an outer layer with coarser pore frames, on the abdominal part of the thoraco-abdomen the outer layer is missing. The proximal, narrow, slightly nodose ring on the postabdominal segments is indistinct, if present.

**Remarks:** See also at the species. The undivided globular thoraco-abdomen distinguishes *Planispinocyrtis pulchra globulata* n. sp. both from the nominate subspecies and from other *Planispinocyrtis* species.

The Fassanian ? *Planispinocyrtis longispinosa* group (*P. ? gabiolaensis* n. sp., *P. ? longispinosa* n. sp., *P. ? nishimurai* n. sp., *P. ? thoraciglobulosa* n. sp.) that displays an undivided globular to subglobular thorax and distinctly separated abdomen is clearly distinguished by the missing or rudimentary horns 2L.

***Planispinocyrtis praecursor* n. sp.**

(Pl. 25, figs. 7, ? 13, 14)

**Derivatio nominis:** According the phylomorphogenetic position within the *P. multiporata* group.

**Holotypus:** The specimen on pl. 25, fig. 7; rep.-no. KoMo 1980 I-74.

**Locus typicus:** Felsöors (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 100 D, lowermost part of 'Xenoprotrachyceras' reitzi Oppel Zone (*Kellnerites* fauna), basal Fassanian.

**Material:** 29 specimens.

**Diagnosis:** Test cylindrical. Cephalis subhemiglobular, moderately large, smooth, poreless. Apical horn large, tricarinate. Cephalic spicular system with Mb, A, V, 2L, 2I. Vertical horn large, very high (bladelike), lower boundary line slightly downward directed, upper boundary line strongly downward directed with distinct bend in the basal part. Other horns in prolongation of 2L and 2I small, broad, carinate.

Thoraco-abdomen subglobular to subcylindrical, indistinctly separated in large subhemiglobular thoracic part and narrow cylindrical abdominal part that has the same width as the thoracic part, but is considerably narrower. Separating poreless stricture very narrow and shallow, overgrown by the multicarinate horns 2L. Thoracic part with tiny, irregularly spaced pores on the inner layer that is overgrown by an outer layer with large, irregular pore frames. Abdominal part with one or two rings of tiny pores. Outer layer missing.

The 3 first postabdominal segments are hoop-like, separated by deep, narrow, smooth, poreless strictures. They display numerous small pores, often arranged in regular to irregular rings. The next 2 postabdominal segments are narrower and have only one central ring of small pores that are a little larger than the pores of the foregoing segments. Sixth segment in the typical material only partly preserved, with one proximal pore ring. Distal part not preserved. In similar Middle Fassanian forms with broad distal skirt.

**Dimensions:**

Length of test = 279–291 µm

Maximum width of test (without last segment) = 71–80 µm

Width of skirt (*P. cf. praecursor*) = 112–120 µm

**Occurrence:** Basal Fassanian of Balaton Highland (Hungary). Similar forms (*P. cf. praecursor* n. sp.) occur in the Middle Fassanian of the Southern Alps.

**Remarks:** In *Planispinocyrtis cf. praecursor* n. sp. from the Middle Fassanian of the Southern Alps the vertical

horn is not blade-like high and downward directed and the thorax is not covered by an outer layer. All other features are identical. Probably these forms represent a new subspecies, but the preservation is not well enough for establishing this taxon.

*P. praecursor* n. sp. is the oldest representative of the *P. multiperforata* group that is dominant during the Lower Ladinian, but it may be also the forerunner of the *Planispinocyrtis ? longispinosus* group with rudimentary or missing horns 2L and numerous postabdominal segments.

***Planispinocyrtis ? thoraciglobulosa* n. sp.**

(Pl. 26, figs. 3, 4, 9)

**Derivatio nominis:** According to the globular, inflated thorax.

**Holotypus:** The specimen on pl. 26, figs. 3, 4, 9; rep.-no. KoMo 1980 I-362.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy).

**Stratum typicum:** Sample TT 16, upper part of the Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 15 specimens.

**Diagnosis:** Cephalis moderately large, elongated subhemiglobular, smooth, poreless. Cephalic spicular system unknown. Apical horn moderately large, tricarinate. Horn in prolongation of V (2) large, downward inclined. Horns in prolongation of 2I(?) moderately large. All lateral horns are carinate.

Thorax large, inflated, globular, considerably broader and higher than cephalis, with numerous small pores. Pore frames elevated, at the joints of 2L (?) with the thorax wall slightly conical elevated. From this elevation low, rather indistinct radial ribs radiate.

Abdomen considerable smaller (lower and narrower) than thorax, but also inflated, subglobular to broadly hoop-like, with proximal ring of very small pores and numerous irregularly arranged pores below it. Strictures both against thorax and first-postabdominal segments, like the following strictures deep, narrow, smooth, poreless.

First postabdominal segment about as large as abdomen, broadly hoop-like, with narrow, smooth proximal ring, immediately followed by a ring of small pores. Below it follow an often irregular ring of very small pores. Below it further very small pores may be present, but they are mostly closed.

The following 2-3 postabdominal segments become a little broader, whereas their height remains constant. They display an inverted trapezoidal outline and are proximally sharply contrasted against the stricture. They begin with a narrow smooth ring, followed by a ring of vertically elongated pores. Below this pore ring they are poreless and smooth.

**Dimensions:**

Length of test = 259–271  $\mu\text{m}$

Maximum width of test = 69–73  $\mu\text{m}$

Length of longest lateral horn = 32–40  $\mu\text{m}$

**Occurrence:** Upper part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** In the Middle Fassanian (lower part of *Ladinocampe multiperforata* Zone) *Planispinocyrtis multiperforata annuloporida* n. subsp. all lateral horns (V, 2L, 2I) are in their length unreduced. Moreover, this subspecies displays a thoraco-abdomen, like the majority of the *Planispinocyrtis* species.

In the Illyrian *Planispinocyrtis pulchra globulata* n. subsp. with globular thorax and clearly separated abdomen displays fewer pores on the abdomen, the first postabdominal segment displays only one central pore ring, and the second and third postabdominal segments display a ring with round pores.

Because the cephalic spicular system is not known and the horns in prolongation of 2L (?) are only rudimentary, the assignment of *P. ? thoraciglobulosa* n. sp. to the genus *Planispinocyrtis* is not sure. The other species with missing horns 2L (*P. ? gabiolaensis* n. sp., *P. ? longispinosa* n. sp., *P. ? nishimurai* n. sp.) have already on the abdomen only one pore ring.

***Planispinocyrtis ? truempyi* n. sp.**

(Pl. 26, figs. 5, 6, 10)

**Derivatio nominis:** In honour of Prof. TRÜMPY, Zürich.

**Holotypus:** The specimen on pl. 26, figs. 5, 6, 10; rep.-no. KoMo 1980 I-173.

**Locus typicus:** Passo della Gabiola section near Recoaro, Italy.

**Stratum typicum:** Sample MD 1, middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 7 specimens.

**Diagnosis:** Test elongated bell-shaped. Cephalis moderately large, subhemiglobular, with stout, basally very broad, large apical horn. Cephalic spicular system with Mb, A, V, 2L, 2I. Stout, broad, multicarinate horns in

prolongation of V, 2L and 2I all situated on the cephalis or at the boundary cephalis thorax. Inner layer of cephalis poreless. Outer layer consisting of a coarse irregular reticulum and rather high narrow ribs in the place of the arches AV and 2 AI.

Thorax, abdomen and first abdominal segment and strictures between them covered by a thick outer layer with coarse pore frames, partly arranged in irregular rings by stronger elevated pore walls. 2 distinct, but irregular narrow rings are present about at the upper and lower boundary of the thorax. Inner layer with very small pores. Boundaries of cephalis, thorax and abdomen totally covered by outer layer and not visible. Stricture between abdomen and first postabdominal segment also on the outer layer slightly depressed.

Second postabdominal segment shallow hoop-like, with small pores arranged in a proximal pore ring, followed by a second irregular pore ring or irregularly scattered pores. Strictures above and below this segment narrow, smooth, poreless, distinct, but not deep. Third postabdominal segment large, with very short proximal cylindrical part and continuously widening moderately large skirt. Cylindrical part and skirt with each one pore ring of mostly large pores.

**Dimensions:**

Length of test = 269–277  $\mu\text{m}$

Maximum width of test (without skirt) = 98–102  $\mu\text{m}$

Width of skirt = 127–135  $\mu\text{m}$

**Occurrence:** Middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone, Southern Alps.

**Remarks:** *Planispinocyrtis ? truempyi* n. sp. is easily to distinguish from all other *Planispinocyrtis* species by the thick outer layer with coarse pore frames that covers cephalis, thorax, abdomen and first postabdominal segment. Moreover, the horns A, 2L and 2I lies higher than in other *Planispinocyrtis* species and V, 2I are connected by distinct ridges on the cephalis with the 3 ridges of the apical horn.

**Genus *Spinotriassocampe* KOZUR, 1984**

**Type species:** *Spinotriassocampe hungarica* KOZUR, 1984.

**Synonym:** *Bikinella* TIKHOMIROVA, 1986

**Occurrence:** Upper Anisian – Middle Carnian. Eurasatic Tethys.

**Remarks:** The 2 very long, round spines on the small cephalis are at their base obliquely upward directed. A

third very short spine is often present on the cephalis and it is also obliquely upward directed. Despite the fact that the cephalic spicular system is not known, it can be therefore concluded that the very long spines are situated in prolongation of 2I, the short one in prolongation of V. In this constellation D may be missing. For this reason *Spinotriassocampe* is placed into the Planispinocyrtidae KOZUR & MOSTLER, 1981 that have a similar multicyrtyd test.

*Planispinocyrtis ? annulata* n. sp. is especially similar to *Spinotriassocampe* KOZUR, 1984. It belongs to a species group within *Planispinocyrtis* KOZUR & MOSTLER, 1981 that has in contrast to typical *Planispinocyrtis* species with lateral horns V, 2L, 2I only 3 lateral horns (V, 2I). However, it is also distinguished from this group by the position of the lateral horns on the cephalis (V?) and in the collar stricture (2I?) and not on the thorax as in the other *Planispinocyrtis* species.

This position of the lateral horns is similar as in *Spinotriassocampe* KOZUR, 1984, but unlike this genus, the horns 2I(?) are small and the horn V(?) is large, similar to other *Planispinocyrtis* species. Moreover, in the place of the junction 2L(?) with the wall, pores are known on the thorax. This remembers to the *Planispinocyrtis* group with 5 spines.

***Spinotriassocampe carnica* n. sp.**

(Pl. 26, fig. 7)

**Derivatio nominis:** According to the occurrence in the Carnian.

**Holotypus:** The specimen on pl. 26, fig. 7; rep.-no. CK 1188 VII-82.

**Locus typicus:** Rupe de Passo di Burgio, Sosio Valley area, Sicily (Italy).

**Stratum typicum:** Sample S 8, dark grey marly cherty limestone of Middle Carnian age (Mufara Formation).

**Material:** 7 specimens.

**Diagnosis:** Multicyrtyd. Test slender conical. Cephalis very small, globular with conical upper part, smooth, poreless, with very long, needle-like, round apical horn. Lateral horns in prolongation of 2I(?) extremely long, roundish, needle-like, after short straight perpendicular or slightly upward directed part downward curved. The long distal straight part is obliquely downward and outward directed.

Postcephalic segments have all about the same height. They become distalwards slowly and continuously broader. Until the seventh or eighth postabdominal segment all segments are hoop-like, separated by deep

strictures. From the eighth or ninth postabdominal segment the lateral outline is inverted trapezoidal. Thorax to second postabdominal segment have small pores arranged in one often irregular proximal pore ring and a second incomplete pore ring, with small pores. On the thorax and abdomen the pores may be also irregularly spaced. The following postabdominal segments have one central pore ring, but few scattered additional pores may be occasionally present.

**Dimensions:**

Length of test (without apical horn) = 298–316 µm

Maximum width of test = 79–81 µm

Length of apical horn = 160–170 µm

Length of lateral spines = 150–180 µm

**Occurrence:** Middle Carnian of Sicily.

**Remarks:** *Spinotriassocampe longobardica* n. sp. from the Middle and Upper Longobardian displays similar downwards recurvated lateral horns, but it is easily distinguished by its very short, rudimentary apical horn.

The *Spinotriassocampe hungarica* group (*S. hungarica* KOZUR, 1984, *S. eofassanica* n. sp., *S. mediofassanica* n. sp.) displays also a long apical horn, but is characterized by obliquely upward directed straight lateral horns.

*Spinotriassocampe transita* n. sp. that is transitional between these 2 groups, displays perpendicular to distally slightly downward curved lateral horns.

***Spinotriassocampe eofassanica* n. sp.**

(Pl. 27, fig. 3)

**Derivatio nominis:** According to the occurrence in the Lower Fassanian.

**Holotypus:** The specimen on pl. 27, fig. 3; rep.-no. KoMo 1980 I-613.

**Locus typicus:** Passo della Gabiola near Recoaro, Vicentian Alps (Italy).

**Stratum typicum:** Sample MD 12, middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone

**Material:** 3 specimens.

**Diagnosis:** Multicyrtyd. Test slender conical. Cephalis small, globular with conical upper part. Apical horn very long, roundish, needle-like. 2 lateral horns very long, straight, obliquely outward and somewhat upward directed.

Postcephalic segments have about the same height. They increase slowly and continuously in width, but the last 3-4 segments decrease again in width. All these seg-

ments are rounded hoop-like, separated by narrow, but deep strictures. The thorax displays only some scattered pores. Abdomen and the first 3 postabdominal segments display numerous small spines, arranged in irregular rings. In the fourth to seventh postabdominal segment one pore ring of small pores and scattered additional pores are present.

**Dimensions:**

Length of test = 260–274  $\mu\text{m}$

Maximum width of test = 83–86  $\mu\text{m}$

Length of apical spine = More than 95  $\mu\text{m}$  (not fully preserved)

Length of lateral horns = About 145  $\mu\text{m}$

**Occurrence:** Middle subzone of Lower Fassanian *Spongossilicarmiger italicus* Zone, Italy.

**Remarks:** The Longobardian to Middle Carnian *Spinotriassocampe carnica* group (*S. carnica* n. sp., *S. longobardica* n. sp.) is easily to distinguish by the recurvated lateral spines, *S. longobardica* n. sp. additionally by its very short rudimentary apical horn. The Middle Fassanian *Spinotriassocampe transita* n. sp. displays perpendicular to distally slightly curved spines.

All members of the Illyrian to Middle Fassanian *Spinotriassocampe hungarica* group - *S. hungarica* KOZUR, 1984 *S. sabaluevae* (TIKHOMIROVA, 1986), *S. eofassanica* n. sp., *S. mesofassanica* n. sp. - display long, round, needle-like apical spines and long, round, needle-like, straight, slightly obliquely upward directed lateral horns. The Illyrian (*P. trinodosus* Zone) *S. illyrica* KOZUR, 1984 displays more inflated postcephalic segments, the thorax is distinctly larger than the cephalis, apical and lateral horns are shorter. The Lower Ladinian *S. sabaluevae* (TIKHOMIROVA), 1986 displays extremely long lateral horns and the test becomes distally broad. In *S. mesofassanica* n. sp. the fourth and following postabdominal segments display an inverted trapezoidal lateral outline. Beginning with the third postabdominal segment all following segments are proximally sharply contrasted against the very deep strictures.

***Spinotriassocampe longobardica* n. sp.**

(Pl. 26, figs. 8, 11, 12, 14; pl. 27, figs. 4, 6, 8)

**Derivatio nominis:** According to the occurrence in the Longobardian.

**Holotypus:** The specimen on pl. 26, figs. 11, 12; pl. 27, figs. 6-8; rep.-no. KoMo 1980 I-615.

**Locus typicus:** Köveskál (Balaton Highland, Hungary) section at the cemetery

**Stratum typicum:** Nemesvámos Limestone Formation, 65 cm below sample 6/83, lower *Budurovignathus mungoensis* conodont zone, Middle Longobardian.

**Material:** 41 specimens.

**Diagnosis:** Multicyrtid. Test proximally slender subconical, distally subcylindrical. Cephalis small, globular, in the upper part conical to subcylindrical. Apical horn tiny, needle-like. Lateral spines in prolongation of 2l(?) wing-like, needle-like, proximally somewhat higher, here obliquely outward and somewhat upward directed, than strongly recurvated. Long, needle-like distal part either straight or slightly curved, obliquely outward-downward directed. Horn in prolongation of V(?) very short, carinate, between each adjacent ridges with a tiny pore in the wall.

The thorax has the same width as the cephalis. The following segments increase slowly and continuously until the sixth postabdominal segment, the following (at least 5) postabdominal segments display about the same width.

Thorax to first or second postabdominal segment hoop-like, with tiny pores, proximally arranged in a ring, below it irregularly scattered, often closed by a layer of microgranular silica. Following postabdominal segments at first ring-like with straight middle part that displays a central ring of small pores. Distalwards segments with inversely trapezoidal lateral outline follow. They are proximally sharply contrasted against the deep, smooth poreless strictures and display a ring of small pores.

**Dimensions:**

Length of test = 325–444  $\mu\text{m}$

Maximum width of test = 71–100  $\mu\text{m}$

Length of lateral wings = 130–188  $\mu\text{m}$

**Occurrence:** Frequent in the Middle Longobardian of Hungary. A nearly identical form, but with large pores (? corroded) occurs in the Ladinian of Japan, described as *Triassocampe* (?) sp. by YAO (1982).

**Remarks:** The Middle Carnian *Spinotriassocampe carnica* n. sp. that displays also strongly recurvated long, needle-like wings is clearly distinguished by its very long apical horn.

The Illyrian to Middle Fassanian *Spinotriassocampe hungarica* group - *S. hungarica* KOZUR, 1984, *S. sabaluevae* (TIKHOMIROVA, 1986), *S. eofassanica* n. sp., *S. mesofassanica* n. sp. - is clearly distinguished by long, straight, needle-like lateral spines that are outward and slightly upward directed along their whole length. Moreover, all species of this group display a long apical spine.

The Middle Fassanian *Spinotriassocampe transita* n. sp. displays only slightly curved lateral spine and a moderately long apical spines.



***Spinotriassocampe mesofassanica* n. sp.**

(Pl. 26, fig. 13; pl. 27, figs. 1, 2, 5, 9)

1979 *Stichopilium* sp. A, pars - NAKASEKO & NISHIMURA, pp. 79-80, pl. 9, only figs. 6, 7

**Derivatio nominis:** According to the occurrence in the Middle Fassanian.

**Holotypus:** The specimen on pl. 26, fig. 13; pl. 27, figs. 2, 9; rep.-no. KoMo 1980 I-228.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto, Vicentinian Alps (Italy)

**Stratum typicum:** Sample TT 3, lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 14 specimens.

**Diagnosis:** Multicyrtid. Test proximally slender conical, distally subcylindrical. Cephalis small, globular, granular, poreless. Apical horn long, rounded, needle-like. Lateral spines in prolongation of 2I(?) very large, straight, obliquely outward and somewhat upward directed. Horn in prolongation of V(?) very short, tricarinate, between each two adjacent ridges with one tiny pore in the wall.

Postcephalic segments increase in width until the fourth postabdominal segment. In the following segments the width remains nearly constant. Thorax, abdomen, first and second, sometimes also third postabdominal segments hoop-like, proximally and distally rounded, separated by deep smooth, narrow, poreless strictures. Third or fourth postabdominal segment ring-like with straight middle part, proximally sharply contrasted against the stricture. Following 5-6 postabdominal segments with inverted trapezoidal lateral outline, proximally sharply contrasted against the stricture.

In the thorax and abdomen the tiny pores are mostly closed by a layer of microgranular silica. Only few pores of the inner pore rings are open. First abdominal segment with numerous tiny pores, arranged in a regular proximal pore ring and irregular or incomplete following 2 pore rings. Second postabdominal segment with proximal ring of tiny pores and below it some scattered pores or with second, often incomplete pore ring. Third postabdominal segment with central ring of small pores or with the same size and arrangement of the pores as the second postabdominal segment, if it is still hoop-like.

Following postabdominal segments with proximal ring of small pores and few, widely scattered tiny pores below it that may be arranged in a second, mostly incomplete pore ring.

**Dimensions:**

Length of test (without apical horn) = 308-326  $\mu\text{m}$

Maximum width of test = 75-77  $\mu\text{m}$

Length of apical horn = 125-131  $\mu\text{m}$

Length of long lateral spines = 171-179  $\mu\text{m}$

**Occurrence:** Lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone. Italy, Japan.

**Remarks:** The Longobardian to Middle Carnian *Spinotriassocampe carnica* group (*S. carnica* n. sp., *S. longobardica* n. sp.) is clearly distinguished by the strongly recurved lateral spines. In the Middle Fassanian *Spinotriassocampe transita* n. sp. the lateral spines are slightly curved.

In the Illyrian to Middle Fassanian *Spinotriassocampe hungarica* group - *S. hungarica* KOZUR, 1984, *S. sabaluevae* (TIKHOMIROVA, 1986), *S. eofassanica* n. sp., *S. mesofassanica* n. sp. - the 2 latter species are most similar each other. *S. eofassanica* n. sp. is distinguished from *S. mesofassanica* n. sp. by the form of the segments that remain until the last known (seventh) postabdominal segment hoop-like, proximally not sharply contrasted against the strictures.

***Spinotriassocampe transita* n. sp.**

(Pl. 27, fig. 7)

1979 *Stichopilium* sp. a, pars - NAKASEKO & NISHIMURA, pp. 79-80, pl. 9, only fig. 8

**Derivatio nominis:** According to the transitional position between the *S. hungarica* group and the *S. carnica* group.

**Holotypus:** The specimen on pl. 27, fig. 7; rep.-no. KoMo 1980 I-618.

**Locus typicus:** Road cut San Ulderico-Pallé. Tretto, Vicentinian Alps (Italy)

**Stratum typicum:** Sample TT 5, lower part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 9 specimens.

**Diagnosis:** Multicyrtid. Test slender conical. Cephalis small, subglobular, in the upper part conical, smooth, poreless. Apical horn round, needle-like, moderately long. Lateral spines roundish, needle-like, slightly curved. Horn in prolongation of V(?) very short, multicarinate. Tiny pores in the wall are present at the junction of this horn with the wall. They are situated between adjacent ridges of the horn.

Postcephalic segments until the fifth postabdominal segment rounded hoop-like. Pores on the thorax mostly closed by an outer layer of microgranular silica. Some more tiny pores are open on the abdomen arranged in a proximal ring. Scattered pores below it almost all closed by a layer of microgranular silica. The following segments

have a proximal ring of small pores, followed by widely scattered pores or by an incomplete second pore ring. Last preserved segment (sixth postabdominal segment) proximally sharply contrasted against the deep, smooth, poreless stricture, with proximal pore ring. Its distal part and further segments not preserved.

**Dimensions:**

Length of test (without apical horn) = More than 258  $\mu\text{m}$  (distal part of test not fully preserved)

Maximum width of test = 70–77  $\mu\text{m}$

Length of apical spine = 35–44  $\mu\text{m}$

Length of lateral spines = 65–68  $\mu\text{m}$

**Occurrence:** Lower subzone of Middle Fassanian *Ladinocampe multiperforata*-Zone.

**Remarks:** The Longobardian to Middle Carnian *Spinotriassocampe carnica* group (*S. carnica* n. sp., *S. longobardica* n. sp.) can be easily distinguished by the strongly recurved winglike lateral spines.

In the *Spinotriassocampe hungarica* group (*S. hungarica*, *S. sabaluevae*, *S. eofassanica*, *S. mesofassanica*) the lateral spines are straight, obliquely outward and somewhat upward directed.

**Family Ruesticyrtiidae KOZUR & MOSTLER, 1979**

**Genus *Pararuesticyrtium***

**KOZUR & MOSTLER, 1981**

**Type species:** *Pararuesticyrtium densiporatum* KOZUR & MOCK, 1981

**Occurrence:** Lower Fassanian to Carnian of the Eurasiatic Tethys.

**Remarks:** *Pararuesticyrtium* KOZUR & MOSTLER, 1981 was separated by the presence of an apical horn and horns in prolongation of V and D from the genus *Ruesticyrtium* KOZUR & MOSTLER, 1979. In the light of newer investigations, the form of the postabdominal segments seems to be important as well. In *Pararuesticyrtium* those segments are broad, hoop-like. In *Ruesticyrtium*, they are narrow, sharp-edged in their medium part with acute triangular marginal outline.

The primitive representatives of *Pararuesticyrtium* from the Ladinian display not yet strong horns, but the excentric apical horn is mostly present, the other horns may be present as well.

The forerunner of *Ruesticyrtium*, the genus *Paratriassocampe* n. gen., displays in many species already the sharp-edged postabdominal segments with triangular marginal outline. None of these species display an apical horn

or other horns. In *Ruesticyrtium* the surface of the most segments is covered by a layer of microgranular silica, in *Pararuesticyrtium* this outer layer is sometimes also present.

Regarding the above mentioned features the Carnian *Ruesticyrtium robustum* KOZUR & MOSTLER, 1981 belongs to *Pararuesticyrtium*. The apical part of the cephalis is not preserved in the 2 present specimens. Therefore an apical horn may be also present in this species.

In the Lower Fassanian the later clearly distinct genera *Pararuesticyrtium* and *Paratriassocampe* are still very similar and connected by transitional species.

***Pararuesticyrtium constrictum* n. sp.**

(Pl. 28, figs. 7,8)

**Derivatio nominis:** According to the distinct narrowing of the test before the last segment with skirt.

**Holotypus:** The specimen on pl. 28, figs. 7, 8; rep.-no. Ko-Mo 1980 I-760.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto, Vicentinian Alps (Italy).

**Stratum typicum:** Sample TT 16, upper subzone of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 3 specimens.

**Diagnosis:** Test conical, before the last segment (with skirt) distinctly narrowed. Cephalothorax dome-shaped, smooth, poreless. Cephalic part small, semiglobular; thoracic part larger, subglobular. Excentric apical horn small, short. Further small, short horns in prolongation of V and D may be present. Abdomen and first to fifth postabdominal segments hoop-like, with at least 3, often irregular pore rings. Pores small. Strictures between the segments narrow, moderately deep, smooth, poreless.

Abdomen somewhat broader, but lower than cephalothorax. The following 3 postabdominal segments increases continuously in width and height. The third postabdominal segment is about as high as the cephalothorax, but considerably broader than it. The fourth postabdominal segment is about as wide and high as the foregoing one or only a little higher. The fifth postabdominal segment is again distinctly narrower and somewhat lower than the fourth segment. The last segment is high and displays a distinct, moderately wide distal skirt. Its proximal part is subcylindrical and displays 3 rings of moderately large pores. The skirt displays at least 4 irregular rings of moderately large pores.

**Measurements:**

Length of test = 314–323  $\mu\text{m}$

Maximum width of test (without skirt) = 93–102  $\mu\text{m}$

Width of skirt = 135–152  $\mu\text{m}$

**Occurrence:** Upper subzone of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** The similar *Pararuesticyrtium trettoense* n. sp. from the lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone displays more segments and only a narrow skirt (?preservation). Abdomen and first 2–3 postabdominal segments are covered by a layer of microgranular silica.

***Pararuesticyrtium eofassanicum* n. sp.**

(Pl. 28, figs. 5, 6, 10, 12; pl. 43, fig. ? 13)

**Derivatio nominis:** According to the occurrence in the Lower Fassanian.

**Holotypus:** The specimen on pl. 28, figs. 6, 10; rep.-no. KoMo 1980 I-330.

**Locus typicus:** Passo della Gabiola section, Vicentinian Alps (Southern Italy).

**Stratum typicum:** Sample MD 21, upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** More than 100 specimens.

**Diagnosis:** Test conical with narrow but distinct distal skirt. Cephalothorax dome-shaped, smooth, poreless. Cephalic part small, semiglobular. Thoracic part larger, globular. Apical horn very small and very excentric. Further horns in prolongation of V and D rarely present.

Abdomen and postabdominal segments become gradually wider, but their height remains with exception of the last segment nearly constant and is a little less than the length of the cephalothorax. Abdomen and first 2–3 postabdominal segments are hoop-like, with 2–3 rings of very small pores that may be covered by a layer of microgranular silica on the abdomen and first postabdominal segment in higher evolved, untypical forms. The following 2–3 segments are subcylindrical, with 2 rings of small pores and in some of these segments with a third, distal, incomplete ring of very small pores. These pores are arranged in vertical rows with short, often indistinct, low vertical ribs between them. The last (sixth) postabdominal segment is considerably higher than the foregoing segments and displays a distinct, but narrow distal skirt. This last segment displays at least 5, partly irregular rings of moderately large pores. The strictures between all postthoracic segments are relatively deep, moderately broad, smooth, poreless.

**Measurements:**

Length of test = 267–284  $\mu\text{m}$

Maximum width of test (without skirt) = 96–108  $\mu\text{m}$

Width of skirt = 113–133  $\mu\text{m}$

**Distribution:** Upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone of the European Tethys. Highly evolved forms are rarely present in the lower part of Middle Fassanian.

**Remarks:** This species is in some respects still similar to *Paratriassocampe* n. gen. (subcylindrical third to fifth postabdominal segments with only 2 rings of pores). However, the skirt is already distinct and a very small excentric apical horn is always present.

In the Middle Fassanian *Pararuesticyrtium mediofassanica* n. sp. all postabdominal segments are hoop-like, display 3 ribs between the pores and vertical ribs between the pores are never present.

***Pararuesticyrtium ? illyricum***

(KOZUR & MOSTLER, 1981)

(Pl. 43, figs. 11, 12, 15, 16)

1981 *Triassocampe illyrica* n. sp. – KOZUR & MOSTLER, p. 98, pl. 15, fig. 2

1990 *Triassocampe* sp. A – GORIČAN, p. 160, pl. 12, fig. 1

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone) up to Middle Fassanian. Eurasiatic Tethys.

**Remarks:** This species is transitional to *Paratriassocampe* n. gen. Like in this genus, an apical horn is still missing and the most segments display only 2 rings of pores. However, a narrow skirt is present and the segments are hoop-like as in *Pararuesticyrtium* KOZUR & MOSTLER, 1981.

***Pararuesticyrtium mediofassanicum* n. sp.**

(Pl. 28, figs. 1–4, 9, 11)

**Derivatio nominis:** According to the occurrence in the Middle Fassanian.

**Holotypus:** The specimen on pl. 28, fig. 4; rep.-no. KoMo 1980 I-758.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto, Vicentinian Alps (Italy).

**Stratum typicum:** Sample TT 13, upper subzone of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** More than 100 specimens.

**Diagnosis:** Test conical, with narrow distal skirt. Cephalothorax dome-shaped, smooth, poreless, with excentric small apical horn. Cephalic part rounded conical to sub-hemiglobular. Thoracic part broader, but not higher, hoop-like.

Abdomen and postabdominal segments hoop-like, broad, separated by narrow to very narrow, deep, smooth, poreless strictures. Abdomen broader, but lower than cephalothorax. The postabdominal segments becomes gradually wider. Their height increases until the second or third postabdominal segment and remains than constant or decreases even a little. All postabdominal segments display 3, in the fifth or (and) sixth postabdominal segments sometimes only 2 rings of pores. Abdomen and first postabdominal segment, in highly evolved forms also second postabdominal segment covered by a layer of microgranular silica. Only in primitive forms this layer is still missing. The last (seventh) postabdominal segment displays a distinct, but narrow skirt.

**Measurements:**

Length of test = 284–355 µm

Maximum width of test (without skirt) = 115–135 µm

Width of skirt = 158–165 µm

**Distribution:** Widely distributed in the Middle Fassanian *Ladinocampe multiperforata* Zone. Primitive forms occurs already in the upper subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Remarks:** The Lower Fassanian *Pararuesticyrtium eofassanicum* n. sp. displays only 6 postabdominal segments. The third to fifth postabdominal segments display only 2 complete pore rings and low vertical ribs between the vertical pore lines.

***Pararuesticyrtium trettoense* n. sp.**

(Pl. 43, fig. 14)

**Derivatio nominis:** According to the occurrence in Tretto Holotypus: The specimen on pl. 43, fig. 14; rep.-no. KoMo 1980 I-761.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto, Vicentinian Alps (Italy).

**Stratum typicum:** Sample TT 3, lower part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 7 specimens.

**Diagnosis:** Test slender conical, distally subcylindrical and becomes than even narrower. Cephalothorax dome-shaped, smooth, poreless, with tiny, excentric apical horn.

An additional apical horn in prolongation of V may be present. Cephalic part of cephalothorax very small, hemiglobular. Thoracic part larger, globular.

Abdomen and postabdominal segments hoop-like, separated by deep, moderately wide, smooth, poreless strictures. Abdomen broader, but lower than cephalothorax. The width of the postabdominal segments increases gradually until the fourth postabdominal segment. The following 2 segments display nearly the same width. The seventh postabdominal segment is again narrower, the eighth postabdominal segment displays the same width as the foregoing segment. The height of the segments increases from the abdomen to the fifth postabdominal segment very slowly. All these segments are shorter than the cephalothorax. The sixth to eighth postabdominal segments are considerably higher than the foregoing ones. Abdomen to sixth postabdominal segment display 3, especially distally irregular rings of very small to small pores. The last 2 segments display small to moderately large pores of irregular arrangement.

**Measurements:**

Length of test = 324–337 µm

Maximum width of test = 89–93 µm

**Distribution:** Lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone. Southern Alps.

**Remarks:** *Pararuesticyrtium constrictum* n. sp. from the upper subzone of the Middle Fassanian *Ladinocampe multiperforata* Zone displays only 6 postabdominal chambers and a moderately wide distal skirt.

**Family Sanfilippoellidae KOZUR & MOSTLER, 1979**

**Synonym:** Poulpinae DE WEVER, 1981

**Remarks:** The Sanfilippoellidae KOZUR & MOSTLER, 1979 was established for the genus *Sanfilippoella* KOZUR & MOSTLER, 1979 that has a large cephalis with stout tricarinate apical horn, and 3 large tricarinate feet, followed by a differently structured velum that can be subdivided by a wide, shallow stricture into 2 pseudosegments. For this reason *Sanfilippoella* was originally regarded as tricyrtid, but by KOZUR & MOSTLER (1981) as dicyrtid.

It is a matter of choice to regard the velum as an independent segment (than the Sanfilippoellidae are dicyrtid) or as a velum of the cephalis (than the Sanfilippoellidae would be monocyrtid with long velum).

DE WEVER (1981) established the monocyrtid Poulpinae that are on the first view distinctly different

from the Sanfilippoellidae. However, in *Poulpus transitus* KOZUR & MOSTLER, 1981 3 long velate lobes are present that grow together in *Parapoulpus* KOZUR & MOSTLER, 1979 to a long, cylindrical velum.

The only difference of *Parapoulpus* from the Sanfilippoellidae is the absence of an apical horn and of the short lateral horns in prolongation of V and 2l in *Parapoulpus*. However, in the Poulpinae both forms with and without apical and lateral horns are present (*Poulpus* DE WEVER, 1979, *Hozmadia* DUMITRICĂ, KOZUR & MOSTLER, 1980, *Baratuna* KOZUR & MOSTLER, 1981) that are connected by all transitions. The here described *Poulpus illyricus* n. sp. has a very small apical horn and tiny horns in prolongation of V and 2l may be present.

Therefore the Poulpinae comprises forms with and without apical and lateral horns and with and without a long velum after the cephalis and all these forms are in family or subfamily level unseparably connected by transitional forms.

Whereas all transitional forms between *Poulpus* (without horns, without velum) and *Parapoulpus* (without horns, with long velum) are known (*Poulpus transitus* KOZUR & MOSTLER, 1981), transitional forms between *Hozmadia* (with apical horn, partly also with lateral horns V and 2l, without velum) and *Sanfilippoella* (with horns, with long velum) have not been recognized. However, re-studies of the genus *Eonapora* KOZUR & MOSTLER, 1979 have now shown these transitional forms between *Hozmadia* and *Sanfilippoella*.

*Hozmadia* has a smooth distal margin of the cephalis, often elevated in a smooth ridge. The apical horn is always stout. Small horns in prolongation of V and 2l are mostly absent. The type species of *Eonapora*, *E. pulchra* KOZUR & MOSTLER 1979 has a distinct velum and short horns in prolongation of V and 2l. This species is similar to Sanfilippoellidae KOZUR & MOSTLER, 1979, but the velum is thin-walled and considerably shorter.

The oldest known *Eonapora* species from the Illyrian, *E. robusta* KOZUR & MOSTLER, 1981 displays a short, fragile velum. This species is nearer related to *Hozmadia* than to *Sanfilippoella*. The same is true for the Illyrian *Eonapora mesotriassica* KOZUR & MOSTLER, 1981, from which only small, short pieces of the very fragile velum are known. Both species have Ladinian successors, from which one is described here. They have a clearly larger, more stable velum transitional between Illyrian and Carnian *Eonapora* species.

These transitional forms from Poulpinae with stout apical horn, without velum (*Hozmadia*) into typical Sanfilippoellidae with stout apical horn with long velum indi-

cate that both family taxa are very near related. Because also typical Poulpinae without apical horn, without velum (*Poulpus*) show all transitions to forms with velum (*Parapoulpus*), the development of a velum could be only used for separating 2 family taxa, if the forms with velum would begin later than forms without velum. Until now, both *Parapoulpus* and Sanfilippoellidae have been known only from the Upper Triassic. Poulpinae with and without horn since the Upper Anisian and transitional forms (*Eonapora*) since the Upper Anisian. However, now a typical *Sanfilippoella* was found in the Upper Anisian (Illyrian) from the Balaton Highland. Therefore typical Poulpinae (without velum), typical Sanfilippoellidae (with long velum) and transitional forms (with very short to short delicate velum) occur in the Middle and Upper Triassic together. For this reason, the Poulpinae DE WEVER, 1981 are here regarded as younger synonym of the Sanfilippoellidae KOZUR & MOSTLER, 1981 emend. that contain monocytid radiolarians with or without apical horn and small horns in prolongation of V and 2l and with or without velum.

### Genus *Sanfilippoella* KOZUR & MOSTLER, 1979

**Type species:** *Sanfilippoella tortilis* KOZUR & MOSTLER, 1979

#### *Sanfilippoella laevis* n. sp.

(Pl. 29, figs. 1, 2)

**Derivatio nominis:** According to the smooth cephalis.

**Holotypus:** The specimen on pl. 29, figs. 1, 2; rep.-no. Ko-Mo 1980 I-17.

**Locus typicus:** Felsöörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** 11 specimens.

**Diagnosis:** Cephalis large, hemiglobular, smooth, with few widely scattered pores, in the largest part poreless. Cephalic spicular system very robust, with Mb, A, V, 2L, D, 2l. Apical horn very large, tricarinate, without torsion. 3 downward directed, proximally outward-, distally inward curved tricarinate spines in prolongation of D and 2L and 2 very short, tricarinate horns in prolongation of V and 2l are present. The arches AV, Al, Dl, Ll and LV are recog-

nizable as ridges on the cephalis that originate in the ridges of the apical horn and feet. In direction of the horns V and 2l the ridges on the cephalis (arches AV, AI, LV, LI, DL) become very low and indistinct.

Velum large, but shorter than the feet, in the apical part widened, in the distal part narrowing. The velum is rather thick-walled and displays scattered small, oval and triangular pores.

Aperture moderately large.

**Dimensions:**

Length of cephalis = 50–68 µm

Maximum width of cephalis = 50–68 µm

Length of velum = 78–82 µm

Maximum width of velum = 97–103 µm

Length of apical horn = 70–83 µm

Length of feet = 100–120 µm

**Occurrence:** Illyrian (*Paraceratites trinodosus* zone) of Balaton Highland (Hungary).

**Remarks:** Most of the Carnian *Sanfilippoella* species display a distinct torsion of ridges and grooves of the apical horn. Only *Sanfilippoella recta* KOZUR & MOSTLER, 1981 displays straight ridges on the apical horn as in *Sanfilippoella laevis* n. sp. However, also this species is easily to distinguish by the reticulated cephalis, by the shorter and not so strongly downward curved feet and by the longer spongy velum that is distinctly longer than the feet.

By the unreticulated cephalis and by the velum shorter than the feet, *Sanfilippoella laevis* n. sp. is a primitive representative of the genus *Sanfilippoella*.

### Genus *Eonapora* KOZUR & MOSTLER, 1979

**Type species:** *Eonapora pulchra* KOZUR & MOSTLER, 1979

*Eonapora fassanica* n. sp.

(Pl. 30, figs. 1–3, 5)

**Derivatio nominis:** According to the occurrence in the Fassanian.

**Holotypus:** The specimens on pl. 30, figs. 1, 5; rep.-no. KoMo 1980 I-174.

**Locus typicus:** Passo della Gabiola near Recoaro, Vicentian Alps, Italy.

**Stratum typicum:** Sample MD 1, middle subzone of Lower Fassanian *Spongilicarmiger italicus* Zone.

**Material:** 32 specimens.

**Diagnosis:** Cephalis large, hemiglobular. Surface with distinct ridges expressing arches DI, LI, AI, AV and AL. Between these ridges some further narrower and lower ridges are present that become indistinct on the velum. Remaining surface with irregularly scattered small pores that are to a large part closed by a layer of microgranular silica. Velum distinct, relatively fragile, but strengthened by some irregular, low ribs. Cephalic spicular system very robust, with Mb, A, V, 2L, D, 2l. The 3 feet in prolongation of D and 2L are tricarinate, downward and outward directed, but only a little curved. Therefore also their distal ends are still downward and outward directed. Apical horn stout, large, tricarinate, with broad, deep furrows. In continuation of V a small, tricarinate lateral horn is present. Horns in prolongation of 2l indistinct.

**Dimensions:**

Length of cephalis = 118–145 µm

Maximum width of cephalis (+ velum) = 104–125 µm

Length of apical horn = 104–135 µm

Length of feet = 141–200 µm

**Occurrence:** Middle subzone of Lower Fassanian *Spongilicarmiger italicus* Zone, Italy.

**Remarks:** The Illyrian *Eonapora mesotriassica* KOZUR & MOSTLER, 1981 displays a very fragile velum, mostly totally broken away. The feet are proximally strongly outward directed and then strongly curved in a directly downward directed position.

In the Middle Fassanian *Eonapora longispinosa* n. sp. the feet are not curved and along their whole length downward and only a little outward directed.

*Eonapora longispinosa* n. sp.

(Pl. 30, figs. 6, 9)

1980 *Eonapora* sp. – DUMITRICĂ, KOZUR & MOSTLER, p. 21, pl. 9, figs. 3, 4

**Derivatio nominis:** According to the long apical horn and feet.

**Holotypus:** The specimen on pl. 30, fig. 6; rep.-no. KoMo 1980 I-606.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentian Alps, Italy).

**Stratum typicum:** Sample TT 5, lower part of Middle Fassanian *Ladinocampe multiperforata* A.Z.

**Material:** 31 specimens.

**Diagnosis:** Monocyrtid. Cephalis very large, with very long, stout, tricarinate, slightly twisted apical horn and 3

very long, slender tricarinate, downward and only proximally a little outward directed feet in prolongation of D and 2L. Surface covered with strong ribs that express the arches AV, AI, VI, DI, and few shorter delicate ribs. Pore frames with small node-like elevations at the joints. Pores very small, irregularly arranged. Velum of similar structure with numerous small pores, but thinner than cephalis wall and without nodes on the joints of the pore frames.

Cephalic spicular system very robust with Mb, A, V, 2L, D, 2I. Very small horns in prolongation of V and 2I.

**Dimensions:**

Length of cephalis = 123–148  $\mu\text{m}$

Width of cephalis = 137–172  $\mu\text{m}$

Length of apical horn = 177–213  $\mu\text{m}$

Length of feet = 150–300  $\mu\text{m}$

**Occurrence:** Higher part of Lower, and Middle Fassanian, Southern Alps.

**Remarks:** Successor of the Illyrian *Eonapora mesotriasica* KOZUR & MOSTLER, 1981. This species is distinguished by proximally more outward directed feet.

The Lower Longobardian *Eonapora longobardica* (KOZUR & MOSTLER, 1981) displays shorter more outward directed feet and a shorter, but still broader apical horn. One specimen, determined here as *Eonapora cf. longispinosa* n. sp. has a similar broad and short horn and also shorter and broader feet. It is distinguished from *Eonapora longobardica* the missing outer reticulum and not so much outward directed feet.

***Eonapora pulchra* KOZUR & MOSTLER, 1979**

1979 *Eonapora pulchra* n. gen. n. sp. – KOZUR & MOSTLER, p. 90, fig. 1

**Occurrence:** Middle Carnian of Tethys.

***Eonapora robusta* KOZUR & MOSTLER, 1979**

(Pl. 30, figs. 8, 11)

1981 *Eonapora robusta* n. sp. – KOZUR & MOSTLER, P. 82, pl. 29, fig. 1

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone of Balaton Highland, Hungary).

**Remarks:** The Fassanian specimen, figured by GORIČAN (1990) as *Eonapora aff. robusta* KOZUR & MOSTLER is the successor of *Eonapora robusta*. The differences of this new species against *E. robusta* have

been clearly recognized by GORIČAN (1990, p. 144). We have not enough well preserved material to describe this species. Apical horn and feet are distinctly slender than in *Eonapora robusta*.

***Eonapora transita* n. sp.**

(Pl. 30, fig. 10)

**Derivatio nominis:** According to the transitional position between the genera *Eonapora* KOZUR & MOSTLER and *Sanfilippoella* KOZUR & MOSTLER.

**Holotypus:** The specimen on pl. 30, fig. 10; rep.-no. KOMO 1980 I-605.

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto, Vicentinian Alps (Italy).

**Stratum typicum:** Sample TT 12, upper part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Material:** 4 specimens.

**Diagnosis:** Cephalis very large, elongated subhemiglobular, with distinct, distally somewhat widening velum. Cephalic spicular system very robust, with Mb, A, V, 2L, D, 2I. 3 tricarinate long feet in prolongation of D and 2L are downward and almost not outward directed. Apical horn stout, tricarinate with distinct torsion. Horns in prolongation of V and 2I very short.

Surface of cephalis with distinct ridges expressing the position of AV, AI, VI and DI.

Cephalic wall two-layered. Inner layer with small pores covered by an outer, irregular reticulum. On the velum the outer layer is only weak.

**Dimensions:**

Length of cephalic (+ velum) = 191–213  $\mu\text{m}$

Maximum width of cephalis = 90–94  $\mu\text{m}$

Length of apical horn = 145–149  $\mu\text{m}$

Length of feet = 147–167  $\mu\text{m}$

**Occurrence:** Upper part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** *Eonapora longispinosa* n. sp. from the lower part of the Middle Fassanian *Ladinocampe multiperforata* Zone displays only a very little torsion of the apical horn, the velum is more delicate and not strengthened by an outer layer. The cephalis wall has no outer layer that built up an irregular reticulum.

By the stabiler, somewhat longer velum and the development of an outer reticulum of the cephalis surface as well as by the distinct torsion of the apical horn, *Eonapora transita* n. sp. is a transitional form to the typical Carnian *Sanfilippoella* species that are distinguished by a longer,

still stabler velum, a more regular and stronger reticulum and in general by a still stronger torsion of the apical spine.

The phylomorphogenetic line *Eonapora mesotriassica* KOZUR & MOSTLER, 1981 (very fragile, often not preserved velum, transitional form to *Hozmadia*) - *Eonapora fassanica* n. sp. - *Eonapora longispinosa* n. sp. (both species with distinct, but still fragile, thin velum) - *Eonapora transita* n. sp. (transitional to typical *Sanfilippoella*) indicates that the genus *Sanfilippoella* KOZUR & MOSTLER, 1979 has developed in several lines from *Hozmadia* DUMITRICĂ, KOZUR & MOSTLER, 1980 through the genus *Eonapora* KOZUR & MOSTLER, 1979. The distinction between *Eonapora* and *Sanfilippoella* is in the transitional field between both genera difficult. Here all species with stabile velum, longer than the height of the cephalis are placed into *Sanfilippoella*. Species with mostly fragile velum shorter than the height of the cephalis are placed into *Eonapora*. Most *Eonapora* species display no torsion of the apical spine and most *Sanfilippoella* species display distinct torsion of the apical spine, but this difference is not diagnostic, because few *Sanfilippoella* species without torsion of apical spine are present (*S. recta* KOZUR & MOSTLER, 1981, *S. laevis* n. sp.) and *Eonapora transita* n. sp. displays distinct torsion of apical spine.

**Genus *Hozmadia* DUMITRICĂ,  
KOZUR & MOSTLER, 1980**

**Type species:** *Hozmadia reticulata* DUMITRICĂ, KOZUR & MOSTLER, 1980

***Hozmadia reticulata* DUMITRICĂ,  
KOZUR & MOSTLER, 1980  
(Pl. 31, fig. 4)**

1980 *Hozmadia reticulata* n. sp. - DUMITRICĂ, KOZUR & MOSTLER, pp. 21-22, pl. 9

**Occurrence:** Lower Fassanian *Spongosilicarmiger italicus* Zone, Hungary, Italy, Yugoslavia.

***Hozmadia costata* n. sp.**

(Pl. 31, figs. 1, 2, 5-10)

**Derivatio nominis:** According to the distinct costae on the outer surface.

**Holotypus:** The specimen on pl. 31, figs. 2, 8, 9, 10; rep.-no. KoMo 1980 I-1.

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** More than 100 specimens.

**Diagnosis:** Monocyrtid. Cephalis very large, subhemispherical with widely scattered tiny pores. Surface covered by high narrow ribs expressing the arches between the spicules (AV, AI, LV, LI, DI) and few strong connecting costae between them. Strong, smooth distal ridges are built up by the connections between the lateral ridges of the feet. The wall surface between the ridges is smooth, pitted or has an indistinct, incomplete reticulum (above all in the fields above the distal ridges).

Apical horn stout, tricarinate. Feet in prolongation of D and 2L, stout, tricarinate, slightly curved.

Cephalic spicular system very robust, with Mb, A, V, 2L, D, 2I.

Aperture moderately large, round, distal limit of cephalis triangular, built up by the distal marginal ridges.

**Dimensions:**

Height of cephalis = 94-100 µm

Width of cephalis = 94-110 µm

Length of apical horn = 41-57 µm

Length of feet = 63-78 µm

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone) and Lower Fassanian of Balaton Highland and Southern Alps. The Lower Fassanian forms belong to a different subspecies, described in an other paper.

**Remarks:** *Hozmadia costata* n. sp. is the forerunner of *Hozmadia reticulata* DUMITRICĂ, KOZUR & MOSTLER, 1980 from the higher part of Lower Fassanian *Spongosilicarmiger italicus* Zone. In this species the whole surface between the ridges displays a strong reticulum.

Transitional forms (*H. costata* n. subsp.) are present in the Lower Fassanian. In these forms the surface between the ridges is strongly nodose and the nodes are connected by a low, often indistinct reticulum.



***Hozmadia koeveskallensis* n. sp.**

(Pl. 31, fig. 3)

**Derivatio nominis:** According to the occurrence in Köveskál, Balaton Highland (Hungary).

**Holotypus:** The specimen on pl. 31, fig. 3; rep.-no. KoMo 1980 I-612.

**Locus typicus:** Koveskál (Balaton Highland, Hungary) section at the cemetery.

**Stratum typicum:** Sample 4b, Nemesvámos Limestone Formation, Upper Fassanian *Budurovignathus truempyi* conodont zone.

**Material:** 52 specimens.

**Diagnosis:** Monocyrtid. Cephalis large, subglobular; inner layer with widely scattered small pores. Outer layer consists of a coarse reticulum with large triangular to pentagonal pore frames broadened at the joints and here with nodes. Pores of the outer layer large, but of different size and shape, mostly rounded triangular to rounded rhomboidal. Arches AV and AI incerted as somewhat thicker ridges into the outer reticulum.

Cephalic spicular system very robust, with Mb, A, V, 2L, D, 2I. Apical horn tricarinate, stout, large. Feet in prolongation of D and 2L long, stout, tricarinate, obliquely outward-downward directed.

**Dimensions:**

Length of cephalis = 100–122 µm

Maximum width of cephalis = 156–161 µm

Length of apical horns = 105–111 µm

Length of feet = 194–222 µm

**Occurrence:** Upper Fassanian *Budurovignathus truempyi* Zone of the Balaton Highland.

**Remarks:** *Hozmadia reticulata* DUMITRICĂ, KOZUR & MOSTLER, 1980 has the same shell structure with widely scattered small pores on the inner layer and an outer reticulum with large pore frames. However, the feet of this species are considerably shorter and not so far outward directed.

***Hozmadia longicephalis* n. sp.**

(Pl. 29, figs. 5, 6)

**Derivatio nominis:** According to the long cephalis.

**Holotypus:** The specimen on pl. 29, figs. 5, 6; rep.-no. KoMo 1980 I-525.

**Locus typicus:** Felsőörs (Balaton Highland), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within a tuffitic layer, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** 4 specimens.

**Diagnosis:** Test small. Cephalis long, subellipsoidal, constricted above the feet. Cephalic spicular system with Mb, A, V, 2L, D, 2I. Arches between the spiculae at the surface visible as indistinct ribs. Remaining surface smooth, to a large part poreless. Pores only present around the junction between the spiculae with the wall. Here are also very small tricarinate horns present. Apical horn very large, tricarinate. 3 feet in prolongation of D, L and I (only observed in one specimen, may be that the feet in prolongation of I is a occasional feature). Feet outside rounded, inside excavated. In the proximal part the feet are still indistinctly tricarinate.

**Dimensions:**

Length of test = 131–145 µm

Length of cephalis = 65–74 µm

Maximum width of cephalis = 50–55 µm

**Occurrence:** Illyrian (*P. trinodosus* Zone) of Balaton Highland.

**Remarks:** *Hozmadia pyramidalis* GORIČAN, 1990 from the Ladinian has also a somewhat elongated cephalis constricted above the feet, but it is shorter than in *H. longicephalis* n. sp. The feet are clearly tricarinate, the horn V is stronger, the arches are visible on the shell surface as strong ridges. Between these ridges the shell surface is slightly reticulate.

*Hozmadia longicephalis* n. sp. is the forerunner of the Monicastericidae n. fam., that have at primitive forms the same shape of the feet, but the test is still more elongated and displays a short distal tubus on which the feet are situated. The test becomes dicyrtid and in higher forms with reduced or lacking feet multicyrtid. By this the development of slender multicyrtid Nassellaria from monocyrtid forms is demonstrated.

***Hozmadia spinosa* n. sp.**

(Pl. 30, figs. 4, 7)

**Derivatio nominis:** According to the spinose apical horn and feet.

**Holotypus:** The specimen on pl. 30, figs. 4, 7; rep.-no. KoMo 1980 I-10.

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* zone (Illyrian).

**Material:** 9 specimens.

**Diagnosis:** Monocyrtid. Cephalis large, surface with few large pores near the feet, otherwise poreless, covered by distinct ridges as expressions of the arches AI and AV starting from the 3 ridges of the apical horn. Remaining surface smooth or with few low, indistinct ridges. Collar edge sharp, but only a little thickened by marginal distal ridges.

Cephalic spicular system very robust, with Mb, A, V, 2L, D, 2I. Apical ridge stout, tricarinate. Somewhat before its distal end 3 spines branch off from the 3 high ridges.

The 3 straight, stout, but relatively short feet are situated in prolongation of D and 2L. They are tricarinate. Somewhat before the distal end also in the feet 3 spines branch off from the 3 ridges. The inner one is very long and slender, the lateral ones are considerably shorter and triangular.

In prolongation of 2I and V very small spines are present.

**Dimensions:**

Length of cephalis = 60–68  $\mu\text{m}$

Width of cephalis = 70–75  $\mu\text{m}$

Length of apical horn = 55–58  $\mu\text{m}$

Length of feet = 50–55  $\mu\text{m}$

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone) of Balaton Highland.

**Remarks:** This species has a transitional position between *Hozmadia* DUMITRICĂ, KOZUR & MOSTLER, 1980 and *Neopylentonema* KOZUR 1984. As in *Neopylentonema* all feet and the apical horn display 3 subterminal vertices. However, in *Neopylentonema* also the prolongations of 2I are tricarinate, stout and display 3 subterminal vertices, whereas the prolongation of V is stout, tricarinate without vertices. In *Hozmadia spinosa* n. sp. only tiny spines in prolongation of V and 2I are present. The other *Hozmadia* species, in turn, have no subterminal vertices at the apical horn and feet.

***Hozmadia rotunda***

(NAKASEKO & NISHIMURA, 1979)

(Pl. 29, figs. 3, 4, 7)

1979 *Tripilidium rotundum* NAKASEKO & NISHIMURA  
n.sp. – NAKASEKO & NISHIMURA, pp. 81–82,  
pl. 8, figs. 1–3

**Occurrence:** Typical and frequent species in the Illyrian (*Paraceratites trinodosus* Zone) of Balaton Highland. Illyrian of Japan (erroneously placed into the Upper Triassic by NAKASEKO & NISHIMURA, 1979).

**Genus *Poulpus* DE WEVER, 1979**

**Type species:** *Poulpus piabyx* DE WEVER, 1979

***Poulpus curvispinus curvispinus***

DUMITRICĂ, KOZUR & MOSTLER, 1980

(Pl. 32, figs. 5, 8)

**Occurrence:** Upper subzone of Lower Fassanian *Spongossilicarmiger italicus* Zone up to Upper Fassanian.

***Poulpus curvispinus praecurvispinus* n. sp.**

(Pl. 32, figs. 3, 6, 7)

**Derivatio nominis:** According to the stratigraphic occurrence before *P. curvispinus curvispinus* DUMITRICĂ, KOZUR & MOSTLER.

**Holotypus:** The specimen on pl. 32, figs. 6, 7; rep.-no. Ko-Mo 1980 I-277.

**Locus typicus:** Passo della Gabiola near Recoaro, Vicentian Alps (Italy).

**Stratum typicum:** Sample MD 2, middle subzone of Lower Fassanian *Spongossilicarmiger italicus* Zone.

**Material:** 39 specimens.

**Diagnosis:** Monocyrtid. Cephalis large, hemiglobular. Arches AV and 2AI recognizable on the wall as distinct ridges. Remaining surface smooth, distal part of the arches often with small nodes. Near the base of the feet and near the junction of V and 2I with the wall often small pores are present. Remaining surface poreless. Cephalic spicular systems very robust with Mb, A, V, 2L, D, 2I. The 3 very large, downward and proximally also outward directed curved feet are situated in prolongation of D and 2L. They display 3 high ridges and broad deep furrows. The outer furrow ends in a large pore in the wall. A tiny needle-like apical horn may be present. Tiny denticles as remnants of a velum are present around the aperture.

**Dimensions:**

Length of cephalis = 69–75  $\mu\text{m}$

Maximum width of cephalis = 84–89  $\mu\text{m}$

Length of the feet = 144–175  $\mu\text{m}$

**Occurrence:** Middle subzone of Lower Fassanian *Spongossilicarmiger italicus* Zone. Italy.

**Remarks:** The Illyrian (*Paraceratites trinodosus* Zone) *Poulpus illyricus* n. sp. has shorter spines. The very small to small tricarinate apical horn is always distinct and a tiny

vertical horn, sometimes also tiny horns in prolongation of 2l are present.

*Poulpus curvispinus curvispinus* DUMITRICĂ, KOZUR & MOSTLER, 1980 from the upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone to Upper Fassanian displays distinct nodes on the whole surface of cephalis.

***Poulpus gracilis* n. sp.**

(Pl. 32, figs. 9, 12)

**Derivatio nominis:** According to the delicate cephalis wall.

**Holotypus:** The specimen on pl. 32, figs. 9, 12; rep.-no. KoMo 1980 I-18.

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian).

**Material** 12 specimens.

**Diagnosis:** Monocyrtid. Cephalis large, hemiglobular, consisting of a loose meshwork of round bars. These bars are the arches Al, AV, Dl, Ll and connecting bars that branch off to a large part from the base of the feet. The pores between this loose pore frames are very large, polygonal to oval.

Cephalic spicular system robust, consisting of Mb, A, V, 2L, D, 2l. The feet are long, slender, round, downward and proximally also outward directed. Their distal parts are a little inward curved.

**Dimensions:**

Length of cephalis = 85–89  $\mu\text{m}$

Width of cephalis = 67–73  $\mu\text{m}$

Length of feet = 129–137  $\mu\text{m}$

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone) of Balaton Highland (Hungary).

**Remarks:** *Poulpus gracilis* n. sp. represents together with *P. longicephalis* n. sp. a characteristic Upper Anisian *Poulpus* group, from which no successors are so far known in the Ladinian. By their loose pore frames and large pores they are distinctly distinguished from all younger *Poulpus* species.

*Poulpus longicephalis* n. sp. is distinguished by the shape of the cephalis that is considerably longer than broad, by the denser meshwork of finely spined bars and therefore not so large pores.

***Poulpus illyricus* n. sp.**

(Pl. 29, figs. 8–10; pl. 32, figs. 1, 2, 4)

**Derivatio nominis:** According to the occurrence in the Illyrian.

**Holotypus:** The specimen on pl. 32, fig. 4; rep.-no. KoMo 1980 I-7.

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section.

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian.)

**Material:** 51 specimen.

**Diagnosis:** Monocyrtid. Cephalis large, hemiglobular, with very small to small tricarinate apical horn. Surface with few pores near the base of the feet and at the junction of V and 2l with the wall, otherwise poreless, smooth, but with low ridges in the place of arches Al and AV. Cephalic spicular system very robust, in prolongation of 2l tiny horns may be present, in prolongation of V always a tiny horn is situated. The 3 tricarinate feet in prolongation of D and 2L are stout, large, in the basal part cylindrical with low continuation of the inner ridge, in the remaining part tricarinate with high ridges and deep furrows. In prolongation of the outer furrow the 3 feet are open.

**Dimensions:**

Length of cephalis = 45–50  $\mu\text{m}$

Width of cephalis = 63–70  $\mu\text{m}$

Length of feet = 100–113  $\mu\text{m}$

**Occurrence:** Illyrian *Paraceratites trinodosus* Zone of Balaton Highland, Hungary.

**Remarks:** *Poulpus illyricus* n. sp. is a very primitive form that has still a very small, but distinct apical horn and horns in prolongation of V, sometimes also in prolongation of 2l. It is the forerunner of the Lower to Fassanian *Poulpus curvispinus* DUMITRICĂ, KOZUR & MOSTLER, 1980 that is distinguished by longer, recurvated spines, missing or indistinct apical horn, and a nodose surface. *P. curvispinus praecurvispinus* n. subsp. is a transitional form between *P. illyricus* and *P. curvispinus*. Differences of *P. illyricus* from *P. curvispinus praecurvispinus* see under this subspecies.

It is stratigraphically important that all 3 Illyrian *Poulpus* species are very primitive forms with features unknown in younger *Poulpus* species. 2 of these 3 species have no successors in the Ladinian.

***Poulpus longicephalis* n. sp.**

(Pl. 32, figs. 10, 11)

**Derivatio nominis:** According to the long cephalis

**Holotypus:** The specimen on pl. 32, figs. 10, 11; rep.-no. KoMo 1980 I-6

**Locus typicus:** Felsöors (Balaton Highland, Hungary), Forráshegy section

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian)

**Material:** 5 specimens.

**Diagnosis:** Monocyrtid. Cephalis large, long, proximally hemiglobular, distally subcylindrical. Pore frames large, consisting of roundish bars with numerous tiny, needle-like spines. Cephalic spicular system very robust, with Mb, A, V, 2L, D, 2I. Arches AV, AI, DI and LI are part of the pore frames. 3 feet in prolongation of D and 2L long, roundish, needle-like, downward and outward directed.

**Dimensions:**

Length of cephalis = 135-150 µm

Width of cephalis = 110-123 µm

Length of feet = More than 135 µm (no exemplar with fully preserved feet)

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone) of Balaton Highland (Hungary).

**Remarks:** The Illyrian *Poulpus gracilis* n. sp. has a shorter cephalis and still larger pores in a still looser pore frames.

**Family Silicarmigeridae**

**KOZUR & MOSTLER, 1980**

**Genus *Silicarmiger* DUMITRICĂ, KOZUR & MOSTLER, 1980**

**Type species:** *Silicarmiger costatus* DUMITRICĂ, KOZUR & MOSTLER, 1980

***Silicarmiger costatus costatus* DUMITRICĂ,  
KOZUR & MOSTLER, 1980**

(Pl. 33, figs. 6, 15, 16; pl. 34, fig. 8)

1980 *Silicarmiger costatus* n. gen. n. sp. - DUMITRICĂ, KOZUR & MOSTLER, p. 23, pl. 7, figs. 1-6; pl. 14, fig. 4

1981 *Silicarmiger costatus costatus* DUMITRICĂ, KOZUR & MOSTLER, 1980 - KOZUR & MOSTLER, p. 104

**Occurrence:** Lower to Middle Fassanian of European Tethys.

***Silicarmiger costatus anisicus***

**KOZUR & MOSTLER, 1981**

(Pl. 33, figs. 1-5, 7-9, 13)

1981 *Silicarmiger costatus anisicus* n. subsp. - KOZUR & MOSTLER, p. 104, pl. 10, fig. 1

**Occurrence:** Upper Anisian (*Paraceratites trinodosus* Zone) of Balaton Highland.

***Silicarmiger costatus magnicornus* n. subsp.**

(Pl. 33, fig. 10; pl. 34, fig. 7)

**Derivatio nominis:** According to the big apical spine

**Holotypus:** The specimen on pl. 34, fig. 7; rep.-no. KoMo 1980 I-576

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** Sample TT 7, lower part of Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 43 specimens.

**Diagnosis:** With the character of the species. Apical horn very large, stout; broad proximal part straight, transition to round, needle-like distal part fast. Feet slender, only in the proximal part tricarinate, in the distal part roundish and needle-shaped. Number of costae on the thorax high (5-8).

**Dimensions:**

Length of test (without apical horn and feet) = 175-207 µm

Width of test = 131-135 µm

Length of apical horn = 138-160 µm

Length of feet = 200-220 µm

**Occurrence:** Middle Fassanian of Italy.

**Remarks:** In the Lower to Middle Fassanian *Silicarmiger costatus costatus* DUMITRICĂ, KOZUR & MOSTLER, 1980 the apical horn has no straight, broad proximal part, but it tapers continuously from its broad base toward the round, needle-shaped distal part that is with exception of the Middle Fassanian forms always very short.

In the Upper Anisian (*P. trinodosus* Zone) *Silicarmiger costatus anisicus* KOZUR & MOSTLER, 1981, the apical horn tapers continuously toward the very short roundish, needle-shaped distal part, the feet are broader, shorter and tricarinate until their distal ends and the test has fewer costae (1-4).

***Silicarmiger curvatus* (KOZUR & MOSTLER, 1979)**  
(Pl. 33, figs. 11, 12, 14)

1979 *Eonapora curvata* n. sp. - KOZUR & MOSTLER,  
pp. 90-91, pl. 13, fig. 5

1984 *Silicarmiger curvatus* (KOZUR & MOSTLER,  
1979) - KOZUR, p. 63, pl. 4, fig. 3

**Occurrence:** Middle Longobardian to Julian of European  
Tethys (Austria, Hungary, Italy).

***Silicarmiger latus* n. sp.**

(Pl. 34, figs. 1-4, 9; pl. 35, figs. 1, 2, 4, 5)

1979 *Stichopterium* (?) sp. A - NAKASEKO & NISHI-  
MURA, p. 80, pl. 11, figs. 1(?), 3(?), 4

1990 *Silicarmiger* aff. *costatus* DUMITRICĂ, KOZUR  
& MOSTLER, 1980 - GORIČAN, p. 156, pl. 10,  
fig. 9

**Derivatio nominis:** According to the broad thorax

**Holotypus:** The specimen on pl. 34, fig. 9; rep.-no. KoMo  
1980 I-578

**Locus typicus:** Köveskál (Balaton Highland, Hungary),  
section at the cemetery

**Stratum typicum:** Nodular cherty limestone within tuf-  
fites, 65 cm below sample 6/83, Nemesvámos Formation,  
lower part of *Budurovignathus mungoensis* A.Z., Middle  
Longobardian

**Material:** More than 100 specimens.

**Diagnosis:** Cephalis small to moderately large, hemiglob-  
ular to subglobular, with ribs in the place of arches AV, AI  
and few additional oblique or ring-like costae. Cephalic  
spicular system robust, with Mb, A, V, 2L, D, 2I. In prolon-  
gation of V and 2I small, carinate horns are present. Apical  
horn stout, tricarinate, short, with missing to long needle-  
like prolongation.

Thorax large, subglobular to broadly frustum-like,  
with 4-8 sharp narrow rings that are interrupted and often  
displaced along the feet.

The feet in prolongation of D and 2L are long, slen-  
der, in their distal part roundish and needle-like, in their  
free proximal part tricarinate. In large parts of their proxi-  
mal section the feet are inserted into the thoracic wall as a  
strong ridge.

Aperture large, subtriangular to round.

Dimensions: See under the subspecies.

**Occurrence:** Upper part of Middle Fassanian *Ladino-  
campe multiperforata* Zone up to Longobardian. Hun-  
gary, Italy, Japan.

**Remarks:** In the Lower to Middle Fassanian *Silicarmiger*

*costatus costatus* DUMITRICĂ, KOZUR & MOSTLER,  
1980 the lib relation of the thorax is larger and the broad tri-  
carinate part of the apical spine is longer. The nominate  
subspecies is additionally distinguished by a smaller cepha-  
lis and a missing roundish distal part of the apical spine.

***Silicarmiger latus latus* n. subsp.**

(Pl. 34, figs. 3, 4, 9; pl. 35, figs. 2, 5)

**Holotypus** = Holotypus of the species

**Material:** More than 100 specimens.

**Diagnosis:** With the character of the species. Cephalis  
small, only in primitive forms moderately large. Apical  
horn very broad, but short. Distal needle-like, roundish  
part missing or very short. Thorax subglobular, with 5-8  
very high ring-like costae.

**Dimensions:**

Length of test (without apical horn and feet) =  
225-270 µm,

in primitive Upper Fassanian forms about 180 µm

Maximum width of test = 200-233 µm, in primitive Upper  
Fassanian forms about 175 µm

Length of cephalis = 50-60 µm, in primitive Upper Fassa-  
nian forms about 65 µm~

Maximum width of cephalis = 65-73 µm, in primitive  
Upper Fassanian forms about 80 µm

Length of apical horn = about 40 µm, in primitive Upper  
Fassanian forms 65-75 µm

**Occurrence:** Primitive forms with still moderately large  
cephalis occur in the Upper Fassanian *Budurovignathus  
truempyi* conodont A.Z., but the main occurrence of typi-  
cal forms is in the Longobardian. Hungary, Japan.

**Remarks:** See also under the species.

The Middle Fassanian *Silicarmiger latus longispi-  
nosus* n. subsp. has a long, roundish, needle-like distal part  
of the apical horn. The cephalis is somewhat broader.

*Silicarmiger latus mediospinosus* n. subsp. has a  
medium-long distal, roundish, needle-like part of the api-  
cal horn and the cephalis is somewhat broader.

***Silicarmiger latus longispinosus* n. subsp.**

(Pl. 35, fig. 1)

**Derivatio nominis:** According to the long needle-like dis-  
tal part of the apical spine

**Holotypus:** The specimen on pl. 35, fig. 1; rep.-no. KoMo  
1980 I-577

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** Sample TT 14, upper part of Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 8 specimens.

**Diagnosis:** With the characters of the species. Cephalis moderately large, hemiglobular. Apical horn with long, roundish distal part. Thorax broadly frustum-like.

**Dimensions:**

Length of test (without apical horn and feet) = 150-170  $\mu\text{m}$

Maximum width of test = 181-190  $\mu\text{m}$

Length of cephalis = 50-60  $\mu\text{m}$

Width of cephalis = 82-90  $\mu\text{m}$

Length of apical horn = 125-134  $\mu\text{m}$

**Occurrence:** Upper part of Middle Fassanian *Ladinocampe multiperforata* Zone, Italy.

**Remarks:** See also under the species.

The Longobardian nominate subspecies has a somewhat smaller cephalis and a broad, short apical horn without or with very short roundish needle-like part of the apical horn.

*Silicarmiger latus mediospinosus* n. subspecies from the uppermost part of the Middle Fassanian displays a medium-sized roundish, needle-shaped distal part of the apical horn.

*Silicarmiger latus longispinosus* n. subsp. in the most primitive member of a phylomorphogenetic line within *S. latus* n. sp. in which the long, needle-shaped distal part of the apical spine is rapidly reduced and finally also the cephalis becomes smaller. *S. latus longispinosus* n. subsp. is still near related to *S. costatus costatus* DUMITRICĂ, KOZUR & MOSTLER, from which it is only distinguished by the broader thorax, the common feature of all subspecies of *S. latus* n. sp.

***Silicarmiger latus mediospinosus* n. subsp.**

(Pl. 34, figs. 1, 2; pl. 35, fig. 4)

**Derivatio nominis:** According to the medium-sized needle-like distal segment of the apical horn

**Holotypus:** The specimen on pl. 35, fig. 4; rep.-no. KoMo 1980 I-358

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** Sample TT 16, uppermost part of the Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 17 specimens.

**Diagnosis:** With the character of the species. Cephalis moderately large. Apical horn with medium-sized needle-

like, round distal part of apical spine. Thorax broadly frustum-like.

**Dimensions:**

Length of test (without apical spine and feet) = 142-154  $\mu\text{m}$

Maximum width of test = 134-139  $\mu\text{m}$

Length of cephalis = 46-50  $\mu\text{m}$

Width of cephalis = 68-70  $\mu\text{m}$

Length of apical horn = 60-72  $\mu\text{m}$

**Occurrence:** Uppermost part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** In the Middle Fassanian *Silicarmiger latus longispinosus* n. subsp. the distal needle-like part of the apical horn is longer.

In the Upper Fassanian and Longobardian *Silicarmiger latus latus* n. subsp. the distal needle-like part of the apical horn is missing or very short, the whole apical spine is therefore short.

**Genus *Nofrema* DUMITRICĂ, KOZUR & MOSTLER, 1980**

**Type species:** *Nofrema trispinosa* DUMITRICĂ, KOZUR & MOSTLER, 1980

***Nofrema trispinosa* DUMITRICĂ, KOZUR & MOSTLER, 1980**

(Pl. 34, figs. 5, 6, 10)

1980 *Nofrema trispinosa* n. sp. - DUMITRICĂ, KOZUR & MOSTLER, p. 25, pl. 9, fig. 1; pl. 15, fig. 3

**Occurrence:** Upper subzone of Lower Fassanian *Spongossilicarmiger italicus* Zone.

**Genus *Spongossilicarmiger* KOZUR, 1984**

**Type species:** *Spongossilicarmiger italicus* KOZUR, 1984

***Spongosilicarmiger italicus italicus* KOZUR, 1984**

(Pl. 35, fig. 7; pl. 37, figs. 1, 5, 6, 9, 10)

1984 *Spongosilicarmiger italicus* n. gen. n. sp. - KOZUR, pp. 64-65, pl. 6, fig. 2; pl. 7, fig. 1

**Occurrence:** Lower and Middle Fassanian, Hungary, Italy, Japan, Philippines, Yugoslavia.

***Spongosilicarmiger italicus transitus* n. subsp.**

(Pl. 35, fig. 10; pl. 36, fig. 6)

1989 *Silicarmiger* sp. A, pars - CHENG, p. 148, only pl. 7, fig. 12

**Derivatio nominis:** According to the transitional position between *S. italicus* KOZUR and *S. priscus* n. sp.

**Holotypus:** The specimen on pl. 36, fig. 6; rep.-no. KoMo 1980 I-384

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section

**Stratum typicum:** Limestone bed 100D within the Pietra verde of Buchenstein Formation. Lower *Spongosilicarmiger italicus* Zone, basal "*Xenoprotrachyceras*" reitzi Oppel Zone (*Parakellnerites* fauna), basal Fassanian

**Material:** 32 specimens.

**Diagnosis:** Cephalis subglobular, poreless, covered with a nodose outer layer. Cephalic spicular system with Mb, A, V, 2L, D, 2I. Apical horn stout, cylindrical, distally conical. With exception of a short distal spine the whole apical horn is covered by an outer layer with pores and distinct nodes that may join partly to short ribs around the pores. The basal part of the apical spine displays fewer or lower nodes. The transition between the cylindrical and distal conical part may be a little widened. The 3 needle-like, long feet in prolongation of D and 2L are proximally inserted in the shell wall, outside visible as a ridge, than they are connected with the wall by ridges and blades with pores. The distal part of the feet is free and rather strongly outward and downward directed.

Postcephalic portion of the test subcylindrical. Inner layer with 9-11 transversal ribs that connect the feet with the wall. In the distal part of test, where the feet are free, these transversal ribs are uninterrupted rings. Between the rings pores are present, mostly arranged in irregular pore rings. The outer layer consists of distinct nodes connected each other by short narrow bars. The pores of the outer layer are somewhat longer than that of the inner layer and triangular to oval. Distal part of test slightly narrowing, in the distalmost portion the outer layer is missing. Aperture roundish, relatively large.

**Dimensions:**

Length of test (without apical horn) = 321-340  $\mu$ m

Maximum width of test = 130-136  $\mu$ m

Length of apical horn = 120-133  $\mu$ m

Width of apical horn in its midlength = 53-50  $\mu$ m

**Occurrence:** Lower subzone of *Spongosilicarmiger italicus* Zone. Hungary, Philippines. In Felsőörs this level belongs to the lower part of '*Xenoprotrachyceras*' reitzi Oppel Zone (level with *Kellnerites*), basal Fassanian.

**Remarks:** The Illyrian *Spongosilicarmiger priscus* n. sp. displays a conical apical horn that becomes continuously narrower from its broad base. Moreover, the feet are not so much outward directed.

*Spongosilicarmiger italicus italicus* KOZUR 1984 displays also a subcylindrical apical horn, but it is not covered by an outer layer in its basal part and therefore here distinctly narrower than in the midlength. In *S. italicus transitus* n. subsp. the widening in the midlength is either missing or weak. In many specimens of *S. italicus italicus* the distal part of the test becomes distinctly narrower with relatively small aperture, but in the holotype and many other forms the distal narrowing is not significantly stronger than in *S. italicus transitus* n. subsp.

In the Illyrian a similar form with broad, slightly conical apical horn occurs, covered like the inflated cephalis by nodes. Probably it belongs into the field of intraspecific variation of *Spongosilicarmiger priscus* n. sp., because the apical horn is slightly conical, but it does not taper so rapidly as in this species. Only one specimen is present, here regarded a *Spongosilicarmiger cf. priscus* n. sp.

The Lower Fassanian *Spongosilicarmiger gabiolaensis* n. sp. from the middle subzone of *Spongosilicarmiger italicus* Zone displays also a subcylindrical, in the midlength not or only indistinctly widened apical horn, but it has a long, uncovered, needle-like distal part of the apical horn.

According to the form of the apical horn, *S. italicus transitus* n. subsp. could be both the forerunner of *S. italicus italicus* KOZUR and of *S. gabiolaensis* n. sp.

***Spongosilicarmiger gabiolaensis* n. sp.**

(Pl. 35, figs. 3, 6, 8, 9, 11; pl. 36, figs. 21, 4, 5, 7, 8, 10; pl. 37, figs. 2-4, 7, 8)

1990 *Spongosilicarmiger italicus* KOZUR, 1984 - GORČAN, p. 158, pl. 10, fig. 7

**Derivatio nominis:** According to the occurrence in the Passo della Gabiola section

**Holotypus:** The specimen on pl. 36, fig. 4, 5, 8; rep.-no. KoMo 1980 I-386

**Locus typicus:** Passo della Gabiola near Recoaro, Vicen-  
tinian Alps (Italy)

**Stratum typicum:** Sample MD 20, middle subzone of  
*Spongosilicarmiger italicus* Zone, Lower Fassanian

**Material:** More than 100 specimens.

**Diagnosis:** Cephalis relatively small, globular, imperforat, covered with a nodose or pustulose outer layer. Nodes sometimes connected in irregular ribs. Cephalic spicular system with Mb, A, V, 2L, D, 2I. The 3 needle-like feet are situated in prolongation of D and 2L. They are straight downward and somewhat outward directed. The feet are in their upper part inserted into the wall. In the lower part the feet are connected with the wall by the ends of the transversal ribs. The distal ends of the feet are free. Apical spine very large, in the proximal part slender subcylindrical, straight or slightly curved. It is here covered by an outer layer with small pores. Pore frames with short irregular ribs and nodes. Distal part needle-shaped, moderately to very long, straight or curved, not covered by an outer layer. Basal part of apical spine may be also uncovered by the outer layer and it is than a little narrower than the following part. Postcephalic part of test subconical, distally somewhat narrowing. The inner layer consists of 6-10 transversal ribs, irregularly spaced between two adjacent feet. The pores between the ribs vary in size and shape. The outer layer has irregular pore frames with small nodes on the joints. Outer pore frames arranged in irregular short longitudinal ribs.

**Dimensions:** See under the subspecies.

**Occurrence:** Middle and upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Remarks:** Well preserved representatives of the Lower Fassanian *Spongosilicarmiger italicus* KOZUR, 1984 have a very short, conical, tricarinate terminal spine, in *S. italicus transitus* n. subsp. this very short spine may be rounded. In *S. italicus* never a long terminal spine was observed. The characteristic widening of the middle part of the relatively short subcylindrical portion of the apical spine of *S. italicus italicus* KOZUR, 1984 can be also observed in some of those specimens of *S. gabiolaensis* n. sp., where the basal apical spine displays no cover of the outer layer. In general, this widening is considerably weaker than in *S. italicus italicus* KOZUR 1984, similar to *S. italicus transitus* n. subsp. that displays, however, no long smooth, needle-like apical spine. Moreover, this subspecies is also distinguished by more outward directed feet, a

longer, subcylindrical distal part of the test behind the inserted feet and a different pore frames of the outer layer (more pronounced nodes, connected by radially bars).

*Spongosilicarmiger gabiolaensis*  
*gabiolaensis* n. subsp.

(Pl. 35, fig. 8; pl. 36, figs. ?1, 4, 5, 7, 8, 10;  
pl. 37, figs. ?7, 8)

**Holotypus:** Holotype of the species.

**Material:** 28 specimens.

**Diagnosis:** With the characters of the species. Both slender cylindrical proximal part and straight, needle-like moderately long to long terminal part of the apical horn straight.

**Dimensions:**

Length of test (without apical horn and feet) = 310-356 µm

Maximum width of test = 190-261 µm

Length of apical horn = 145-310 µm

Length of distal needle-like part of apical horn = 54-110 µm

**Occurrence:** Upper part of middle and upper subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone. Transitional forms to *S. italicus italicus* KOZUR, 1984 occur in the middle subzone of the *S. italicus* zone.

**Remarks:** Transitional forms to *Spongosilicarmiger italicus italicus* KOZUR have a broader and shorter cylindrical proximal part of the apical horn that is distinctly broadened in its middle portion and has only a short needle-like distal part that is at least basally tricarinate.

In *Spongosilicarmiger gabiolaensis curvatospinus* n. subsp. is at least the needle-shaped distal part distinctly curved.

*Spongosilicarmiger gabiolaensis*  
*curvatospinus* n. subsp.

(Pl. 35, figs. 3, 6, 9, 11; pl. 37, figs. 2-4)

**Derivatio nominis:** According to the distally distinctly curved apical spine

**Holotypus.** The specimen on pl. 35, figs. 9, 11; rep.-no. KoMo 1980 I-592

**Locus typicus:** Passo della Gabiola near Recoaro, Vicen-  
tinian Alps, Italy

**Stratum typicum:** Sample MD 1, middle subzone of  
Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** 79 specimens.



**Diagnosis:** With the character of the species. Proximal, slender cylindrical part of apical spine very long, covered with a thick porous outer layer, but basally often smooth. This part is mostly oblique or somewhat curved, rarely straight. The following needle-shaped distal part of the apical horn is always distinctly curved.

**Dimensions:**

Length of test (without apical horn) = 245-294  $\mu\text{m}$

Maximum width of test = 127-195  $\mu\text{m}$

Length of apical horn = 114-200  $\mu\text{m}$

**Occurrence:** Frequent in the middle subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone, rare in the upper subzone of this zone.

**Remarks:** Clearly distinguished from the Lower Fassanian *Spongosilicarmiger italicus italicus* KOZUR, 1984 both by the longer, slender cylindrical proximal part of the apical horn and by the long, needle-like, curved distal part of the apical horn. This latter feature distinguishes *S. gabiolaensis curvatospinosus* n. subsp. also from *S. gabiolaensis gabiolaensis* n. subsp. that has a straight distal needle-like spine. Moreover, the slender subcylindrical part covered by the thick outer layer is shorter in the nominate subspecies.

*Spongosilicarmiger posterus* n. sp.  
(pl. 35, figs. 12, 13; pl. 36, figs. 2, 3)

**Derivatio nominis:** According to the occurrence after *Spongosilicarmiger italicus* n. sp.

**Holotypus:** The specimen on pl. 36, figs. 2, 3; rep.-no. KoMo 1980 I-600

**Locus typicus:** Passo della Gabiola near Recoaro, Vicentian Alps, Italy

**Stratum typicum:** Sample MD 28, basal part of Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 27 specimens.

**Diagnosis:** Cephalis relatively small, elongated subhemiglobular, poreless, covered with low ribs and nodes. Cephalic spicular system with Mb, A, V, 2L, D, 2I. Apical horn cylindrical, with short distal tip that is on one side rounded or with broadly rounded, only a little elevated ridge, whereas on the other side a broad furrow is present. The basal part is smooth, but has about the same width as the following part with small roundish pores surrounded by high pore frames of short, rounded bars, nodes, sometimes short spinés. Thorax shallowly hoop-like elevated, with few tiny pores, mostly closed by an outer layer that bears numerous short, often indistinct, irregular, but most-

ly transversal and diagonal ribs and small nodes. The outer expression of the inserted feet begins only below the thorax. The distal part of the needle like, long feet in continuation of D and 2L is free, the proximal part is connected by the ends of the transversal ribs with the wall. The distal end of the inserted part of the feet is often blade-like high.

The inner layer of the postthoracic velum displays 6-8 transversal ridges between the inserted part of the feet. Between these transversal ridges irregularly sized and spaced pores are present. They are mostly roundish or oval. Outer pore frames considerably larger consisting of irregular bars and indistinct nodes at the joints.

**Dimensions:**

Length of test (without apical horn and feet) = 235-307  $\mu\text{m}$

Maximum width of test = 170-194  $\mu\text{m}$

Length of apical horn = 105-118  $\mu\text{m}$

**Occurrence:** Basal part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** Both *Spongosilicarmiger italicus* KOZUR, 1984 and *S. gabiolaensis* n. sp. from the Lower Fassanian are distinguished by the missing elevation of the thorax and above all by the outer expression of the inserted feet that begins in the collar stricture below the cephalis, where it is at least indicated by a vertical line of nodes. *S. italicus italicus* KOZUR 1984 is additionally distinguished by widening of the middle part of apical horn, *S. gabiolaensis* n. sp. by the presence of a long needle-like distal part.

*Spongosilicarmiger priscus* n. sp.  
(Pl. 36, figs. 9, 11)

1979 *Stichopterium* (?) sp. B - NAKASEKO & NISHIMURA, pp. 80-81, pl. 11, only fig. 2

1989 *Silicarmiger* sp. A, pars - CHENG, p. 148, only pl. 6, fig. 12

**Derivatio nominis:** Oldest known *Spongosilicarmiger* species

**Holotypus:** The specimen on pl. 36, figs. 9, 11; rep.-no. KoMo 1980 I-385

**Locus typicus:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian)

**Material:** 9 specimens.

**Diagnosis:** Cephalis large, subglobular. Cephalic spicular system with Mb, A, V, 2L, D, 2I. Apical horn stout covered with an outer layer with irregular pore frames bearing irregular short ribs and nodes around irregularly distributed roundish pores. Only a very short, tricarinate tip is not covered by the outer layer. The apical horn is conical. The out-

er layer continues either without interruption onto the poreless cephalis (here mostly in form of nodes) or it may be somewhat reduced on the basal part of the apical cone. In prolongation of D and 2L 3 needle-like long feet are present that start in the collar stricture. The proximal part of the feet is connected by bars and pore-bearing blades with the test. Distal parts of feet free, downward and moderately outward-directed.

The postcephalic part of the test is cylindrical and bears an inner layer with about 10 irregular transverse ribs. The pores of the inner layer are irregular in shape and size, but rather small. The pore frames of outer layer are nodes with radial thin bars. The inner transversal ribs are outside indicated by a ring of these nodes, but in the distal parts these nodes are also present between the rings. The pores of the outer layer are small and triangular. In the distalmost part of the test the outer layer consists only of elevations around the pores of the inner layer. Test only indistinctly narrowing toward the distal end. Aperture roundish, large.

#### Dimensions:

Length of test = 389-400  $\mu\text{m}$

Maximum width of test = 123-129  $\mu\text{m}$

Length of apical horn = 86-90  $\mu\text{m}$

Width of apical horn in its midlength = 37-39  $\mu\text{m}$

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone) of Balaton Highland, Hungary. Illyrian of Japan.

**Remarks:** *Spongosilicarmiger italicus* KOZUR, 1984 displays a subcylindrical apical horn that widens in its middle part. The test after the inserted part of the feet becomes narrower. In transitional forms between both species (*S. italicus transitus* n. subsp.) the apical horn is not yet widened in its middle part or this widening is only indistinct, but the apical horn is already subcylindrical and not conical from its base, as in *S. priscus* n. sp.

### Family Spongolophophenidae n. fam.

**Diagnosis:** Test spongy, dicyrtid. Cephalis large, globular, elongated subhemiglobular or large-conical. Cephalic spicular system with Mb, A, V, 2L, D, 2l. Thorax long, cylindrical or conical. 3 long, needle like feet in prolongation of D and 2L may be present, starting about from the cephalis-thorax boundary. Aperture wide.

**Occurrence:** Upper Devonian-Ladinian.

Assigned genera:

*Spongolophophaena* n. gen.

*Cyrtentactinia* FOREMAN, 1963

*Conospongocyrtis* n. gen.

*Triassospongocyrtis* n. gen.

**Remarks:** The Triassic forms of this family are seemingly directly related to the Upper Devonian *Cyrtentactinia* FOREMAN, 1963 that displays the same shape and cephalic spicular system. Some larger individuals of the type species *Cyrtentactinia primatica* FOREMAN, tends to have a spongy wall.

*Spongomelissa* HAECKEL, 1887 from the Paleogene has the same shape and feet as *Triassospongocyrtis* n. gen. However, the spicules 2l are missing. *Spongomelissa* HAECKEL, 1887 has seemingly evolved from the new family, but the total reduction of 2l and the latticed, in the cephalis two-layered shell exclude this genus from the Spongolophophaenidae n. fam.

*Lophophaena* EHRENBERG, 1847 from the Tertiary to Recent displays the same outline as *Spongolophophaena* n. gen. However, the wall is latticed. Seemingly also the Lophophaenidae HAECKEL, 1881 have evolved from the Spongolophophaenidae n. fam. The transformation of thick spongy shell into latticed shell can be observed during the Mesozoic-Recent evolution in different radiolarian groups (e.g. within the Saturnaliacea DEFLANDRE, 1954: Pseudacanthocircidae KOZUR & MOSTLER, 1990 - Saturnalidae DEFLANDRE, 1954, see KOZUR & MOSTLER, 1990). These differences in shell wall have family rank.

Seemingly the Spongolophophaenidae n. fam. are a conservative group within the Narsellaria that begin in the Upper Devonian and reaches until the Triassic with Recent successors that can be distinguished in family rank.

### Genus *Spongolophophaena* n. gen.

**Derivatio nominis:** According the identical shape with *Lophophaena* EHRENBERG, 1847 and the spongy wall.

**Type species:** *Spongolophophaena globocephalis* n. gen. n. sp.

**Diagnosis:** Cephalis large, globular. Cephalic spicular system with long Mb that bears on one side 3 on the other side 4 spicules that represent V, 2L on one side and A, D, 2l on the other side. Their arrangement is asymmetrical. V runs so steep upward as A, both in a left direction. D runs downward in a right direction, 2L and 2l are situated in oblique planes. Thorax long conical to subcylindrical. Wall spongy. Inner layers with big pores, outer layers with very small pores.

**Occurrence:** Middle Fassinian Ladinocampe multiperforata Zone of Southern Alps.

**Assigned species:**

*Spongolophophaena globocephalis* n. gen. n. sp.

*Spongolophophaena longa* n. sp.

Remarks: *Lophophaena* EHRENBERG, 1847 (Tertiary-Recent) has the same shape, but a single-layered latticed shell.

*Triassospongocyrtis* n. gen. has an elongated sub-hemisphaerical or rounded broadly conical cephalis that continues fluently into the cylindrical thorax. Long needle-like feet in prolongation of D, 2L are always present. The cephalic spicular system is not asymmetric.

***Spongolophophaena globocephalis* n. gen. n. sp.**

(Pl. 38, figs. 1, 3, 5)

**Derivatio nominis:** According the very large, globular cephalis.

**Holotypus:** The specimen on pl. 38, figs. 1, 3; rep.-no. Ko-Mo 1980 I-233

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** sample TT 7, Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 14 specimens.

**Diagnosis:** With the character of the genus. Cephalis very large, globular. Apical region often with small spines, the largest of them in prolongation of A and V. Thorax broadly conical, long. Its broadening begins either immediately below the cephalis or after a short cylindrical proximal part. Proximal part of thorax narrower than cephalis, distal end considerably broader than cephalis and skirt-like widened.

**Dimensions:**

Length of test = 300-330 µm

Maximum width of test = 164-195 µm

**Occurrence:** Lower and middle part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** *Spongolophophaena longa* n. sp. displays a somewhat smaller cephalis and a longer, fewer widened thorax.

***Spongolophophaena longa* n. sp.**

(Pl. 38, figs. 2, 4)

**Derivatio nominis:** According to the long thorax

**Holotypus:** The specimen on pl. 38, fig. 2; rep.-no. I-509

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vi-

centinian Alps, Italy)

**Stratum typicum:** sample TT 18, upper part of *Ladinocampe multiperforata* Zone, Middle Fassanian.

**Material:** 9 specimens.

**Diagnosis:** With the character of the genus. Cephalis large, globular, apically with 2 very small denticles in prolongation of V and A.

Thorax very long, slender conical to almost subcylindrical, in the upper half narrower than cephalis, distalwards only very slowly widening, at the distal end only somewhat broader than cephalis.

**Dimensions:**

Length of test = 325-400 µm

Maximum width of test = 130-160 µm

**Occurrence:** Upper part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** In *Spongotriassocyrtis globocephalis* n. sp. the cephalis is still larger, the thorax is shorter and distally considerably broader.

**Genus *Conospongocyrtis* n. gen.**

**Derivatio nominis:** According the conical shape and spongy shell

**Type species:** *Conospongocyrtis cephaloconica* n. gen. n. sp.

**Diagnosis:** Shell conical or in the upper part conical, in the lower part cylindrical with apical spine, but without feet. Cephalic spicular system with Mb, A, V, 2L and 2I. Wall thick, spongy.

**Occurrence:** Middle Fassanian *Ladinocampe multiperforata* Zone.

**Assigned species:**

*Conospongocyrtis cephaloconica* n. gen. n. sp.

*Conospongocyrtis conica* n. sp.

**Remarks:** *Triassospongocyrtis* n. gen. has a very large, elongated subhemispherical to rounded subconical cephalis and 3 long feet in prolongation of D and 2L. *Spongosilicarmiger* KOZUR, 1984 of the *S. ultima* group (described in a separate paper) has an inner latticed shell with rings covered by a spongy layer. It is only a homoeomorphic form group. In the form and outer wall structure similar Lower Jurassic Nassellaria (e.g. within the genus *Droltus* PESSAGNO & WHALEN, 1982) have a different inner layer with distinctly vertically arranged pore frames. They are also homoeomorphic forms.

***Conospongocyrtis cephaloconica* n. gen. n. sp.**

(Pl. 38, figs. 6, 7, 9)

**Derivatio nominis:** According to the conical cephalis, clearly separated from the cylindrical thorax

**Holotypus:** The specimen on pl. 38, figs. 6, 9; rep.-no. KoMo 1980 I-513

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** sample TT 13, upper part of Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 7 specimens.

**Diagnosis:** With the character of the genus. Cephalis large conical, with short, broad apical horn that has several narrow carinae. Thorax abruptly broader, cylindrical to subcylindrical (in the latter case with very slight broadening toward the distal end. Shell wall thick, spongy, on the cephalis additionally covered by a layer of microgranular silica that closes all pores. In the thorax this layer may be missing, showing than the deeper spongy layer with indistinct *Alievium* pore frames. Also the basal part of the apical horn is covered by a dense spongy layer.

**Dimensions:**

Length of test = 275-330  $\mu\text{m}$

Maximum width of test = 145-175  $\mu\text{m}$

**Occurrence:** Upper part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** *Conospongocyrtis conica* n. sp. has a conical shell, that becomes distalward broader both in the cephalis and thorax that are not distinctly separated on the outer shell surface.

***Conospongocyrtis conica* n. sp.**

(Pl. 38, fig. 10)

**Derivatio nominis:** According to the conical shell

**Holotypus:** the specimen on pl. 38, fig. 10; rep.-no. KoMo 1980 I-511

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** sample TT7, Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 19 specimens.

**Diagnosis:** With the character of the genus. Test conical. Cephalis conical with stout, short apical horn that bears several (5 or more) narrow, low carinae; its basal part is covered by a spongy layer. The cephalis is not separated from the following segments on the shell surface. There-

fore the whole test widens continuously toward the distal end. The number of segments is unclear. There are minimally 2, maximally 4 segments that are also at the inner side almost unseparable. Shell wall thick, spongy. The outer pore frames are partly arranged into short, irregular vertical striae. At the distal end of the shell short, delicate, needle-like spines are present that continue into the shell wall as needle-like bars.

**Dimensions:**

Length of test = 277-330  $\mu\text{m}$

Maximum width of test = 154-165  $\mu\text{m}$

**Occurrence:** Lower and middle part of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** *Conospongocyrtis cephaloconica* n. sp. displays only a conical proximal part of shell. The distal part of shell is cylindrical to subcylindrical. Also the outer pore frames are different.

**Genus *Triassospongocyrtis* n. gen.**

**Derivatio nominis:** According to the throughout spongy wall and the occurrence in the Triassic

**Type species:** *Triassospongocyrtis longispinosa* n. gen. n. sp.

**Diagnosis:** Shell broadly cylindrical to subcylindrical with broadly, rarely narrowly rounded apical part and roundish to roundish subtriangular, big aperture. Cephalis very large, elongated subhemispherical, rarely apically rounded conical or apically broadly rounded cylindrical. Thorax long cylindrical. Shell spongy, with large pores frames, partly arranged in rings on the inner side. Outer pore frames very small to moderately large, mostly covered by a nearly dense, fine-spongy layer.

Cephalic spicular system with Mb, A, V, 2L, D, 2I and distinct arches between them, especially LI. In prolongation of A a needle-like lateral-apical horn is present. A second lateral-apical horn or short horn-like elevation covered by spongy material may be present. It is situated in prolongation of V. 3 only basally broad and carinate, than needle-like and round, long feet are present in prolongation of D and 2L. Additional needle-like spines may be present around the aperture.

**Occurrence:** Lower Fassanian *Spongosilicarmiger italicus* Zone to Upper Longobardian *Muelleritortis cochleata* Zone of Hungary and Southern Alps.

**Assigned species:**

*Triassospongocyrtis longispinosa* n. gen. n. sp.

*Triassospongocyrtis cylindrica* n. sp.

*Triassospongocyrtis ruesti* n. sp.

*Triassospongocyrtis yaoi* n. sp.

**Remarks:** *Spongomelissa* HAECKEL 1887 from the Paleogene has the same shape and the same position of the spines in prolongation of A, V, D, 2L. However, the wall is latticed, consisting of 2 layers in the cephalis and of one layer in the thorax. Moreover, the spines 2l of the cephalic spicular system are not more present. *Spongomelissa* HAECKEL is surely the successor of *Spongotriassocyrtis* n. gen.

In *Cyrtentactinia* FOREMAN, 1963, the shell is mostly latticed and the position of the outer spines in prolongation of the inner spicules is not yet fixed. Forms with 3 characteristically arranged feet in prolongation of D and 2L are missing.

***Triassospongocyrtis cylindrica* n. sp.**

(Pl. 38, figs. 8, 11)

**Derivatio nominis:** According to the cylindric shape of the test

**Holotypus:** The specimen on pl. 38, figs. 8, 11; rep.-no. KoMo 1980 I-515

**Locus typicus:** Köveskál (Balaton Highland), section at the cemetery

**Stratum typicum:** Siliceous nodular limestone from a 70-80 cm thick greenish tuffit, about 15 cm above the base of the tuffit; with "*Posidonia*" *wengensis*, *Budurovignathus mungoensis* (DIEBEL). *B. mungoensis* A.Z. (Middle Longobardian). Nemesvámos Formation, 5.60 m below the base of the Füred Limestone Formation, ca. 6.20 m below the base of the Cordevolian.

**Material:** 7 specimens.

**Diagnosis:** Test large, cylindrical. Cephalis very large, cylindrical with broadly rounded apical end, on the outer surface not separated from the thorax. Cephalic spicular system with Mb, A, V, 2L, D, 2l and arches between the ends of the spicules. Apical horn often missing, replaced by a latero-apical area with different sculpture.

Thorax long, likewise cylindrical. The needle-like, but tricarinate feet in prolongation of D and 2L are situated near to the distal end of the thorax.

Wall thick, spongy. Inner layer with large and small pores, partly arranged in rings, separated by narrow, solid rings. Outer pore frames irregular, with moderately large and tiny pores both on the cephalis and thorax. However, the pores on the cephalis are mostly closed by a layer of microgranular silica, not present in the apical part of the cephalis.

**Dimensions:**

Length of test = 509-543 µm

Maximum width of test = 221-239 µm

**Occurrence:** Middle Longobardian of Hungary.

**Remarks:** This large species is clearly distinguished from all other *Spongotriassocyrtis* species by the position of the tricarinate feet near the distal end of the cephalothorax.

***Triassospongocyrtis longispinosa* n. gen. n. sp.**

(Pl. 39, figs. 1-3, 6, 7, 9)

**Derivatio nominis:** According to the 3 long, needle-like feet

**Holotypus:** The specimen on pl. 39, figs. 1, 2; rep.-no. KoMo 1980 I-342

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** Sample TT 2, lower part of Middle Fassinian *Ladinocampe multiperforata* Zone

**Material:** More than 100 specimens.

**Diagnosis:** Shell subcylindrical. Cephalis very large, elongated subhemispherical with broadly, in the view perpendicularly to VA obliquely rounded apical end.

Thorax long, cylindrical with the same diameter as the cephalis.

Cephalic spicular system with Mb, A, V, 2L, D, 2l. The spicule V is strongly upward directed (about in the same degree as A). Between the spicules arches run in the wall or at the inner margin of the wall. Especially distinct is the arch Ll, but also the arches LL, AV, VL are distinct. In prolongation of A a latero-apical needle-like relatively long, delicate (mostly not preserved in its full length) horn is present (excentric apical horn). In prolongation of V a likewise latero-apical, mostly very short, broad horn is present totally covered by spongy material. 3 long feet are present in prolongation of D and 2L. On the outer surface they start about at the boundary between cephalis and thorax. Only their very basal part is broad and bears here several short carinae. The remaining part is needle-like with roundish cross section.

The wall consists of a thick spongy meshwork. The innermost layer has in the thorax rather big pores, partly arranged in rings, the outer layer is on the cephalis almost dense with only tiny pores, on the thorax it has longer, irregular pore frames, at least in its distal part the joints of the outer pore frames display tiny nodes or spines. Sometimes the outer layer is imperfect or missing in the distal parts of the thorax.

The aperture is large, round or roundish subtriangular. Few needle-like, delicate, mostly broken spines are here present. They continue within the shell wall or on its inner side as delicate, long spicules until the joints of the cephalic spicular system with the shell wall. The most distinct distal spine at the aperture is connected with the joint of the shell wall with V, where 4 arches start, one of it running to the most distinct distal aperture spines.

**Dimensions:**

Length of test (without spines) = 271-375 µm

Maximum width of test = 146-210 µm

**Occurrence:** Widely distributed in the *Spongosilicarmiger italicus* Zone and in the lower part of the *Ladinocampe multiperforata* Zone (Lower and Middle Fassanian of Hungary and Italy).

**Remarks:** The Longobardian *Triassospongocyrtis cylindrica* n. sp. has a cylindrical cephalothorax, in which the tricarinate, needle-like feet start on the outer shell wall near the distal end of the thorax.

*Triassospongocyrtis ruesti* n. sp. from upper part of the Middle Fassanian *Ladinocampe multiperforata* A.Z. has a rounded subconical cephalis with narrowly rounded apical end. The subcylindrical thorax becomes narrower toward the distal end.

Most similar is the Upper Fassanian *Triassospongocyrtis yaoi* n. sp. In this species the needle-like latero-apical apical horn is tricarinate and the short vertical horn is not totally covered by a spongy layer. Moreover, the outer pore frames both on the cephalis and thorax are coarser.

***Triassospongocyrtis ruesti* n. sp.**

(Pl. 39, figs. 4, 8)

**Derivatio nominis:** In honour to D. RÜST, one of the pioneers of the fossil Radiolaria research.

**Holotypus:** The specimen on pl. 39, figs. 4, 8; rep.-no. KoMo 1980 I-516

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps)

**Stratum typicum:** Sample TT 16, upper part of the Middle Fassanian *Ladinocampe multiperforata* Zone

Material: 12 specimens.

**Diagnosis:** Test large, in the proximal part subconical, distally cylindrical. Cephalis very large, rounded subconical with narrowly rounded apical end. Latero-apical apical horn very small. Cephalic spicular system with Mb, A, V, 2L, 2l. In prolongation of D and 2L 3 needle-like feet with round cross section are present about in the middle part of

the cephalothorax. In their very basal part they are broad and covered by a spongy layer. Near to one of the feet a very delicate additional spine is present. Thorax long, in the proximal part narrowing, in the distal part cylindrical. At the margin of the round aperture with one or few needle-like short, delicate spines, mostly broken away.

Wall thick, spongy. Outer layer in the cephalis nearly dense, only with tiny pores. In the thorax the irregularly distributed pores are a little larger, but the most are also here very small.

**Dimensions:**

Length of test = 411-485 µm

Maximum width of test = 283-312 µm

**Occurrence:** Upper part of the Middle Fassanian *Ladinocampe multiperforata* Zone of Southern Alps.

**Remarks:** *Triassospongocyrtis ruesti* n. sp. is distinguished from all other *Triassospongocyrtis* species by its rounded conical cephalis with narrowly rounded apical end.

***Triassospongocyrtis yaoi* n. sp.**

(Pl. 39, figs. 5, 10)

**Derivatio nominis:** In honour of Prof. Dr. A. YAO, Osaka

**Holotypus:** The specimen on pl. 39, figs. 5, 10; rep.-no. KoMo 1980 I-517

**Locus typicus:** Köveskál (Balaton Highland, Hungary), section at the cemetery

**Stratum typicum:** Sample 4a. Nodular cherty limestone with reddish chert nodules from a 160 cm thick interbedding of greenish tuffite and thin limestone beds within the lower part of the Nemesvámos Formation, 55 cm below the top of the tuffit-limestone, stone interbedding, 2.75 m above the base of the Nemesvámos Formation. Rich occurrence of *Budurovignathus truempyi* (HIRSCH), the index species of the *B. truempyi* conodont zone. Upper Fassanian.

**Material:** 4 specimens

**Diagnosis:** Test cylindrical with broadly rounded to nearly blunt apical end. Cephalis very large, elongated subhemispherical. Cephalic spicular system with Mb, A, V, 2L, D, 2l. Latero-apically lies a distinct, needle-like, but tricarinate, basally broad apical horn, at its very base covered with spongy material. Opposite the apical horn, likewise in latero-apical position, lies a short carinate, broad horn in prolongation of V. 3 long needle-like feet are situated in prolongation of D and 2L. At their very base they are broad, carinate. The feet 2L begin near the boundary between the

cephalis and thorax, the foot D begins in the upper part of the thorax.

The thorax is cylindrical and outside not separated from the cephalis. However, the outer layer of the spongy wall is different in the cephalis and thorax. In the cephalis the irregular pore frames display only tiny pores. The position of the collar stricture is indicated by a poreless stripe. The pores of the outer layer in the thorax have different size, the most are small, but as a whole distinctly larger than in the cephalis.

**Dimensions:**

Length of test (without spines) = 260-290 µm

Maximum width of test = 168-182 µm

**Occurrence:** Upper Fassanian of the Balaton Highland.

**Remarks:** Most similar is *Triassospongocyrtis longispinosa* n. sp. from the Lower and Middle Fassanian. In this species the outer layer on the cephalis is nearly dense and also the pores in the outer layer of the thorax are smaller than in *T. yaoi* n. sp. The latero-apical apical horn is tricarinate and larger in *T. yaoi* n. sp. than in *T. longispinosa*. Also the latero-apical vertical horn is somewhat larger than in *T. longispinosa* n. sp. and not covered by a spongy layer.

**Family Tetraspinoctyrtidae n. fam.**

**Diagnosis:** As for the genus *Tetraspinoctyrtis* n. gen. (see there).

**Occurrence:** Illyrian to Lower Fassanian of the Tethys.

**Remarks:** The Planispinoctyrtidae KOZUR & MOSTLER, 1981 display a similar shape, but D is missing in the cephalic spicular system.

In the Triassocampidae KOZUR & MOSTLER, 1981 horns in prolongation of D and 2L are missing.

**Genus Tetraspinoctyrtis n. gen.**

**Derivatio nominis:** According to the 4 spines in prolongation of A, D, 2L

**Type species:** *Tetraspinoctyrtis laevis* n. gen. n. sp.

**Diagnosis:** Test multicyrtid, subcylindrical to subconical. Cephalis large, partly fused with the thorax to a large cephalothorax. Cephalic spicular system with Mb, A, V, 2L, D, 2l. The spine V is sometimes missing. On the lower side of the joints D, 2l, A with Mb, and (V) 2L with Mb a distinct node is present. Thorax large, hoop-like or subcylindrical, sometimes united with cephalis to globular cephalothorax.

Abdomen and postabdominal segments hoop-like, strongly elevated to almost flat.

Apical horn moderately large to large; round to tricarinate. Other 3 horns large to moderately large, tricarinate to vertically oval with lateral grooves. These horns are situated on the thorax or cephalothorax. They are the prolongations of D and 2L.

**Occurrence:** Illyrian to Lower Fassanian of the Tethys.

**Assigned species.**

*Tetraspinoctyrtis laevis* n. gen. n. sp.

*Tetraspinoctyrtis anisica* n. sp.

*Tetraspinoctyrtis annulopora* n. sp.

*Tetraspinoctyrtis fassanica* n. sp.

**Remarks:** *Planispinoctyrtis* KOZUR & MOSTLER, 1981 is in the shape similar, but has horns in prolongation of V, 2L and 2l. The spine D is missing in the cephalic spicular system. *Planispinoctyrtis* species, in which the horns 2L are rudimentary or missing have also 3 lateral horns, but they are in prolongation of other spines of the cephalic spicular system (V, 2l) than in *Tetraspinoctyrtis* (D, 2L).

*Spinotriassocampe* KOZUR, 1984 has only 2 round spines in prolongation of 2L, starting from the always small cephalis.

*Yeharaia* NAKASEKO & NISHIMURA, 1979 has only an apical horn, but no additional horns.

***Tetraspinoctyrtis laevis* n. gen. n. sp.**

(Pl. 40, figs. 4, 5, 6, 10, 12)

1989 Forme évoque les Albaillellides connus dans le Permien - MARTINI, DE WEVER et al., p. 158, pl. 3, fig. 7

**Derivatio nominis:** According to the almost smooth postabdominal part

**Holotypus:** The specimen on pl. 40, figs. 5, 6, 10; rep.-no. KoMo 1980 I-402

**Locus typicus:** Felsőőrs (Balaton Highland, Hungary), Forráshegy section

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian).

**Material:** 43 specimens.

**Diagnosis:** Cephalis large, hemiglobular to subglobular, smooth, poreless or with few pores, with moderately large, proximally carinate, distally round apical horn, situated somewhat excentrically on the dorsal side.

Cephalic spicular system with Mb, AV, 2L, D, 2l. Large horns in prolongation of D and 2L. They are proximally carinate, distally smooth. The horn D starts from the

collar stricture and is downward inclined. The horns 2L start from the thorax and stand nearly perpendicularly on the thorax.

Thorax slightly hoop-like elevated, as wide as, but lower than the cephalis, smooth, covered with a layer of microgranular silica and therefore outside poreless.

Abdomen and at least 3 postabdominal segments somewhat narrower than or as wide as thorax. They form a long cylindrical part with very shallow strictures. Segments in this cylindrical part only slightly elevated, with small pores (mostly more than one pore ring), most of them closed by a layer of microgranular silica.

**Dimensions:**

Length of test = 163-189  $\mu\text{m}$

Maximum width of test = 42-48  $\mu\text{m}$

Length of lateral horns = 39-50  $\mu\text{m}$

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone) of the Balaton Highland (Hungary) and Lagonegro Basin (Southern Italy).

**Remarks:** Most similar to the Illyrian *Tetraspinocyrtis annuloporata* n. sp., in which all pores in the abdomen and postabdominal segments are open. These pores are arranged in one pore ring in each segment. Moreover, the thorax is distinctly broader than the cephalis, the apical horn is throughout round and the lateral horns are likewise round or oval and may be only basally slightly carinate.

*Tetraspinocyrtis multiperforata* n. sp., likewise present in the Illyrian, has a globular cephalothorax. The pores on the distinctly elevated abdomen and postabdominal segments are always open.

Highly interesting that MARTINI, DE WEVER et al. (1989, 1990) compared these typical Nassellaria (with Nassellarian spicular system and without columella) with Permian Albaillellaria that are not related to Nassellaria (presence of 2 columella, absence of Nassellarian spicular system).

The evidence that these forms (also *Tetraspinocyrtis annuloporata* n. sp. was compared with Permian Albaillellaria) are typical Anisian (Illyrian) Radiolaria is in so far important, because the Lagonegro Basin belongs to the margin of the Permian Tethys, in which Albaillellaria are frequent (CATALANO, DI STEFANO & KOZUR, 1988a, b, 1989). Reworked Permian rocks are known in the Lagonegro Basin. However, so far only shallow-water carbonates without Permian radiolarians have been found. The presence or absence of Permian Albaillellaria is paleogeographically important.

***Tetraspinocyrtis anisica* n. sp.**

(Pl. 40, fig. 1)

**Derivatio nominis:** According to the occurrence in the Anisian

**Holotypus:** The specimen on pl. 40, fig. 1; rep.-no. KoMo 1980 I-52.

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian)

**Material:** 15 specimens.

**Diagnosis:** Test subconical, short for the genus. Cephalothorax still distinguishable into cephalis and thorax, but with fluent transition. Cephalic part rounded subconical to subhemiglobular. Thoracic part globular. Whole cephalothorax smooth, poreless. Only at the junction between 2l and the wall small pores may be present. Cephalic spicular system with Mb, A, 2L, D, 2l. Apical horn large, tricarinate. Horns in prolongation of D, 2L stout, broad and multicarinate.

Abdomen and first postabdominal segment broad, hoop-like, with small, roundish, irregularly spaced pores. Second postabdominal segment frustum-like, poreless.

**Dimensions:**

Length of test = 150-163  $\mu\text{m}$

Maximum width of test = 55-70  $\mu\text{m}$

Length of lateral horn = 25-35  $\mu\text{m}$

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone) of Balaton Highland (Hungary).

**Remarks:** Both *Tetraspinocyrtis anisica* n. sp. and *T. fassanica* n. sp. are clearly distinguished from typical *Tetraspinocyrtis* species (*T. annuloporata* n. sp., *T. laevis* n. sp.) by the presence of a cephalothorax and the presence of numerous small pores in the abdomen and first postabdominal segment.

The near related Lower Fassinian *Tetraspinocyrtis fassanica* n. sp. is distinguished from *T. anisica* n. sp. by a subroundish apical horn and a globular cephalothorax, in which the cephalis and thorax are outside inseparable. Moreover, the abdomen and first postabdominal segment are stronger elevated in *T. fassanica* n. sp.

***Tetraspinocyrtis annuloporata* n. sp.**

(Pl. 40, figs. 2, 3, 8)

1989 Forme évoque étrangement les Albailles connus dans le Permian - MARTINI, DE WEVER et al., p. 158, pl. 3, figs. 4, 18 (?)



**Derivatio nominis:** According to the open pore rings on the post-thoracic segments

**Holotypus:** The specimen on pl. 40, fig. 8; rep.-no. KoMo 1980 I-51

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section

**Stratum typicum:** Limestone bed 87 within greenish tuffites, *Paraceratites trinodosus* Zone (Illyrian)

**Material:** 41 specimens.

**Diagnosis:** Cephalis moderately large, subhemispherical to subconical, smooth, poreless, with moderately large, round apical horn. Cephalic spicular system with Mb, A, V, 2L, D, 2l. The spines D and 2L continue as large horns that are located on the thorax. Horns basally carinate, distally round or oval or rounded triangular. Thorax broader than and about as high as cephalis, hoop-like to subglobular, with small, irregularly arranged pores.

Abdomen and first 3 postabdominal segments shallow hoop-like, with distinct, but shallow, smooth strictures; each segment with a central pore ring. Following at least 5 segments flat, distinctly separated each other forming a distalwards very slightly widening cylindrical part, each segment with a ring of small roundish pores.

**Dimensions:**

Length of test = 208-221  $\mu\text{m}$

Maximum width of test = 78-82  $\mu\text{m}$

Maximum length of lateral horns = 30-38  $\mu\text{m}$

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone) of Balaton Highland (Hungary) and Illyrian of Lagonegro Basis (Southern Italy).

**Remarks:** The importance of the Nassellaria character of this species against the assumed Albaillellaria relationship (MARTINI, DE WEVER et al., 1989) has been discussed under *Tetraspinocyrtis laevis* n. gen. n. sp. (see there). This species is distinguished by a considerably larger cephalis, the carinate apical horn and the mostly closed pores on the abdomen and first postabdominal segment.

The Illyrian to Lower Fassanian *Tetraspinocyrtis anisica* group (*T. anisica* n. sp., *T. fassanica* n. sp.) has a cephalothorax, in which cephalis and thorax are outside not separated by a stricture. Abdomen and postabdominal segments are hoop-like with irregularly arranged small pores or with more than one pore ring.

#### ***Tetraspinocyrtis fassanica* n. sp.**

(Pl. 40, figs. 7, 9, 11)

**Derivatio nominis:** According to the occurrence in the Fassanian

**Holotypus:** The specimen on pl. 40, figs. 9, 11; rep.-no. KoMo 1980 I-401

**Locus typicus:** Val di Creme, near Recoaro (Vicentinian Alps, Italy)

**Stratum typicum:** Sample VCB, upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone

**Material:** 9 specimens.

**Diagnosis:** Cephalothorax large, globular, smooth, poreless, not separable in cephalis and thorax. Apical spine very large, round. Lateral horns large, tricarinate, perpendicularly to the cephalothorax or a little upward inclined.

Abdomen and first postabdominal segment high, rounded, hoop-like, with 2 rings of tiny pores. Below them still some additional pore may be present. Third postabdominal segment short trapezoidal.

**Dimensions:**

Length of test = 160-189  $\mu\text{m}$

Maximum width of test = 55-63  $\mu\text{m}$

Length of apical spines = 68-71  $\mu\text{m}$

Length of lateral spines = 37-45  $\mu\text{m}$

**Occurrence:** Lower Fassanian of Southern Alps.

**Remarks:** The Illyrian *Tetraspinocyrtis anisica* n. sp. is most similar, but distinguished by a tricarinate apical spine, not so strongly inflated abdomen and first postabdominal segment, and irregularly distributed pores on the abdomen.

These 2 species belong to a near related group within the genus *Tetraspinocyrtis* n. gen. The Illyrian *Tetraspinocyrtis laevis* group (*T. laevis* n. gen. n. sp., *T. annuloporata* n. sp.) is distinguished by clearly separated cephalis and thorax, only slightly elevated post-thoracic segments that have only one pore ring.

#### **Family Triassocampidae**

##### **KOZUR & MOSTLER, 1981**

##### **Genus *Annulotriassocampe* KOZUR,**

**n. gen.** (see appendix)

**Type species:** *Annulotriassocampe baldii* KOZUR, n. gen. n. sp. (see appendix)

**Remarks:** Typical *Annulotriassocampe* species begin in the Middle Fassanian *Ladinocampe multiperforata* Zone, but are most frequent in the Longobardian and in the Upper Triassic. They are characterized by narrow, highly and vertically elevated cylindrical postabdominal segments with one slightly depressed pore ring between an upper and lower solid ring.

In the Illyrian and Lower Fassanian a different species group occur, characterized by very slender, long cylin-

drical test with not so sharply elevated, often still narrow hoop-like postabdominal segments. Like in typical *Annulotriassocampe* they display only one central pore ring, but the upper and lower solid ring is not yet present. This group represents the most primitive *Annulotriassocampe* species.

***Annulotriassocampe campanilis* n. sp.**

(Pl. 41, figs. 1-4, 7, 9-11, 13-18)

**Derivatio nominis:** According to the shape of the very long, slender-cylindrical test

**Holotypus:** The specimen on pl. 41, fig. 9; rep.-no. KoMo 1980 I-34

**Locus typicus:** Felsőörs (Balaton Highland), Forráshegy section

**Stratum typicum:** Bed 87, Illyrian *Paraceratites trinodosus* zone

**Material:** More than 200 specimens.

**Diagnosis:** Test long, very slender, cylindrical. Cephalothorax dome-shaped, smooth, poreless. Cephalic part hemiglobular to subhemiglobular, situated somewhat excentric on the subglobular thoracic part. A tiny, excentric apical horn may be present. In prolongation of V, L and D a tiny, hornlike elevation or a pore (or both) may be present.

Abdomen subglobular to broadly hoop-like, with numerous tiny pores, mostly closed by a layer of microgranular silica. Proximally the pores are arranged into an irregular pore ring. Remaining pores irregularly arranged. First postabdominal segment hoop-like, with proximal ring of tiny pores followed by an often incomplete ring of tiny pores. Following 5-6, rarely up to 9 postabdominal segments hoop-like, in the distal part more inversely trapezoidal, in stratigraphically younger forms also narrow, ringlike. They display one central or subcentral ring of small, in the distal part moderately large pores. In the segment next to the last an incomplete second ring of pores may be rarely present below the complete pore ring. Outer pore frames in stratigraphically older forms roundish, in stratigraphically younger forms at least in the distal part vertically elongated. The last segment is thin-shelled, mostly broken away. It is considerably higher and broader than the foregoing segments and displays 3 or 4 pore rings or the pores are below the proximal pore ring irregularly arranged. All constrictions between the postthoracic segments are deep, broad, smooth, poreless.

**Measurements:**

Length of test = 258-400  $\mu\text{m}$

Maximum width of test (without last segment) = 58-70  $\mu\text{m}$

Width of last segment = 70-75  $\mu\text{m}$

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone) up to Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** *Annulotriassocampe spinosa* n. sp. from the higher part of Lower Fassanian *Spongosilicarmiger italicus* Zone displays a distinct, relatively long, excentric apical horn and a distinct horn in prolongation of V.

The Middle Fassanian *Annulotriassocampe eoladinica* n. sp. belongs already to the typical *Annulotriassocampe* species and displays therefore high, vertically elevated ring-like postabdominal segments separated against the constrictions by solid rings.

***Annulotriassocampe campanilis campanilis* n. subsp.**

(Pl. 41, figs. 9-11, ?14)

**Holotypus, locus typicus, stratum typicum:** As for the species.

**Material:** More than 100 specimens.

**Diagnosis:** With the characters of the species. Postabdominal segments always hoop-like, in the distal part also rounded inversely trapezoidal. Outer pore frames always roundish, also in the distal postabdominal segments. Cephalic horns never present.

**Measurements:**

Length of test = 258-309  $\mu\text{m}$

Maximum width of test (without last segment) = 58-67  $\mu\text{m}$

Width of last segment (if preserved) = 70-75  $\mu\text{m}$

**Distribution:** Illyrian (*Paraceratites trinodosus* Zone) and basal Fassanian.

**Remarks:** In *Annulotriassocampe campanilis longiporata* n. subsp. displays in the distal half of the test vertically elongated outer pore frames. Moreover, in higher evolved forms of this subspecies the distal postabdominal segments are often narrow, ring-like.

*Annulotriassocampe spinosa* n. sp. displays also roundish outer pore frames in all postabdominal segments. However, this species displays a distinct, excentric apical horn and a distinct vertical horn.

***Annulotriassocampe campanilis longiporata* n. subsp.**

(Pl. 41, figs. 1-4, 7, 13, 15-18)

**Derivatio nominis:** According to the vertically elongated outer pore frames in the distal postabdominal segments

**Holotypus:** The specimen on pl. 41, figs. 7, 15; rep.-no. KoMo 1980 I-225

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto, Vicentinian Alps (Italy)

**Stratum typicum:** Sample TT 7, lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** Several 100 specimens.

**Diagnosis:** With the characters of the species. First 2-4 postabdominal segments hoop-like, with roundish outer pore frames. Following postabdominal segments hoop-like, inversely trapezoidal or narrow, ringlike. Outer pore frames in these segments vertically elongated. Last segment subcylindrical, with proximal ring of vertically elongated pores followed by pores of irregular shape and arrangement. A tiny, excentric apical horn and a tiny vertical horn may be present.

**Measurements:**

Length of test = 267-400  $\mu\text{m}$

Maximum width of test (without last segment) = 60-70  $\mu\text{m}$

Width of last segment (if preserved) = 73-75  $\mu\text{m}$

**Occurrence:** Very frequent in the Lower and Middle Fassanian of the Eurasiatic Tethys.

**Remarks:** *Annulotriassocampe campanilis campanilis* displays in all postabdominal segments roundish outer pore frames.

***Annulotriassocampe eoladinica* n. sp.**

(Pl. 42, figs. 5, 6)

**Derivatio nominis:** According to the occurrence in the Lower Ladinian

1990 *Triassocampe sulovensis* KOZUR & MOCK, 1981 - GORIČAN, p. 160, pl. 12, fig. 4, 5 (?)

**Holotypus:** The specimen on pl. 42, fig. 6; rep.-no. KoMo 1980 I-827

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto, Vicentinian Alps (Italy)

**Stratum typicum:** Sample TT 6, lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 51 specimens.

**Diagnosis:** Test conical, distally cylindrical. Cephalothorax dome-shaped, smooth, poreless. Cephalic part rounded conical, thoracic part hoop-like to trapezoidal.

Abdomen narrow, hoop-like, considerably lower than cephalothorax, with 1-2 rings of tiny pores, covered by a layer of microgranular silica. Postabdominal segments all narrower than cephalothorax, subcylindrical, distally inversely trapezoidal, highly and vertically elevated

above the narrow, deep, smooth strictures. All postabdominal segments, with exception of the last one, display one central ring of pores bordered by a solid upper and lower ring. In the distal, inversely trapezoidal postabdominal segment the lower ring becomes indistinct and it is absent in the last postabdominal segments. The width of the test increases until the third to fifth postabdominal segment and it remains then unchanged. The last or the last two strictures are considerably broader than the foregoing ones. The last segment, if present, is considerably higher and displays numerous pores, proximally often arranged in a ring of vertically elongated pores, below it irregularly arranged or all pores are irregularly spaced.

**Measurements:**

Length of test = 262-345  $\mu\text{m}$

Maximum width of test = 85-110  $\mu\text{m}$

**Occurrence:** Middle Fassanian of the European Tethys. Longobardian (?) of Hungary and Yugoslavia.

**Remarks:** This species is the oldest typical *Annulotriassocampe* species. In the Longobardian and Upper Triassic *Annulotriassocampe* species the postabdominal segments are still more pronounced, the strictures deeper. In *Annulotriassocampe baldii* KOZUR, n. sp., moreover, the stricture between the cephalothorax and the abdomen is not so pronounced as in *A. eofassanica* n. sp. and the proximal ring is very strong.

Part of *Triassocampe sulovensis* KOZUR & MOCK sensu GORIČAN, 1990 belongs surely to *Annulotriassocampe eofassanica* n. sp. (GORIČAN, pl. 12, fig. 4). The Longobardian specimen figured by GORIČAN (1990, pl. 12, fig. 5) is more slender and may belong to a new species.

***Annulotriassocampe spinosa* n. sp.**

(Pl. 41, figs. 5, 6, 8, 12)

**Derivatio nominis:** According to the distinct apical horn and vertical spines

**Holotypus:** The specimen on pl. 41, figs. 5, 6; rep.-no. KoMo 1980 I-824

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto, Vicentinian Alps (Italy)

**Stratum typicum:** Sample TT 14, upper subzone of Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 69 specimens.

**Diagnosis:** Test slender conical to slender subcylindrical. Cephalothorax dome-shaped, smooth, poreless. Cephalic part rounded conical to hemiglobular, situated obliquely

on the subglobular thoracic part. Apical horn distinct, ex-centric, very short to moderately long. Vertical horn distinct. A tiny horn in prolongation of D may be also present.

Abdomen and postabdominal segments hoop-like, only the last segment is subcylindrical to bell-like. With exception of the last segment, their height is nearly the same along the whole test. Their width increases very slowly. Strictures relatively broad, deep, smooth, poreless. The abdomen displays two irregular rings of tiny pores covered by a layer of microgranular silica. Also the first, sometimes the first 3 postabdominal segments are covered by a layer of microgranular silica. The postabdominal segments display a central ring of pores, tiny in the first postabdominal segments, small to moderately large in the distal segments. The last postabdominal segment is rarely preserved, thin-shelled. It is subcylindrical with slight median constriction or bell-like. Beside of a proximal pore ring still further scattered pores are present. Pore frames in all segments roundish, very rarely the outer pore frames are vertically elongated, but not in the distal segments.

#### Measurements:

Length of test = 227-333  $\mu\text{m}$

Maximum width of test (without last segment) = 63-71  $\mu\text{m}$

Width of the last segment (if preserved) = 67-92  $\mu\text{m}$

Length of apical horn = 7-17  $\mu\text{m}$

**Distribution:** Upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone and above all Middle Fassanian. Eurasiatic Tethys.

**Remarks:** *Annulotriassocampe campanilis* n. sp. displays mostly no distinct apical horn and vertical horn. If a tiny apical horn is present, then only in specimens with distinctly elongated pores.

Stratigraphically older forms of *A. spinosa* n. sp. from the higher part of Lower Fassanian display a subcylindrical test, whereas stratigraphical younger forms from the Middle Fassanian display a slender conical test. However, also among the stratigraphically younger forms specimens with subcylindrical test are present. Therefore these difference is here regarded as intraspecific variability.

#### Genus *Paratriassocampe* n. gen.

**Derivatio nominis:** According to its similarity with *Triassocampe* DUMITRICĂ, KOZUR & MOSTLER, 1980

**Type species:** *Paratriassocampe gaetanii* n. gen. n. sp.

**Diagnosis:** Test multicyrtyd, conical, rarely subcylindrical, without distal skirt. Cephalis conical to dome-shaped, smooth poreless. Abdomen, sometimes also first or first

two postabdominal segments hoop-like, often covered by a layer of microgranular silica. Other postabdominal segments narrow, with triangular marginal outline. They display two rings of pores and with exception of the most primitive forms a distinct central nodose ring. Short irregular vertical ribs may be present on primitive forms.

**Distribution:** Illyrian to Middle Fassanian, Eurasiatic Tethys.

#### Assigned species:

*Paratriassocampe gaetanii* n. gen. n. sp.

*Triassocampe ? pulchra* KOZUR & MOSTLER, 1981

*Paratriassocampe ? brevis* n. sp.

*Paratriassocampe ornata* n. sp.

*Paratriassocampe postornata* n. sp.

**Remarks:** *Paratriassocampe* n. gen. is the forerunner of *Ruesticyrtium* KOZUR & MOSTLER, 1979. This Carnian genus is distinguished by a wide distal skirt and by the covering of all segments (with exception of the last segment and the distal skirt) by a layer of microgranular silica.

*Triassocampe* DUMITRICĂ, KOZUR & MOSTLER, 1980 displays different postabdominal segments, characterized by a distinct upper smooth or nodose ring and often also by a lower smooth or nodose ring. A central ring, like in *Paratriassocampe* n. gen., is never present in *Triassocampe*. By this, the outline of the segments in cross section is different. Subcylindrical with depressed central part and above all inversely trapezoidal in *Triassocampe* and ringlike with triangular outer margin in *Paratriassocampe* n. gen.

*Paratriassocampe* n. gen. has probably evolved from primitive *Pararuesticyrtium* KOZUR & MOSTLER, 1981 without distal skirt that may be the common ancestor for both genera. This is also indicated by the Illyrian *Paratriassocampe pulchra* (KOZUR & MOSTLER, 1981) that displays in many specimens a tiny apical horn, always present in *Pararuesticyrtium*, but missing in all other higher evolved *Paratriassocampe* species. Otherwise in *Paratriassocampe pulchra* already the typical *Paratriassocampe* structure and -outline of the postabdominal segments is present.

In general, *Pararuesticyrtium* KOZUR & MOSTLER, 1981 can be easily distinguished by its distinct distal skirt and by hoop-like postabdominal segments with mostly 3 rings of pores. Most similar is the primitive *Pararuesticyrtium ? illyricum* (KOZUR & MOSTLER, 1981), in which no distal skirt has been observed (? preservation) and the apical horn is mostly missing. The rounded hoop-like postabdominal segments are typical for *Pararuesticyrtium*. Both *Paratriassocampe pulchra* and *Pararuesticyrtium illyricum* are seemingly near related to the com-

mon forerunner of *Pararuesticyrtium* and *Paratriassocampe*.

***Paratriassocampe gaetanii* n. gen. n. sp.**

(Pl. 42, figs. 7, 8, 9, 10, 11)

**Derivatio nominis:** In honour of Prof. Dr. M. GAETANI, Milano

**Holotypus:** The specimen on pl. 42, fig. 10; rep.-no. Ko-Mo 1980 I-762

**Locus typicus:** Passo della Gabiola section, Vicentinian Alps (Italy)

**Stratum typicum:** Sample MD 28, lower subzone of Middle Fassanian

**Material:** More than 100 specimens.

**Diagnosis:** Test conical. Cephalis dome-shaped, smooth, poreless, without apical horn. Thorax, abdomen, sometimes also the first postabdominal segment hoop-like, with two irregular rings of tiny pores. The thorax is in stratigraphically younger forms always, in stratigraphically older forms often covered by a layer of microgranular silica. In stratigraphic younger forms also the abdomen and the first postabdominal segments may be covered by a layer of microgranular silica.

The width of the postabdominal segments increases gradually, whereas their width remains nearly unchanged. The lateral outline of the postabdominal segments is triangular because of the distinct central slightly nodose ring and the symmetrical lowering of the postabdominal segments from this ring toward the upper and lower margin of the segment. Above and below the central ring a ring of mostly roundish pores is present. The outer pore frames are coarser, pentagonal to quadrangular, sometimes irregular, with distinct nodes at the joints with the central ring and sometimes also with indistinct nodes at the upper and lower margin of the segments. The last postabdominal segment is thin-walled and therefore mostly not preserved. It is considerably higher than the foregoing postabdominal segments, subcylindrical or trapezoidal, with numerous moderately large pores that may be arranged into an irregular proximal pore ring followed by irregularly arranged pores or all pores are irregularly arranged. The strictures between all postthoracic segments are deep, narrow, smooth, poreless.

**Measurements:**

Length of test = 280-340  $\mu\text{m}$

Maximum width of test = 117-129  $\mu\text{m}$

**Distribution:** Middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone to lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone. Eurasiatic Tethys.

**Remarks:** In the stratigraphic youngest forms, the first postabdominal segment may be already covered by a layer of microgranular silica, whereas in the stratigraphic oldest forms even the thorax may be uncovered. In continuation of this trend, the whole postabdominal segments have been covered with a layer of microgranular silica. By this way and by development of a distinct broad distal skirt, the genus *Ruesticyrtium* has evolved from the *Paratriassocampe gaetanii* group.

***Paratriassocampe ? brevis* n. sp.**

(Pl. 42, figs. 14, 15)

**Derivatio nominis:** According to the short test

**Holotypus:** The specimen on pl. 42, fig. 15; rep.-no. Ko-Mo 1980 I-768

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section

**Stratum typicum:** Bed Fö 110, upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone

**Material:** 9 specimens.

**Diagnosis:** Test short, conical. Cephalis dome-shaped, smooth, with few widely scattered pores in its distal part, otherwise poreless. Thorax hoop-like, with one irregular pore ring, closed or nearly closed by a layer of microgranular silica. Abdomen hoop-like, with one irregular pore ring. The first 3 postabdominal segments are hoop-like to subcylindrical, the first one with rounded triangular outer margin. They display 2 rings of pores, but no distinct separating central ring. The outer pore frames are longer, elevated, quadrangular to pentagonal in outline. The fourth postabdominal segment is considerably higher, inversely trapezoidal, but in its distalmost part again a little widening. It displays a proximal smooth ring, followed by two irregular pore rings and a larger smooth and poreless segment. No outer pore frames present. The strictures between all postcephalic segments are deep, narrow, smooth, poreless.

**Measurements:**

Length of test = 187-208  $\mu\text{m}$

Maximum width of test = 80-83  $\mu\text{m}$

**Distribution:** Rare in the upper subzone of the Lower Fassanian.

**Remarks:** *Paratriassocampe ? brevis* n. sp. does not fit well into the genus *Paratriassocampe* n. gen., but also not

in any other genus of the Triassocampidae. It is easily to distinguished from other *Paratriassocampe* species by its very short test.

***Paratriassocampe ornata* n. sp.**

(Pl. 42, fig. 12)

**Derivatio nominis:** According to the sculptured test  
**Holotypus:** The specimen on pl. 42, fig. 12; rep.-no. KoMo 1980 I-35

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section

**Stratum typicum:** Bed 87, *Paraceratites trinodosus* Zone (Illyrian)

**Material:** 23 specimens.

**Diagnosis:** Test cylindrical. Cephalis dome-shaped, distally relatively broad, smooth, poreless. Thorax distinctly broader, but considerably lower than cephalis, hoop-like. Abdomen somewhat broader, but not higher than thorax, marginal triangular. The postabdominal segments have about the same height and width as the abdomen. They are low, hoop-like, separated by narrow, deep, smooth, poreless strictures. The last two strictures are broader. Cephalis, abdomen and postabdominal segments display two, partly somewhat irregular rings of pores. The separating central ring is indistinct, in some segments missing. The outer pore frames are very coarse and arranged into distinct, short vertical ribs. Their joints with the central ring are node-like thickened. Between some segments, a part of the vertical ribs is connected by very low ribs across the strictures. On the last two postabdominal segments the outer pore frames are very low or missing. This segment displays irregularly arranged pores of different size and shape.

**Measurements:**

Length of test = 256-274  $\mu\text{m}$

Maximum width of test = 66-71  $\mu\text{m}$

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone) of the Balaton Highland (Hungary).

**Remarks:** *Paratriassocampe ornata* n. sp. is not a typical representative of this genus. The typical triangular marginal outline is only developed in one or few segments and the central rib is indistinct.

The test of *Paratriassocampe postornata* from the lower subzone of the Lower Fasnian *Spongosilicarmiger italicus* Zone displays a conical outline and the central ring is in the distal segments distinct. These segments display a triangular marginal outline.

***Paratriassocampe postornata* n. sp.**

(Pl. 42, fig. 16)

**Derivatio nominis:** According to the occurrence after *P. ornata* n. sp.

**Holotypus:** The specimen on pl. 42, fig. 16; rep.-no. KoMo 1980 I-63

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section

**Stratum typicum:** Sample 100 D, lower subzone of "X." *reitzei* Oppel Zone

**Material:** 17 specimens.

**Diagnosis:** Test slender conical. Cephalis dome-shaped, smooth, poreless. Thorax broader, but considerably lower than cephalis, hoop-like, with 2 or 3 irregular rings of tiny pores. Abdomen and postabdominal segments become slowly and gradually broader, but not or only insignificantly higher than the thorax. Those segments are partly hoop-like, partly (especially distally) they display distinct triangular marginal outline. All segments are separated by deep, narrow, smooth, poreless strictures.

Every postcephalic segment display two rings of pores separated by a central ring that is indistinct in the proximal postabdominal segments, but distinct in the distal ones. The outer pore frames are very strong, only in the last two segments shallow. They are mostly quadratic and arranged into distinct, short vertical ribs. Only in the last two segments these ribs are indistinct or missing. Distinct nodes are present at the joints between these vertical ribs and the central ring.

**Measurements:**

Length of test = 287-307  $\mu\text{m}$

Maximum width of test = 96-104  $\mu\text{m}$

**Distribution:** Lower subzone of Lower Ladinian *Spongosilicarmiger italicus* Zone of the Balaton Highland.

**Remarks:** *Paratriassocampe ornata* n. sp. displays a cylindrical test and the central ring of the postabdominal segments is not so well developed.

**Genus *Pseudotriassocampe* n. gen.**

**Derivatio nominis:** According to similarity with *Triassocampe* DUMITRICĂ, KOZUR & MOSTLER

**Type species:** *Pseudotriassocampe hungarica* n. gen. n. sp.

**Diagnosis:** Test multicystid, slender conical, postabdominal sector often cylindrical. Moderately large to large apical horn. Cephalothorax smooth or distally with indistinct

nodes, with few pores in the thorax or poreless. Abdomen and postabdominal segments with 2 pore rings, the distal one is often irregular. Pores mostly closed by thin layer of microgranular silica. The sculpture consists of short nodose vertical ribs or of nodes connected by short thin vertical ribs.

**Occurrence:** Illyrian to Middle Fassinian of European Tethys.

**Assigned species:**

*Pseudotriassocampe hungarica* n. gen. n. sp.

*Pseudotriassocampe angustiannulata* n. sp.

*Pseudotriassocampe longispinosa* n. sp.

**Remarks:** *Yeharaia* NAKASEKO & NISHIMURA, 1979 displays distinct proximal smooth rings on the postabdominal segments and the sculpture is not arranged into vertical ribs.

*Triassocampe* DUMITRICĂ, KOZUR & MOSTLER displays no apical horn. Only few species displays an indistinct, tiny apical horn.

***Pseudotriassocampe hungarica* n. gen. n. sp.**

(Pl. 43, figs. 1, 5, 6)

**Derivatio nominis:** According to the occurrence in Hungary

**Holotypus:** The specimen on pl. 43, fig. 6; rep.-no. KoMo 1980 I-72

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section

**Stratum typicum:** Bed 110 (upper part of the pietra verde, above the occurrence of "*X. reitzi*"), upper part of Lower Fassinian

**Material:** 11 specimens.

**Diagnosis:** Test multicyrtyd, conical. Cephalothorax dome-shaped, poreless, with distinct, but relatively short apical horn. Cephalic part smooth, poreless. Thoracic part not separated by a stricture, somewhat broader, but lower than cephalic part, with short, often indistinct or missing vertical ribs.

Abdomen and postabdominal segments narrow, hoop-like, broadest in their middle part. They become slowly, but continuously broader, whereas their height increases distally only very few. The sculpture consists of short vertical ribs that bear a distinct node in the middle part of the segments and indistinct nodes at their proximal ends. This sculpture is indistinct on the abdomen, partly even on the first two postabdominal segments, but distinct on all further postabdominal segments. The abdomen displays

one irregular pore ring, the following segments two regular pore rings. The small pores are mostly closed (partially or totally) by a layer of microgranular silica. The strictures are narrow, deep, smooth, poreless.

**Dimensions:**

Length of test (without apical horn) = 250-267  $\mu\text{m}$

Maximum width of test = 90-92  $\mu\text{m}$

Length of apical horn = 19-27  $\mu\text{m}$

**Occurrence:** Upper subzone of Lower Fassinian *Spongosilicarmiger italicus* Zone of Hungary and Southern Alps.

**Remarks:** The Illyrian *Pseudotriassocampe angustiannulata* n. sp. has only proximally a conical shape, distally it is cylindrical. The apical horn is larger and strongly asymmetrical.

***Pseudotriassocampe angustiannulata* n. sp.**

(Pl. 43, fig. 2)

**Derivatio nominis:** According to the narrow segments

**Holotypus:** The specimen on pl. 43, fig. 2; rep.-no. KoMo 1980 I-405

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section

**Stratum typicum:** Bed 87 (Illyrian, *Paraceratites trindosus* Zone)

**Material:** 5 specimens.

**Diagnosis:** Test multicyrtyd, in the proximal part conical, distally cylindrical. Cephalothorax dome-shaped, smooth, with strong, round, excentric apical horn. Cephalic and thoracic part not separated by a collar stricture, but both parts can be distinguished by the shape (subhemicircular cephalic part and hoop-like thoracic part). Cephalic part poreless. Thoracic part with very few, often closed round pores.

From the abdomen to the second postabdominal segment the width increases continuously, in the following segments the width does not change. The abdomen is very narrow, the postabdominal segments are narrow, distally partly very narrow. Abdomen and all postabdominal segments are hoop-like, widest in their middle part. The abdomen displays an indistinct median ring of nodes and two irregular rings of tiny pores, mostly closed by a layer of microgranular silica. The postabdominal segments display short vertical ribs, in the middle part of the segment mostly thickened by low nodes. Each postabdominal segment displays two rings of tiny pores. Strictures between the postabdominal segments narrow, deep, smooth, poreless.

**Dimensions:**

Length of test (without apical horn) = 246-260  $\mu\text{m}$

Maximum width of test = 81-85  $\mu\text{m}$

**Occurrence:** Illyrian (*Paraceratites trinodosus* Zone) of Balaton Highland (Hungary).

**Remarks:** *Pseudotriassocampe angustiannulata* n. sp. is distinguished by its cylindrical distal part of test from the other two known species of this genus.

***Pseudotriassocampe longispinosa* n. sp.**

(Pl. 43, fig. 9)

**Derivatio nominis:** According to the very long apical horn

**Holotypus:** The specimen on pl. 43, fig. 9; rep.-no. KoMo 1982 I-702

**Locus typicus:** Road cut between San Ulderico and Pallé, Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** Sample TT 6, lower subzone of the Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** More than 50 specimens.

**Diagnosis:** Test multicyrtyd, slender conical. Cephalis dome-shaped, smooth, poreless, with very long apical horn. The post-cephalic segments increase very slowly in width. The height increases slowly from the very low thorax until the second postabdominal segment and remains than unchanged. The strictures between all segments are narrow, moderately deep, poreless.

The thorax is distinctly broader and considerably lower than the cephalis. Both segments are separated by a shallow, but distinct collar stricture. The thorax is either narrow hoop-like or inversely trapezoidal. All other segments are hoop-like. The sculpture of all postcephalic segments consists of short, low vertical ribs that are node-like thickened in the middle part of the segments. In the proximal part of the test, especially on the thorax and abdomen, the vertical ribs may be indistinct or even missing. Then only the median nodes are distinct. All segments display 2-3 often irregular rings of tiny round pores.

**Dimensions:**

Length of test (without apical spine) = 345-407  $\mu\text{m}$

Maximum width of test = 90-94  $\mu\text{m}$

Length of apical spines = 245-268  $\mu\text{m}$

**Occurrence:** Lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone. Tethys.

**Remarks:** The Illyrian *Pseudotriassocampe angustiannulata* n. sp. is distinguished above all by its cylindrical distal test.

The Lower Fassanian *Pseudotriassocampe hungarica* n. sp. is distinguished by its smaller apical horn.

**Genus *Striatotriassocampe* n. gen.**

**Type species:** *Striatotriassocampe nodosoannulata* n. gen. n. sp.

**Diagnosis:** Test very long, slender-subcylindrical. Each postcephalic segment is ring-like, with a subcentral smooth or nodose ring. Strictures, lower and upper part of the segments are covered with vertical ribs that may in the apical part continue across the ring of the segments. In the distal part, exceptionally also in the apical part the strictures are smooth.

**Assigned species:**

*Striatotriassocampe nodosoannulata* n. gen. n. sp.

*Striatotriassocampe laeviannulata* n. sp.

**Occurrence:** Middle Fassanian *Ladinocampe multiperforata* Zone up to Cordevolian.

**Remarks:** The genus *Striatotriassocampe* n. gen. has evolved from the Illyrian to Lower Fassanian *Triassocampe cylindrica* - *T. kahleri* group. These 2 species display, unusual for *Triassocampe*, a slender-subcylindrical test. The proximal ring of the postabdominal segments, typical for *Triassocampe* s. str., is still well developed in these species. In the Lower Fassanian *T. kahleri* n. sp. the outer pore frames of the first 2-3 postabdominal segments are already arranged into faint vertical ribs. This species is a transitional form to *Striatotriassocampe* n. gen.

***Striatotriassocampe nodosoannulata* n. gen. n. sp.**

(Pl. 43, figs. 4, 10)

**Derivatio nominis:** According to the nodose ring in the first 6-7 postabdominal segments

**Holotypus:** The specimen on pl. 43, fig. 10; rep.-no. KoMo 1980 I-784

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** Sample TT 13, upper subzone of Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 21 specimens.

**Diagnosis:** Test very long, slender-subcylindrical. Cephalis rounded conical, smooth, poreless. The width of the segments increases very slowly and continuously until the sixth postabdominal segment and remains then the following 5-7 segments nearly constantly.



The postcephalic segments are narrow, ringlike, thorax and abdomen are often only indistinctly separated on the outer surface. Thorax, abdomen and the first 6-7 postabdominal segments display a subcentral to subproximal nodose ring or ring of nodes. The following 5-6 segments display a subcentral smooth or slightly nodose ring. Thorax, abdomen and first to fifth or sixth postabdominal segments are covered by vertical ribs that runs from the nodes of one segment ring across the stricture to the nodes of the adjacent segment ring. In the following segments shorter vertical ribs included into the outer pore frames are present that cover only the lower part of the segments and not the stricture and the smooth ring. Toward the distal end these vertical ribs and the whole outer pore frames becomes indistinct.

In the thorax, abdomen and in the first 6 postabdominal segments tiny pores are present that are mostly closed by a layer of microgranular silica or covered by the outer sculpture. Distalward the pores becomes somewhat larger, remain more and more open and are arranged into 2 pore rings.

Strictures narrow and moderately deep, in the proximal half covered by the vertical ribs, in the distal part smooth, poreless.

**Dimensions:**

Length of test = 360-425  $\mu\text{m}$

Maximum width of test = 83-92  $\mu\text{m}$

**Occurrence:** Middle Fassinian *Ladinocampe multiperforata* Zone of the Tethys.

**Remarks:** *Striatotriassocampe laeviannulata* n. sp. from the lowermost Middle Fassinian displays on the whole test smooth rings and the vertical ribs cross never these rings.

***Striatotriassocampe laeviannulata* n. sp.**

(Pl. 43, figs. 3, 7, 8)

**Derivatio nominis:** According to the smooth nodes

**Holotypus:** The specimen on pl. 43, figs. 3, 7, 8; rep.-no. KoMo 1980 I-787

**Locus typicus:** Passo della Gabiola section, Vicentinian Alps (Italy)

**Stratum typicum:** Sample MD 28, lower subzone of Middle Fassinian *Spongosilicarmiger italicus* Zone

**Material:** 3 specimens.

**Diagnosis:** Test very long, slender subcylindrical. Cephalis is rounded conical, smooth or with few pores at the junction of V with the cephalis wall. Thorax lower than cephalis and only a little wider, smooth, separated from the cephalis

by a ring of tiny pores. The following segments become gradually wider until the third postabdominal segment, then they remain nearly constantly wide until the eleventh postabdominal segment.

All postthoracic segments are ring-like and become distalwards slightly higher. They display all a subcentral smooth ring. Until the sixth or seventh postabdominal segment the space between 2 rings of adjacent segments is covered by distinct, moderately large outer pore frames, arranged in vertical stripes. In the following segments this pore frames pattern is restricted to the lower part of the segments and the strictures remain smooth. In the last 2 segments the outer pore frames become indistinct and only slight elevation around the inner pores are present. In the strictures between the postthoracic segments until about the fifth postabdominal segment 2 rings of tiny pores are present. They are to a large part closed by the outer pore frames. In the following segments the pores (that become a little larger toward the distal end of the test) are more and more restricted to the lower part of the segment and an increasingly broader part of the strictures is poreless and smooth. In the segments the pores are arranged in one complete and one incomplete, often irregular pore ring. In the distal segments the pores are always open.

**Dimensions:**

Length of test = 469-484  $\mu\text{m}$

Maximum width of test = 92-96  $\mu\text{m}$

**Occurrence:** Lower subzone of Middle Fassinian *Ladinocampe multiperforata* Zone of Southern Alps.

**Remarks:** *Striatotriassocampe nodosoannulata* n. sp. displays in the proximal part of the test a ring of nodes or a nodose ring on each segment. The vertical ribs are stronger and cross in the apical part of test the rings.

***Striatotriassocampe* ? n. sp.**

(Pl. 42, fig. 13)

**Remarks:** Only few specimens are known from a species that belongs probably to *Striatotriassocampe* n. gen. Their transitional character to *Triassocampe* is obvious. They occur in the middle and upper subzone of the Lower Fassinian *Spongosilicarmiger italicus* Zone.

**Genus *Triassocampe* DUMITRICĂ, KOZUR & MOSTLER, 1980**

**Type species:** *Triassocampe scalaris* DUMITRICĂ, KOZUR & MOSTLER, 1980

**Remarks:** The genus *Triassocampe* is here restricted to Triassocampidae without apical horn, with proximal ring of nodes or smooth ring and often also with distal ring of nodes. These forms begin rarely in the Upper Anisian (only the *T. deweveri*-group) and are the most frequent Nassellaria of the Lower Ladinian.

***Triassocampe cylindrica* n. sp.**  
(Pl. 42, fig. 3; pl. 47, fig. 10)

**Derivatio nominis:** According to the subcylindrical test. Holotypus: The specimen on pl. 42, fig. 3; rep.-no. KoMo. 1980 I-406

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section

**Stratum typicum:** Bed 87, *Paraceratites trinodosus* Zone (Illyrian)

**Material:** 23 specimens.

**Diagnosis:** Test subcylindrical. Cephalis large, rounded conical, smooth, poreless. In prolongation of A and V tiny spines may be present. Thorax not separated from the cephalis, only a little broader, but considerably lower than cephalis. It is not higher than a ring of relatively widely spaced, distinct nodes. The pores are mostly closed or overgrown by the nodes. The abdomen is somewhat broader and higher than the thorax, but also considerably lower than the cephalis. It is short-cylindrical and bears a distinct proximal ring of nodes and below it an elevated, nodose outer pore frame. Inner pores small, mostly closed by the outer pore frame, arranged into 2 rings. The first 3 postabdominal segments are somewhat broader, but not higher than the abdomen. They have a distinct proximal ring of nodes, partly fused to a nodose ring. Their shape is increasingly inversely trapezoidal in lateral view. Below the proximal node ring nodose outer pore frames are present that partly built up a second, but always low ring of nodes. Inner pore frames of small pores arranged in 1-2 rings. The following postabdominal segments become again narrower. They are at first inversely trapezoidal, distal hoop-like. This part of the test has different length. In long forms the fourth to sixth or even seventh segment display a distinct, higher smooth proximal ring and a inversely trapezoidal outline. Only the following segments are hoop-like, with-

out proximal ring. In short forms already the fourth or fifth postabdominal segment is hoop-like without proximal ring. All postabdominal segments display 2 pore rings. The proximal one is always complete, the lower ring is mostly incomplete and consists in some segments only of few widely scattered pores. Strictures narrow, smooth, poreless, in the short morphotype shallow, in the long morphotype deep.

**Dimensions:**

Length of test = 245-339  $\mu\text{m}$

Maximum width = 65-89  $\mu\text{m}$

Occurrence: Illyrian (*Paraceratites trinodosus* Zone) of Tethys.

**Remarks:** *Triassocampe cylindrica* n. sp. is very variable, but in the moment it is not possible to separate the short and long morphotype into 2 species.

The new species displays characters both of the *Triassocampe deweveri* group (in the most part of the test) and of the genus *Paratriassocampe* n. gen. (the distal segments). The very slender, subcylindrical test remembers to the genus *Annulotriassocampe* n. gen. It is the oldest and most primitive *Triassocampe* species, clearly distinguished from typical representatives, starting in the basal *Xenoprotrachyceras reitzi* Oppel Zone.

Most similar is *Triassocampe kahleri* n. sp. from the lower *X. reitzi* Oppel Zone. This species displays the same shape of the test and the same *Paratriassocampe* type of the distal segments. However, the thorax is higher and displays 2 rings of low nodes. The sculpture of the 3 first postabdominal segments is arranged into irregular short vertical ribs (transitional to *Striatotriassocampe* n. gen.).

***Triassocampe deweveri***

**(NAKASEKO & NISHIMURA, 1979)**

(Pl. 42, fig. 1; pl. 44, fig. 14; pl. 45, fig. 6)

1979 *Dictyomitrella deweveri* NAKASEKO & NISHIMURA, n. sp.: - NAKASEKO & NISHIMURA, p. 77, pl. 10, figs. 8?, 9

1982 *Triassocampe* sp. A - MIZUTANI & KOIKE, p. 128, pl. 4, figs. 3, 5

1982 *Triassocampe* sp. B - KISHIDA & SUGANO, p. 286, pl. 4, fig. 19

1982 *Triassocampe* sp. H - YAO, p. 64, pl. 1, fig. 4

1984 *Triassocampe deweveri* (NAKASEKO & NISHIMURA) - ISHIDA, p. 26, pl. 1, figs. 10.-12

**Occurrence:** Lower Fasnian, Worldwide.

**Remarks:** NAKASEKO & NISHIMURA (1979) united under this species different *Triassocampe* species, but

they figured only 2 small forms that belong both to the *T. deweveri* group. This group is characterized by the presence of one distinct proximal ring of nodes or one smooth proximal ring. The other nodes of the inversely trapezoidal segments are smaller or no nodes are present. It is clearly distinguished from *T. scalaris* DUMITRICA, KOZUR & MOSTLER, in which at least until the third postabdominal segment a proximal and a distal ring of nodes are present and these segments are short cylindrical with central incision.

Many forms have been placed into *T. deweveri* by later authors, but only a few of these forms belong to *T. deweveri*. Therefore here the main features of this species have to be evaluated. The holotype displays the following features:

**Test conical.** Upper part of the cephalis conical, lower part cylindrical. Thorax small, hoop-like. All following segments are inversely trapezoidal, in the abdomen this feature is not yet very distinct. The proximal ring of nodes is in all post-thoracic segments distinctly separated from the segments. Nodes below the proximal ring until the second postabdominal segment present, in the following segments missing or very indistinct. All postthoracic segments display one pore ring below the proximal ring of nodes and further small pores below it.

The paratype is similar, but it is not clear, whether it belongs to the same species. Cephalis and thorax are identical. The following segments are very narrow. Because of the bad preservation cannot be decided, whether below the proximal ring of nodes further nodes are present. If this would not be the case, then this specimen would represent an independent species. However, at least in some segments nodes below the nodose, distally smooth proximal ring seems to be present.

Also the presence of additional pores below the proximal pore ring is not sure, but in some segments their presence is probably. In the distal segments the proximal ring of nodes is fused to a smooth ring. The presence of a ring of separated nodes or of a smooth/nodose ring in the distal segments is an intraspecific feature of *Triassocampe* species, if the other features are the same.

In our material of the Southern Alps and Sicily well preserved specimens of *T. deweveri* are present that are restricted to the middle and upper subzone of the Lower Fassinian *Spongosilicarmiger italicus* Zone.

***Triassocampe deweveri pauciconstricta* n. sp.**

(Pl. 44, fig. 14)

**Derivatio nominis:** According to the indistinct constriction between the postabdominal segments

1989 *Triassocampe deweveri*, pars - KOJIMA, p. 219, pl. 1, fig. 3a non! fig 3b

Holotypus: The specimen on pl. 44, fig. 4; rep.-no. KoMo 1980 I-773

**Locus typicus:** Felsöőrs (Balaton Highland, Hungary), Forráshegy section

**Stratum typicum:** Limestone Bed 110, upper part of the pietra verde, upper "X." *reitzei* Oppel above the last occurrence of "X." *reitzei*. Upper subzone of Lower Fassinian *Spongosilicarmiger italicus* Zone.

**Material:** 5 specimens.

**Diagnosis:** Test in the upper part conical, in the distal part subcylindrical. Cephalis subcylindrical, smooth, poreless. Thorax a little broader, but shorter than cephalis, trapezoidal, with 2 irregular rings of pores and 2 incomplete rings of indistinct, node-like elevations. The following segments becomes slowly and continuously broader until the third postabdominal segment, in the fourth postabdominal segment the width remains constantly, and the fifth postabdominal segment is again narrower. The height of the segments increases until the first postabdominal segment that is about as high as the cephalis. The height of the following postabdominal segments remains nearly constantly.

The abdomen is cylindrical or slightly trapezoidal. It displays a distinct, but not very high proximal ring of nodes and in the remaining part nodose larger outer pore frames that may cover even the stricture. The first 3 postabdominal segments are cylindrical, the fourth one is subcylindrical to inversely trapezoidal, the fifth one inversely trapezoidal. These segments display a distinct proximal node ring and elevated, in the first postabdominal segment, sometimes also in the following segment nodose outer pore frames arranged into 2-3 rings. In the fifth postabdominal segment the outer pore frames are low or missing.

Abdomen and first postabdominal segment displays 3 irregular rings of small inner pores that are narrowed or partly closed by the outer pore frames. The following segments display small to moderately large inner pores arranged into 2-3 rings. The inner pore frames are situated directly below the outer pore frames. Strictures between all segments narrow, shallow in the apical part sometimes overgrown by low ridges continuing from the outer pore frames.

**Dimensions:**

Length of test = 310-316 µm

Maximum width of test = 93-97 µm

**Occurrence:** Upper part of Lower Fassanian *Spongosilicarmiger italicus* Zone. Hungary, China.

**Remarks:** In *Triassocampe deweveri deweveri* (NAKASEKO & NISHIMURA, 1979) all postabdominal segments are inversely trapezoidal and the strictures are deeper.

*Triassocampe transita* n. sp. displays similarly shaped segments with shallow strictures, but the postabdominal segments display a distinct second ring of nodes below the proximal ring of nodes or smooth ring.

***Triassocampe deweveri velata* n. subsp.**

(Pl. 42, fig. 1)

**Derivatio nominis:** According to the velate last segment Holotypus: The specimen on pl. 4, fig. 1; rep.-no. KoMo 1980 I - 774

**Locus typicus:** Road cut San Ulderico-Pallé. Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** Sample TT 5, lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 17 specimens.

**Diagnosis:** Test conical, relatively short. Cephalis conical, distally often cylindrical, smooth, poreless. Thorax and abdomen, sometimes also the first postabdominal segment are low, subtrapezoidal. The thorax is nearly smooth and displays only few, tiny, widely scattered pores. The abdomen displays 2 rings of tiny pores that are mostly closed. Low, coarser outer pore frames are also present. The first, sometimes also the second postabdominal segment are cylindrical with 2 rings of tiny pores, some of which are closed. 2 rings of nodes are totally included into coarse, irregularly shaped outer pore frames which are nodose in the place of the 2 ring of nodes. The following 2 postabdominal segments are inversely trapezoidal with distinct proximal nodose or smooth ring. The tiny inner pores are arranged into 2 pore rings, partly covered by coarse, irregularly shaped outer pore frames. The following postabdominal segment is higher than the foregoing segments, displays a strong smooth proximal ring and an inversely trapezoidal lower part with moderately large pores arranged into 3 irregular rings. The last segment is velum-like, without any proximal ring or other sculpture, with irregularly sized pores and poreless proximal part. This segment is distinctly narrower than the foregoing, but rather high. Because of its thin shell wall, it is often not or only partly preserved. It

is separated from the foregoing segment by a shallow, rather broad stricture. All other strictures between the postabdominal segments are deep and narrow, partly overgrown by low outer pore frames.

**Dimensions:**

Length of test = 265-279 µm

Maximum width of test = 91-97 µm

**Occurrence:** Lower subzone of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** *Triassocampe deweveri deweveri* (NAKASEKO & NISHIMURA, 1979) displays no terminal velate structure, at least not until the maximally preserved eleventh segment. Fully preserved *T. deweveri deweveri* are considerably longer than the new subspecies.

*Triassocampe striata* n. sp. displays a similar shaped and sized test with the same small number of segments. However, the sculpture of the abdomen and first postabdominal segment is arranged into vertical ribs, partly crossing even the strictures.

***Triassocampe kahleri* n. sp.**

(Pl. 42, fig. 4)

**Derivatio nominis:** In honour of Prof. Dr. F. KÄHLER; Klagenfurt

**Holotypus:** The specimen on pl. 42, fig. 4; rep.-no. KoMo 1980 I-62

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section

**Stratum typicum:** Bed 100 D, first limestone bed in the pietra verde, lower part of "X." *reitzei* Oppel Zone (*Kellnerites* faunas)

**Material:** 12 specimens.

**Diagnosis:** Test very slender, subcylindrical. Cephalis conical, smooth, poreless or with few widely scattered pores in its lower part. Thorax hoop-like, somewhat broader but somewhat lower than cephalis. It has 2 rings of low nodes that are connected each other by low ridges forming partly imperfect outer pore frames. Very small inner pores mostly covered, arranged into 2, somewhat irregular rings. Abdomen short-cylindrical, somewhat broader and a little higher than thorax, but a little shorter than cephalis. A low proximal and a still lower distal ring of nodes are present. Some further low nodes are present between the 2 rings of nodes. All nodes are connected by low ribs forming larger outer pore frames. Inner pores small, arranged into 2, partly irregular pore rings, mostly closed.

First postabdominal segment cylindrical or slightly inversely trapezoidal. It displays a distinct, but low proxi-

mal ring of nodes. Below it, outer larger pore frames are present that are arranged into low, irregular, short vertical ribs. The inner pores are small, arranged into 2 or 3 partly irregular rings of pores. The second to fourth postabdominal segments have about the same size as the first postabdominal segments, but they are inversely trapezoidal. They display a distinct proximal ring of nodes that is partly fused to a nodose ring. The distinct, nodose outer pore frames are in the second and partly also in the third postabdominal segments arranged into short, irregular, often indistinct vertical ribs. A distinct ring of small inner pores is present below the proximal ring of nodes. Further 1-2 irregular rings of tiny pores are present.

The width of the distal segments decreases again slowly. Their shape changes from inversely trapezoidal (with distinct proximal ring) into hoop-like. One pore ring is present in the segments. Below it, a further incomplete ring of tiny pores or few widely scattered tiny pores may be present.

The strictures between the postabdominal segments are moderately deep, smooth, poreless, in the proximal part of the test narrow, in the distal part wider.

#### Dimensions:

Length of test = 296-346  $\mu\text{m}$

Maximum width of test = 68-73  $\mu\text{m}$

**Occurrence:** Lower "*Xenoprotrachyceras*" *reitzei* Oppel Zone (*Kellnerites* faunas) of Tethys (lower subzone of *Spongosilicarmiger italicus* Zone).

**Remarks:** *Triassocampe kahleri* n. sp. is a transitional form between the Illyrian (*Paraceratites trinodosus* Zone) *T. cylindrica* n. sp. and the Middle Fassanian genus *Striatotriassocampe* n. gen.

*T. cylindrica* n. sp. is distinguished by a very low thorax bearing only one ring of nodes, and by the missing arrangement of the outer pore frames of the first 3 or 4 postabdominal segments into vertical stripes.

In *Striatotriassocampe* n. gen. the vertical ribs are distinct in more than the proximal half of the postcephalic test. In typical forms, they cover also the strictures and join with the vertical ribs of the adjacent segments.

#### *Triassocampe longicephalis* n. sp.

(Pl. 45, fig. 5)

**Derivatio nominis:** According to the long subcylindrical cephalis

1982 *Triassocampe deweveri* (NAKASEKO & NISHIMURA) pars - YAO, p. 64, pl. 1, fig. 3, non! figs. 1, 2

1984 *Triassocampe* aff. *scalaris* DUMITRICA, KOZUR & MOSTLER, pars - ISHIDA, p. 26, pl. 1, figs. 1, 2, non! figs. 3, 4

**Holotypus:** The specimen on pl. 45, fig. 5; rep.-no. KoMo 1980 I-752

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** Sample TT 13, upper subzone of Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 31 specimens.

**Diagnosis:** Test slender conical, distally cylindrical. Cephalis long, subcylindrical, smooth, poreless. Thorax somewhat broader, but considerably shorter than cephalis, hoop-like, with one pore ring of small pores and below it often some widely scattered additional pores. Pore frames elevated, often nodose or a low ring of nodes is present. The following segments become until the third or fourth postabdominal segment slowly and gradually, than the width remains nearly constant. The height of the segments increases only very slowly. Therefore even the largest postabdominal segments are distinctly shorter than the cephalis.

Abdomen and first 2 postabdominal segments are short-cylindrical, with 2 rings of nodes, connected across the median part of the segments that is only insignificantly incised. These segments display 2 rings of small pores. The following postabdominal segments are in their upper part cylindrical, in their lower part inversely trapezoidal. They display a distinct proximal ring of nodes or a nodose/smooth proximal ring. Below this ring a ring of pores with small to medium-sized pores are present, followed by 2 partly irregular pore rings of small pores. Distally some further small, widely scattered pores may be present in these segments. In the third postabdominal segment high, nodose, larger outer pore frames are present. In the following segments the outer pore frames are only a little elevated. The strictures between the postcephalic segments are narrow, deep, smooth, poreless.

#### Dimensions:

Length of test = 300-350  $\mu\text{m}$

Maximum width of test = 96-104  $\mu\text{m}$

**Occurrence:** Upper subzone of Middle Fassanian *Ladinocampe multiperforata* Zone.

**Remarks:** *Triassocampe longicephalis* n. sp. belongs to the *T. scalaris* group. *T. scalaris scalaris* DUMITRICA, KOZUR & MOSTLER, 1980 is distinguished by a distinct median incision between the proximal and distal ring of nodes in the abdomen until at least the third postabdominal segment.

In *Triassocampe scalaris baloghi* n. subsp. the median incision of the abdomen and first 3 postabdominal

segments is likewise indistinct or missing, but in this form at least in the third postabdominal segment 2 node rings are present, the cephalis is shorter and the constrictions are shallower.

***Triassocampe nishimurai* n. sp.**  
(Pl. 44, fig. 7; pl. 45, figs. 4, 9-11)

**Derivatio nominis:** In honour of Prof. Dr. A. NISHIMURA, Osaka

**Holotypus:** The specimen on pl. 45, figs. 9-11; rep.-no. KoMo 1980 I-773

**Locus typicus:** Felsöőrs (Balaton Highland, Hungary), Forráshegy section

**Stratum typicum:** Bed 110, upper part of the pietra verde. Upper "*Xenoprotrachyceras*" *reitzei* Oppel Zone (above the last occurrence of *X. reitzei*), upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Material:** More than 100 specimens.

**Diagnosis:** Test slender-subcylindrical. Cephalothorax large for the genus, long, cylindrical, apically broadly rounded. Cephalic part smooth, poreless, apically sometimes with a coarse, imperfect reticulum of very narrow, low, indistinct ribs. Thoracic part not or only a little broader and considerably shorter than cephalic part, with 2 rings of low nodes that become in some specimens very indistinct. Abdomen short-cylindrical, with 2, rarely 3 rings of distinct, round nodes, alternately arranged. Postabdominal segments inversely trapezoidal, with strong proximal smooth or nodose ring, in the first 3-4 postabdominal segments the proximal rings consists of separated, strong, round nodes. Until the third to fifth postabdominal segment a second ring of small nodes is present.

The thorax displays one ring of tiny, mostly closed pores. Abdomen and postabdominal segment display 2 rings of tiny pores, that are mostly closed. Only in the distal segments they are mostly open. Few widely scattered pores may be present below the second pore ring or even in the otherwise poreless constriction. The last segment (only rarely preserved) is long, velum-like, but not broader than the foregoing segments. It lacks a proximal ring and it displays numerous pores arranged in 4 or more irregular pore rings. Already one or two segments before this velum-like segments no nodes are present, only slightly nodose large outer pore frames.

**Dimensions:**

Length of test = 300-341  $\mu$ m

Maximum width of test = 86-100  $\mu$ m

**Occurrence:** Upper subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Remarks:** *Triassocampe nishimurai* n. sp. belongs to the *T. deweveri* group. *T. deweveri* (NAKASEKO & NISHIMURA, 1979) is distinguished by its smaller size, smaller cephalis, and above all by its conical shape.

*Triassocampe scalaris* DUMITRICĂ, KOZUR & MOSTLER, 1980 is distinguished by the same size of the proximal and distal node rings at least in the first 3 postabdominal segments. Moreover, the shape of the test is conical to subconical.

Closest related is *Triassocampe transita* n. sp. that occurs in contemporaneous beds. It is distinguished by a smaller conical cephalis, conical shape of the test and differently sculptured abdomen.

In *Triassocampe striata* n. sp. the nodes of the proximal and distal node rings of the abdomen and of the first 1-3 postabdominal segments are connected by ribs that partly cross the strictures.

***Triassocampe postdeweveri* n. sp.**  
(Pl. 42, fig. 2)

**Derivatio nominis:** According to the occurrence after *T. deweveri* (NAKASEKO & NISHIMURA)

1982 *Triassocampe deweveri* NAKASEKO & NISHIMURA - HATTORI & YOSHIMURA, p. 112, pl. 1, fig. 4

1982 *Triassocampe deweveri* (NAKASEKO & NISHIMURA, 1979) - KISHIDA & SUGANO, p. 286, pl. 4, figs. 9, 10

**Holotypus:** The specimen on pl. 42, fig. 2; rep.-no. KoMo 1980 I-743

**Locus typicus:** Köveskál (Balaton Highland, Hungary), section at the cemetery

**Stratum typicum:** Siliceous limestone 10 cm below sample 4. Late Fassanian with *Budurovignathus truempyi* and *Eoprotrachyceras curionii*

**Material:** 7 specimens.

**Diagnosis:** Test conical. Cephalis in the lower part cylindrical, in the upper part rounded conical, smooth, poreless. Thorax broader, but shorter than thorax, rounded inversely trapezoidal, with one pore ring of tiny pores. The width of the following segments increases slowly, but gradually. Their height increases only insignificantly and varies somewhat in the proximal postabdominal segments. Only the distal segments are somewhat higher.

Abdomen and all postabdominal segments are inversely trapezoidal and display a distinct nodose or smooth proximal ring. Immediately below this ring a pore ring is present. The remaining part of the segment is in the abdomen and in the proximal postabdominal segments poreless and smooth. In the distal postabdominal segments, there is a second pore ring with slightly elevated or a little nodose pore frames or the segment is also here smooth. Strictures between all postcephalic segments deep, smooth.

**Dimensions:**

Length of the test = 310-335 µm

Maximum width of the test = 108-115 µm

**Occurrence:** Upper Fassinian of Hungary.

**Remarks:** *Triassocampe deweveri* (NAKASEKO & NISHIMURA, 1979) displays a hoop-like thorax and a cylindrical to slightly inversely trapezoidal abdomen. In the abdomen and first 2 postabdominal segments nodes below the proximal ring of nodes or nodose/smooth ring are present. Abdomen and all postabdominal segments display tiny pores below the proximal pore ring. Pore frames elevated or nodose.

***Triassocampe scalaris scalaris* DUMITRICĂ,**

**KOZUR & MOSTLER, 1980**

(Pl. 44, figs. 1-6, 10-12; pl. 45, figs. 1, 2;

pl. 47, figs. 2, 3)

1980 *Triassocampe scalaris* n. gen. n. sp. - DUMITRICĂ, KOZUR & MOSTLER, 1980, p. 26, pl. 9, figs. 5, 6, 11; pl. 14, figs. 2

1982 *Triassocampe deweveri* (NAKASEKO & NISHIMURA), - YAO, MATSUOKA & NAKAIANI, p. 37, pl. 1, fig. 1

1982 *Triassocampe scalaris* DUMITRICĂ - MIZUTANI & KOIKE, p. 128, pl. 4, fig. 4

1982 *Triassocampe deweveri* (NAKASEKO & NISHIMURA) pars - YAO, p. 64, pl. 1, figs. 1, 2, non! fig. 3

1989 *Triassocampe* sp. - MARTINI et al, p. 154, pl. 1, fig. 1

**Occurrence:** Lower Fassinian *Spongosilicarmiger italicus* Zone and Middle Fassinian *Ladinocampe multiperforata* zone frequent in the whole Eurasiatic Tethys. Rich occurrences of this subspecies are especially known from the upper subzone of the Lower Fassinian *Spongosilicarmiger italicus* Zone.

**Remarks:** *Triassocampe scalaris scalaris* DUMITRICĂ, KOZUR & MOSTLER displays at least in the first 3 postthoracic segments 2 distinct rings of nodes separated by a slight incision. The segments are therefore short cylindrical with slight median incision. In distal segments the proximal ring of nodes becomes stronger and is often fused to a nodose or even smooth ring. The distal nodose ring is replaced by more numerous, but lower nodes that are finally replaced by elevated, partly still nodose pore frames. These distal segments have an inversely trapezoidal outline.

In *Triassocampe deweveri* (NAKASEKO & NISHIMURA, 1979) the thorax is hoop-like, the abdomen cylindrical. All postabdominal segments are inversely trapezoidal with distinct proximal ring of nodes or with a distinct nodose/smooth proximal pore ring. No second ring of nodes, separated by a median incision from the proximal ring, is present.

In *Triassocampe scalaris baloghi* n. subsp. from the basal Fassinian the median incision of the abdomen and the first of 3 postabdominal segments is indistinct or missing.

***Triassocampe scalaris baloghi* n. subsp.**

(Pl. 44, figs. 16, 17)

**Derivatio nominis:** In honour of Prof. Dr. K. BALOGH, Budapest

**Holotypus:** The specimen on pl. 44, fig. 16; rep.-no. Ko-Mo 1980 I-716

**Locus typicus:** Felsőörs (Balaton Highland, Hungary), Forráshegy section

**Stratum typicum:** Bed 100 D, lowermost limestone bed of the Buchenstein Formation, basal "X." *reitzei* Oppel Zone (*Kellnerites felsoeoersensis* Subzone)

**Material:** More than 100 specimens.

**Diagnosis:** Test conical, relatively short. Cephalis apically rounded conically, distally often subcylindrical. It is smooth and poreless. Thorax broader, but considerably lower than cephalis. The following segments become gradually broader, the fourth postabdominal segment and (if present) following segments are often again a little narrower. At least, they become not more broader than the foregoing segment. The height of the segments grows very slowly and even the highest distal postabdominal segments are not higher, often even somewhat shorter than the cephalis.

Thorax, abdomen and first postabdominal segments are hoop-like, the first postabdominal segment may be also cylindrical. Second mostly also third postabdominal segments cylindrical. The following segments are inversely trapezoidal.

The thorax displays one ring of low nodes (or it is nearly smooth) and on ring of small pores, mostly closed a layer of microgranular silica. Abdomen to third (sometimes only to second) postabdominal segment display distinct rings of nodes, situated at the proximal and distal ends of the segment. Beginning with the fourth, sometimes also with the third postabdominal segment, the proximal node ring is fused to a nodose or smooth ring. The nodes of the lower and upper node ring are mostly connected by ribs across the median part of the segments. Sometimes, there also a third node ring is intercalated. There is only an indistinct median incision in the abdomen and first 2 or 3 postabdominal segments. In the distal postabdominal segments the nodes below the proximal ring become lower and are replaced by high, often nodose pore frames. Abdomen and postabdominal segments display 2-3 rings of tiny pores, mostly closed by a layer of microgranular silica. The distal postabdominal segments display coarser outer pore frames arranged in 2, rarely 3 rings. The last segment displays small to moderately large pores arranged into 2-3 irregular pore rings. The surface below the proximal ring is smooth. Strictures smooth, narrow, moderately deep.

**Dimensions:**

Length of test = 235-305  $\mu\text{m}$

Maximum width of test = 87-95  $\mu\text{m}$

**Occurrence:** Basal Ladinian lower "X." *reitzei* Oppel Zone of the Tethys. Lower and middle subzone of Lower Fassinian *Spongosilicarmiger italicus* Zone. Rarely still in the upper subzone of *S. italicus* Zone.

**Remarks:** *Triassocampe scalaris baloghi* n. subsp. is the oldest typical *Triassocampe* species of the *T. scalaris* group. The *T. scalaris* group belongs to the most typical and most frequent Nassellaria of the Ladinian. The appearance of this group at the originally used Anisian/Ladinian boundary strongly support the position of the Anisian/Ladinian boundary at the base of the "X." *reitzei* Oppel Zone (base of *Kellnerites* fauna = top of *Paraceratites trinodosus* Zone).

*Triassocampe scalaris scalaris* DUMITRICĂ, KOZUR & MOSTLER 1980 is distinguished by a distinct median incision between the proximal and distal ring of nodes in the abdomen and first 3 postabdominal segments. Moreover, the test is longer.

The Middle Fassinian *Triassocampe longicephalis* n. sp. is distinguished by its long, cylindrical cephalis, deeper strictures and larger pores.

***Triassocampe striata* n. sp.**

(Pl. 45, fig. 8; pl. 47, fig. 1)

**Derivatio nominis:** According to the vertical ribs on the abdomen and first abdominal segment

**Holotypus:** The specimen on pl. 45, fig. 8; rep.-no. KoMo 1980 I-777

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** Sample TT 3, lower subzone of the Middle Fassinian *Ladinocampe multiperforata* Zone

**Material:** 71 specimens.

**Diagnosis:** Test relatively short, conical with velum-like last chamber. Cephalis conical, distally cylindrical, smooth, poreless. Thorax subcylindrical, only a little wider and somewhat shorter than cephalis, proximally smooth, distally with short, mostly indistinct vertical ribs. Only few, widely scattered tiny pores are present. Abdomen with 2 rings of nodes that are connected by short, vertical ribs. Some of these ribs continue (under shallowing) until the distal part of the thorax. Other ones continue across the separating stricture until the first postabdominal segment, in which the proximal node ring is stronger than the distal one and the nodes of both rings are connected by vertical ribs as well. In the second to fourth postabdominal segments a strong proximal ring of nodes (second postabdominal segment), nodose ring (third postabdominal segment) and smooth or slightly nodose ring (fourth postabdominal segment) is present. The fifth postabdominal segment is long, velum-like, without sculpture. Abdomen to fourth postabdominal segment display 2-3 rings of tiny pores. The velum displays 4 or more rings of little pores. The strictures are narrow, poreless, in the apical part of test overgrown by the vertical ribs that cross the strictures. The stricture before the velum-like last segment is broader and shallower.

**Dimensions:**

Length of test = 250-269  $\mu\text{m}$

Maximum width of test = 85-94  $\mu\text{m}$

**Occurrence:** Lower subzone of Middle Fassinian *Ladinocampe multiperforata* Zone. Tethys.

**Remarks:** The distinct arrangement of the sculpture in irregular vertical ribs on the abdomen and first postabdominal segment remembers to *Striatotriassocampe* n. gen. that displays, however, always a long cylindrical test and the vertical ribs are strongest in the strictures, whereas the smooth ring in the median part of the segments are not crossed by these ribs. Moreover, at least on 8 postabdominal segments (and on the strictures between them) these vertical ribs or vertically arranged outer pore frames (in the more distal segments) are present.



The vertical ribs of *T. striata* n. sp. - strongest on the proximal part of abdomen and first postabdominal segments and crossing the node rings - are homeomorph with the ribs in *Striatotriassocampe* n. gen. This is still confirmed by the close relations to *T. deweveri velata* n. subsp. that has the same short-conical shape of test with velate last segment without sculpture. It is distinguished by coarse outer pore frames not distinctly vertically arranged.

***Triassocampe transita* n. sp.**

(Pl. 44, fig. 15)

**Derivatio nominis:** According to the transitional position between the *T. deweveri* - and the *T. scalaris* group

**Holotypus:** The specimen on pl. 44, fig. 15; rep.-no. Ko-Mo 1980 I-755

**Locus typicus:** Passo della Gabiola section, Vicentinian Alps (Italy)

**Stratum typicum:** Sample MD 18, middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone

**Material:** 7 specimens.

**Diagnose:** Test conical. Cephalis conical, smooth, poreless. Thorax trapezoidal, broader, but shorter than cephalis with one ring of low nodes. Tiny pores mostly covered by a layer of microgranular silica. Abdomen somewhat broader, but not higher than thorax, short cylindrical, likewise with one ring of nodes and tiny pores, mostly closed by a layer of microgranular silica. Postabdominal segments high (higher than cephalis), subcylindrical. Their width increases continuously until the third postabdominal segment, than it decreases again. All postabdominal segments display a distinctly elevated proximal ring of nodes that is in the distal postabdominal segments fused to a smooth, rather broad ring. Until the third postabdominal segment also a distal node ring is present, distinctly lower than the proximal ring. Some of nodes of the 2 rings are connected by ridges across the broad median part of the segments, where often elevated coarser outer pore frames are present. The median part of the segments is only indistinctly incised. In the fourth postabdominal segment the distal pore ring consists only of small, low nodes, incorporated in the here stronger outer pore frames. The postabdominal segments display 3 rings of tiny pores and larger outer pore frames. Only the proximal pore ring is regular. The structures are very narrow, smooth, poreless and shallow, distally somewhat deeper.

**Dimensions:**

Length of test = 298-330  $\mu$ m

Maximum width of test = 97-103  $\mu$ m

**Occurrence:** Middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone.

**Remarks:** *Triassocampe transita* n. sp. displays distinct, elevated proximal node rings (or smooth rings) as in the *T. deweveri* group. However, as in the *T. scalaris* group, it displays in the first 3 postabdominal segments also a distinct distal node ring that is, however, lower than the proximal ring. Therefore *T. transita* n. sp. is in its sculpture transitional between the *T. deweveri* and the *T. scalaris* group. Most similar is *T. scalaris baloghi* n. subsp. that is distinguished by a considerably narrower median part of the first 3 postabdominal segments in which the proximal and distal node rings have in the first 2 postabdominal segments the same high, whereas in the third one the proximal ring is a little higher.

**Genus *Yeharaia* NAKASEKO & NISHIMURA, 1979**

**Type species: *Yeharaia elegans* NAKASEKO & NISHIMURA, 1979**

***Yeharaia annulata* NAKASEKO & NISHIMURA, 1979**

(Pl. 46, figs. 6-11, 13; pl. 47, figs. 4, 5)

1979 *Yeharaia annulata* NAKASEKO & NISHIMURA, n. sp. - NAKASEKO & NISHIMURA, p. 10, figs. 1, 7; pl. 12, fig. 5

**Occurrence:** Lower and Middle Fassanian. Worldwide. Remarks: This easily recognizable species is widely distributed (Japan, North America, Yugoslavia, Italy, Hungary) and occur only in a short stratigraphic interval in the Lower and Middle Fassanian. In our material the species is rather rare. It begins at the base of the *Xenoprotrachyceras reitzi* Oppel Zone.

In Japan this species is common and it occurs in the same stratigraphic level as in Europe. The original assignment of the strata with *Yeharaia* into the Upper Triassic was not correct. These beds contain Longobardian (N 13) and Lower Ladinian (SM 802, SM 803, MN 2311, IN 17) faunas (see KOZUR & MOSTLER, 1981, YAO, 1982, KOZUR, 1984, 1988 a, b, KOJIMA & MIZUTANI, 1987). In really Upper Triassic (Upper Carnian - Middle Norian) beds (MN 2301, MN 2302) *Yeharaia* is absent also in Japan

ISHIGA (1984), in turn, reported *Yeharaia annulata* from the Illyrian and Ladinian of China. However, *Yeharaia annulata* occurs there together with *Triassocampe scalaris* DUMITRICĂ, KOZUR & MOSTLER and *T. deweveri* (NAKASEKO & NISHIMURA) what

excludes Illyrian. This age misinterpretation is based on erroneous determinations of accompanying conodonts.

BLOME et al (1986) accepted again an Upper Triassic (Early and Middle Carnian) age for radiolarian faunas with rich occurrences of *Yeharaia annulata* from western North America. However, the species from this association, figured on pl. 8.3., figs. 1-13, 15-18 belong to the typical Lower Ladinian association, well known from Europe and Japan.

Our rich Illyrian radiolarian fauna from the *Paraceratites trinodosus* Zone with more than 100 species does not contain *Yeharaia annulata* or any other *Yeharaia* species. Therefore the base of the *X. reitzi* Oppel Zone (*Parakellnerites* fauna) is seemingly the lowest level of the occurrence of *Yeharaia annulata*.

*Yeharaia annulata* and the whole genus *Yeharaia* is not more present in the Longobardian. In our rich material from the *Budurovignathus truempyi* conodont zone (upper Fassanian), *Yeharaia* is also missing. *Yeharaia* is a very good world-wide distributed guide form for the Fassanian.

#### ***Yeharaia lata* n. sp.**

(Pl. 46, fig. 5)

**Derivatio nominis:** latus (lat.) = broad

**Holotypus:** The specimen on pl. 46, fig. 5; rep.-no. KoMo 1980 I-700

**Locus typicus:** Road cut San Ulderico-Pallé, Tretto (Vicentinian Alps, Italy)

**Stratum typicum:** Sample TT 14, upper subzone of Middle Fassanian *Ladinocampe multiperforata* Zone

**Material:** 3 specimens.

**Diagnosis:** Test multicyrtyd, broadly conical. Cephalis subhemispherical, smooth, poreless. Apical horn excentric, moderately large. Collar stricture distinct, with some small pores. Thorax subhemispherical, distinctly broader, but not higher than cephalis. Abdomen and first postabdominal segment hoop-like, distinctly broader and somewhat higher than thorax, with small pores, arranged into 2 irregular rings. The second postabdominal segment is also hoop-like, broader, but not higher than the foregoing segment. It displays a smooth, not very distinct proximal ring and moderately large pores arranged in 2 irregular pore rings. The following postabdominal segments have about the same size. Their shape is inversely trapezoidal. They display a strong, smooth proximal ring followed by a ring of large pores. In the third postabdominal segment a sec-

ond irregular ring of somewhat smaller pores is present. In the following postabdominal segments only few, widely scattered pores are present below the proximal pore ring. The strictures between all postabdominal segments are deep, smooth and poreless.

#### **Dimensions:**

Length of test = 196-204  $\mu$ m

Maximum width of test = 79-85  $\mu$ m

**Occurrence:** Upper part of Middle Fassanian, Southern Alps (Italy).

**Remarks:** *Yeharaia annulata* NAKASKEO & NISHIMURA, 1979 from the Lower and Middle Fassanian is slender conical to subcylindrical. Already the first postabdominal segment displays a proximal smooth ring. The postabdominal segments display in general one pore ring, only in the last postabdominal segments additional larger pores may be present.

#### ***Yeharaia transita* n. sp.**

(Pl. 46, figs. 1-4, 12)

? 1989 *Yeharaia* sp. A. - YEH, p. 77, pl. 2, fig. 6

**Derivatio nominis:** According to the transitional position between the genera *Triassocampe* DUMITRICĂ, KOZUR & MOSTLER and *Yeharaia* NAKASEKO & NISHIMURA

**Holotypus:** The specimen on pl. 46, figs. 3, 12; rep.-no. KoMo 1980 I-310

**Locus typicus:** Passo della Gabiola section, Vicentinian Alps (Italy)

**Stratum typicum:** Sample MD 13, middle subzone of Lower Fassanian *Spongosilicarmiger italicus* Zone

**Material:** 18 specimens.

**Diagnosis:** Test multicyrtyd, conical. Cephalothorax conical, with very small apical horn. Cephalic part smooth, not or only indistinctly separated from the thoracic part that displays a ring of widely spaced nodes. The whole cephalothorax is poreless.

Abdomen hoop-like, distinctly broader, but lower than cephalothorax. It displays two rings of nodes. The small pores are mostly closed by a layer of microgranular silica.

The postabdominal segments become continuously broader, but only a little higher. Sometimes their height varies irregularly. All postabdominal segments have a proximal ring. In the first postabdominal segment or in the first two postabdominal segments the proximal ring is moderately high, smooth or somewhat nodose. In the fol-

lowing postabdominal segments the proximal ring is very high. All postabdominal segments display a pore ring below the proximal ring. The pores may be partly closed. Below this pore ring further tiny pores are present, only in the last segment these pores become larger.

The shape of the postabdominal segments is inversely trapezoidal. The strictures between these segments are very deep. They are sharply (vertically) separated from the proximal side, but only slightly separated from the distal ends of the segments.

**Dimensions:**

Length of test = 245-300 µm

Maximum width of test = 100-120 µm

**Occurrence:** Middle subzone of the Lower Fassanian *Spongosilicarmiger italicus* Zone up to lower part of Middle Fassanian of Southern Alps.

**Remarks:** *Yeharaia transita* is distinguished from the other *Yeharaia* species by its very small apical horn.

Within the genus *Triassocampe* DUMITRICĂ, KOZUR & MOSTLER several species display a proximal ring in the postabdominal or in the distal postabdominal segments. However, these species display never an apical spine and the proximal end of the cephalis is mostly rounded.

We place all forms with apical horn and proximal ring on the postabdominal segments into the genus *Yeharaia* NAKASEKO & NISHIMURA. Triassocampidae with distinct apical horn, but without proximal ring on the postabdominal segments are here placed into the genus *Pseudotriassocampe* n. gen.

## IV. Biostratigraphic evaluation

### IV.1. The position of the Anisian-Ladinian boundary

In the present paper, which is part of a monographic study on the taxonomy and biostratigraphic value of the Triassic radiolarians, only the biostratigraphic value of the Middle Anisian to Early Ladinian radiolarians is discussed in detail, but some remarks to the Scythian, Longobardian, Cordevolian, Julian and Rhaetian radiolarian biostratigraphy are made as well. Before the Anisian-Early Ladinian radiolarian biostratigraphy will be discussed, remarks to the position of the Pelsonian-Illyrian- and Anisian-Ladinian boundaries are necessary.

The Pelsonian-Illyrian boundary is not yet defined by ammonoids. The horizon with "*Paraceratites*" *bino-*

*dosus* is placed by some authors in the Pelsonian, by others in the Illyrian.

All European conodont workers have placed the *Neogondolella bifurcata* fauna without *Neogondolella bulgarica* in the Illyrian. This fauna begins in the level of the classical ammonoid locality of Tiefengraben (*binodosus* fauna) that was therefore regarded as basal Illyrian by KOZUR (1972b). TATZREITER & VÖRÖS (1991) rejected this view, because in their new material several ammonoid horizons are present and *Paraceratites* and *Judicarites* are missing. However, the new artificial outcrops (Gutenstein Limestone) are situated morphologically above (stratigraphically below) the classical ammonoid locality in the Reifling Limestones placed by KOZUR (1972b) in the basal Illyrian.

KOZUR (1972b) pointed out that the classical Tiefengraben ammonoid horizon is according to its conodont fauna clearly younger than the Rahnbauerkogel horizon that was until this time correlated with the Tiefengraben horizon (SUMMESBERGER & WAGNER, 1972). This younger age of the Tiefengraben fauna was confirmed by TATZREITER & VÖRÖS (1991).

Our radiolarian fauna of the *Parasepsagon robustus* Zone has been derived from the basal Reifling Limestone of Großreifling, stratigraphically somewhat above a typical Pelsonian conodont fauna with *N. bulgarica* and *Nicoraella kockeli* and stratigraphically somewhat below the *N. bifurcata* fauna of the classical Tiefengraben ammonoid horizon. Most probably, it belongs to the Pelsonian *Bulogites zoldianus* horizon, because in the Aszófő section (Hungary) a similar radiolarian fauna was found in *Bulogites zoldianus*-bearing beds.

The Anisian-Ladinian boundary is according to the priority the clearest boundary within the Triassic. MOJSISOVICS; WAAGEN & DIENER (1985) introduced the Alpine Triassic Stage subdivision and placed the top of the newly introduced Anisian Stage at the top of the *Paraceratites trinodosus* Zone. The *Aplococeras avisianum*- and *Eoprotrachyceras curionii* Zone have been placed into the Fassanian Substage which was also introduced by these authors. The Fassanian is the lower Substage of the Ladinian Stage which was in this time still named as Norian Stage. Later the term Norian was replaced by the term Ladinian and the term Norian have been used then to replace the term Juvavian in the Stage subdivision originally used by MOJSISOVICS; WAAGEN & DIENER (1895).

The Fassanian was defined by the *Eoprotrachyceras curionii*- and *Aplococeras avisianum* Zone. The *E. curionii* Zone was used originally in a wider scope than today including also the later generally used "*Xenoprotra-*

*chyceras*" *reitzei* Zone. The *Aplococeras avisianum* Zone was placed originally above the *Eoprotrachyceras curionii* Zone in this wider sense.

The paper of MOJSISOVICS; WAAGEN & DIENER (1895) shows clearly that the original Anisian-Ladinian boundary was placed above the *Paraceratites trinodosus* Zone and that the *Aplococeras avisianum* Zone and the *Eoprotrachyceras curionii* Zone (including the "*Xenoprotrachyceras*" *reitzei* Zone) were originally placed into the Fassanian (Early Ladinian). This boundary was logical, because it is not only well recognizable in pelagic, ammonoid-bearing beds, but even in the thick shallow-water carbonate platform limestones and dolomites (Dasycladaceen limestones and -dolomites) that are widely distributed in the Alpine Triassic of Eurasia during the Anisian-Ladinian time interval. In this facies the Anisian-Ladinian boundary at the top of the *Paraceratites trinodosus* Zone is indicated by the first appearance of the dasycladacean species *Diplopora annulata*.

Later investigations have shown that this boundary is also recognizable by conodonts, e.g. first appearance of *Neogondolella mesotriassica* (KOZUR & MOSTLER), *Paragondolella alpina* (KOZUR & MOSTLER) and *P. ? trammeri praetrammeri* (KOZUR & MOSTLER) and especially by radiolarians as discussed below. We see therefore no reason to abandon this priority boundary.

After clear separation of the "*Xenoprotrachyceras*" *reitzei*- and *Eoprotrachyceras curionii*-Zone, the Anisian-Ladinian boundary have been placed in agreement with the original intentions by MOJSISOVICS; WAAGEN & DIENER (1895) between the *P. trinodosus*- and "*X. reitzei*" Zone. As shown below, this boundary is roughly identical with the boundary between the *trinodosus*- and *avisianum* Zone.

The "*Xenoprotrachyceras*" *reitzei* Zone (MOJSISOVICS, 1892) was introduced and defined in the famous Forráshegy section near Felsőörs (Hungary) as an Oppel Zone comprising all the faunas of the there present pietra verde beds (see BÖCKH, 1872, LÓCZY, 1916, STÜRZENBAUM, 1875). Despite the fact that originally (MOJSISOVICS, 1882) no stratotype was designated for the *reitzei* Zone, later generally the Forráshegy section (type locality of "*X. reitzei*") was regarded as reference for the *reitzei* Zone. This is correct, because the South Alpine "*X. reitzei*" Zone sensu MOJSISOVICS comprised both the *reitzei* and *curionii* Zones, later together designated as "*Protrachyceras*" *curionii* Zone (MOJSISOVICS, WAAGEN & DIENER (1895). The *reitzei* Zone of the Balaton Highland was used as Oppel Zone in the same scope as today. Moreover, it was already used before MOJSI-

SOVCIS (1882) as *reitzei* fauna (STÜRZENBAUM, 1875).

Below this fauna, only the *Paraceratites trinodosus* fauna was known. But between the *Paraceratites trinodosus* Zone and the "*Xenoprotrachyceras*" *reitzei* Oppel Zone there is still a thin horizon with *Parakellnerites* cf. *meriani*, *Paraceratites subnodosus*, *Hungarites* sp. and "*Reiflingites*" ? *camunus*. This horizon, for which especially "*Reiflingites*" ? *camunus* is very characteristic, is also known from other localities of the Balaton Highland exactly in the same position between the *Paraceratites trinodosus* Zone and the "*Xenoprotrachyceras*" *reitzei* Oppel Zone. For this distinct ammonoid fauna here the "*Reiflingites*" ? *camunus* subzone of the *P. trinodosus* Zone is used. Type locality is the Felőrs section in the Balaton Highland, where this zone is present in beds 91 (?), 94 to 99 A.

According to the newest results (VÖRÖS, SZABÓ, both lectures in Budapest, 1990) the lower part of the "*X. reitzei*" Oppel Zone in the Felsőörs section and other sections in the Balaton Highland contains the *Kellnerites* fauna, the upper part an *Aplococeras*-*Halilucites* fauna. Therefore the *reitzei* Oppel Zone may be subdivided into two subzones, the *Kellnerites* Subzone below and the *Aplococeras avisianum* Subzone above. The *Kellnerites* Subzone is named as *Kellnerites felsoeoersensis* Subzone. The stratotype is the Felsőörs section, where this subzone occur from the base of the pietra verde to the stratigraphic level below the first appearance of "*X. reitzei*".

TORNQUIST (1901) recognized that the "*X. reitzei*" Oppel Zone of the Balaton Highland corresponds to the Mte. Spitz Limestone and to the overlying so called "*nodosus* Formation" of the Southern Alps. This view, however, was not accepted by later authors. They placed the *X. reitzei* Zone (regarded as basal Ladinian) above the *Aplococeras avisianum* Zone (regarded as topmost Anisian), see ZAPFE (1974, referring to data of ASSERETO, KRYSZYN, URLICHS). Only KOZUR (1972b and later publications) placed the *A. avisianum* Zone into the Ladinian (following the original intentions by MOJSISOVICS; WAAGEN & DIENER, 1895) and equated it at least partly with the "*X. reitzei*" Zone. This view was rejected by TOLLMANN (1976), who wrote: "Die Obergrenze des Anis wird heute ganz allgemein ...., im Gegensatz zur Auffassung von H. KOZUR ... über und nicht unter die *Avisianus*zone gelegt" (TOLLMANN, 1976, p. 65). "Die ladinische Stufe umfaßt das Fassan (*Reitzei*-Zone und *Curionii*-Zone)..." (TOLLMANN, 1976, p. 96). In contrast to KOZUR (1972b and later papers), TOLLMANN (1976) and almost all workers of the Alpine Triassic placed the Anisi-

an-Ladinian boundary between the *avisianus*- and *reitzei* zones.

Our radiolarian data have shown that the correlation by TORNQUIST (1901) was correct. The Mte. Spitz Limestone is overlain after a short gap (karst surface) by the "Formacione a nodosus". The upper Mte. Spitz Limestone with *Diplopore annulata* belongs to the lower part of the "X." *reitzei* zone as already recognized by TORNQUIST (1901). We have studied radiolarians immediately above the Mte. Spitz Limestone. They have been never older than the middle part of the middle *Spongosilicarmiger italicus* Zone corresponding to the middle "X." *reitzei* Oppel Zone of the Felsőörs section. The middle and upper "X." *reitzei* Oppel Zone is therefore a time-equivalent of the lower Buchenstein Beds s.l. (in general pietra verde with different amounts of limestone) of the Recoarao area. This "Formacione a nodosus" and overlying pietra verde/limestone deposits have been in general placed into the *A. avisianum* Zone. This means that the lower *Aplococeras avisianum* Zone (as used in the Southern Alps) is contemporaneous to upper X. *reitzei* Oppel Zone of the Balaton Highland. The upper part of this *A. avisianum* Zone is even younger than the "X." *reitzei* Oppel Zone. The *A. avisianum* Zone is roughly the shallow-water to deep-neritic equivalent of the upper part of the fully pelagic "X." *reitzei* Zone and of beds immediately above it.

This yields a possible explanation, why MOJSISOVICS; WAAGEN & DIENER (1895) have placed the *A. avisianum* Zone above the *E. curionii* Zone. Their *curionii* Zone included the ammonoid faunas from the interval of the present day "X." *reitzei* Zone up to the *E. curionii* Zone or even up to the *P. gredleri* Zone. In shallowing upward sequences or in sequences with interfingering of neritic and pelagic deposits *Aplococeras avisianum* may be present above beds that contain pelagic ammonoid faunas of the "X." *reitzei* Zone (as part of the original *E. curionii* Zone s.l.).

The time-equivalence of the lower *A. avisianum* Zone (as used in the Southern Alps) with the upper "X." *reitzei* Oppel Zone (this *A. avisianum* Zone ranges above the "X." *reitzei* Oppel Zone of the Balaton Highland) excludes a position of the Anisian-Ladinian boundary between the "Anisian" *A. avisianum* Zone and the Ladinian "X." *reitzei* Zone as pointed out already by KOZUR (1972b and later papers).

In the last years some attempts have been made to redefine the Anisian-Ladinian boundary by ammonoids and conodonts. TOZER (1974) placed this boundary at the base of the *Eoprotrachyceras subasperum* Zone, a time-equivalent of the *E. curionii* Zone. This boundary is well

recognizable by ammonoids (e.g. first appearance of the genus *Eoprotrachyceras*), but not by conodonts. *Metapolygnathus truempyi* appears only within this zone, but not yet at its base. In the radiolarian fauna this boundary is also not distinct (discussed by KOZUR & MOSTLER, in press).

The Anisian-Ladinian boundary proposed by TOZER is partly used in the Boreal realm, but in the Eurasiatic Tethys it was mostly rejected. Only BRACK & RIEBER (1986) followed him. This boundary is too far from the priority boundary<sup>1)</sup> and its application would drastically change the level of the Anisian-Ladinian boundary in the whole pelagic Tethys development in Eurasia as well as in the marginal seas of the Eurasiatic Tethys (like in the Germanic Basin, the type area of the Triassic system). In the widespread carbonate-platform deposits (*Diplopore* Limestone and -Dolomite) this boundary is not recognizable.

KRYSTYN (1983) proposed the placement of the Anisian-Ladinian boundary between his *Parakellnerites*- (rather *Kellnerites*-) and *Nevadites*- "Zones". Unfortunately, his ammonoid-conodont correlation is exclusively based on highly condensed sequences, like the *Epidaurus* section. This latter section yielded a lot of conodont ranges that are basically different from conodont ranges in uncondensed sections:

- First appearance of *Paragondolella ? trammeri* (KOZUR) simultaneously with the first appearance of the ammonoid genus *Nevadites* (discussed later).
- First appearance of *Budurovignathus hungaricus* (KOZUR & VÉGH) at the base of the *E. curionii* Zone. In uncondensed sequences this species begins only at the base of the next younger *Protrachyceras gredleri* Zone and in the upper *E. curionii* Zone only its forerunner *B. truempyi* (HIRSCH) is present.
- First appearance of *Paragondolella tadpole* (HAYASHI) considerably above the last occurrence of *Budurovignathus diebeli* (KOZUR & MOSTLER). In uncondensed sequences *P. tadpole* (HAYASHI) is already present in the upper part of the *B. diebeli* range zone. In thick uncondensed sequences of the Valăni Nappe (Northern Apuseni Mts. (Romania) *P. polygnathi*-

<sup>1)</sup> The term Ladinian was introduced by BITTNER (1892) for the Buchenstein and Wengen beds. The Buchenstein beds have been defined in this time with the "Trachyceras" *reitzei* and "T." *curionii* Zones, in MOJSISOVICS (1892) only with the "Protrachyceras" *reitzei* Zone comprising both zones.

*formis* (BUDUROV & STEFANOV), *P. tadpole* (HAYASHI), *B. diebeli* (KOZUR & MOSTLER), *B. mostleri* (KOZUR) and *Pseudofurnishius murcianus murcianus* (van den BOOGAARD) occur together. The indicated range of *P. tadpole* in the Epidaurus section is the more surprising as according to KRYSTYN *P. foliata* BUDUROV is a younger synonym of *P. tadpole*, an opinion that we cannot follow. *P. foliata* BUDUROV ranges according to BUDUROV & SUDAR (1990) from the higher Late Ladinian to the basal Cordevolian.

- *B. mostleri* (KOZUR) begins in the Epidaurus section only after *B. diebeli* (KOZUR & MOSTLER). In uncondensed sections, like in Köveskál (Balaton Highland, Hungary), Sosio Valley (western Sicily, Italy) and in several sections in the Alps and Western Carpathians *B. mostleri* (KOZUR) begins considerably before *B. diebeli* (KOZUR & MOSTLER) in the upper part of the *Protrachyceras archelaus* Zone.

The evaluation of all our rich conodont material from condensed Hallstatt Limestones of the Alps and other areas has shown that this facies is unsuitable for establishing exact conodont ranges and correlations between conodont- and ammonoid zonations. As we had awaited, also the conodont- and holothurian sclerite faunas from "uncondensed" ammonoid horizons may indicate strong condensation. This fact is easily explainable. The ammonoid fauna of the Hallstatt Limestones is enriched in lenses or some beds. Over 90 % of the total amount of the Hallstatt Limestones is ammonoid-free. For this reason, the condensation of ammonoid-bearing and ammonoid-free Hallstatt Limestone will be the normal case, condensation of two or more different ammonoid faunas the exception. Because even condensation of ammonoid faunas of different age is frequent, in the condensed Hallstatt facies nearly all seemingly uncondensed ammonoid faunas will be condensation horizons of ammonoid-bearing with ammonoid-free Hallstatt Limestones. A condensation horizon, however, in which only one level of the condensed limestones contains ammonoids, appears to the ammonoid workers as uncondensed. Because also the ammonoid-free Hallstatt Limestones are always rich in conodonts and other microfaunas, many uncondensed ammonoid faunas of the Hallstatt Limestone facies contain strongly condensed microfaunas. This may be an explanation for the "exotic" conodont ranges (published by KRYSTYN, 1983) even in those parts of the condensed Epidaurus section, which contain uncondensed ammonoid faunas.

Some remarks are necessary to the conodont taxonomy, published by KRYSTYN (1983). He established a *Gondolella eotrammeri* n. sp. which is similar to *Paragondolella ? trammeri praetrammeri* (KOZUR & MOSTLER, 1982), which has the priority. In both forms, the adults are larger, have a larger platform and smaller basal cavity as in typical *P. ? trammeri trammeri* (KOZUR), the holotype of which derives from a considerably higher stratigraphic horizon in the locality Köveskál. The arched upper surface of the carina is not diagnostic for primitive representatives of *P. ? trammeri* (KOZUR), as assumed by KOVÁCS et al. (1990), because this feature can be even found in very advanced *P. ? trammeri* from the Middle Longobardian. If the very tips of the denticles of the carina are broken away as in the holotype of *P. ? trammeri praetrammeri* (KOZUR & MOSTLER), a rather straight upper surface of the carina is indicated for forms that have in reality an arched upper surface of the carina, like the whole toptype material of *P. ? trammeri praetrammeri* (KOZUR & MOSTLER).

KRYSTYN (1983) did not give any differential diagnosis against *P. ? trammeri praetrammeri* (KOZUR & MOSTLER), but only pointed out that "*Gondolella*" *eotrammeri* is "surely different from *P. ? trammeri praetrammeri* (KOZUR & MOSTLER)". For supporting this view, KRYSTYN (1983) pointed out that the fauna of Fellbach, rich in *Parakellnerites* (det. Dr. TICHY), must belong to the *Nevadites* "Zone". ("In obiger Arbeit wird aus der angeblich durch *Parakellnerites* abgesicherten Probe FQ eine Conodontenfauna genannt, die verglichen mit Epidaurus und anderen Profilen ganz sicher für die *Nevadites* Zone und keineswegs für die *Parakellnerites*-Zone charakteristisch ist. ... Überflüssigerweise leider, weil *G. trammeri praetrammeri* KOZUR & MOSTLER eindeutig in die Synonymie von *G. trammeri* zu verweisen ist, während sie sich andererseits von *G. eotrammeri* n. sp. artlich sicher unterscheidet." KRYSTYN, 1983, p. 257). In his circular logic that *P. ? eotrammeri* should be restricted to the *Parakellnerites* "Zone", *P. ? trammeri* to the *Nevadites* "Zone", he found than the only, but for him decisive evidence for his conclusion that both taxa are surely not identical.

This statement was done without re-examination of the ammonoid- and conodont fauna of the Fellbach section. The conodont data provided by KRYSTYN (1983) does not support the placement of this fauna into the *Nevadites* "Zone". The Fellbach fauna is characterized by two gondolellid species, *Paragondolella alpina* (KOZUR & MOSTLER) and *P. ? trammeri praetrammeri* (KOZUR & MOSTLER). Both these taxa (the latter assigned to

*Gondolella eotrammeri* n. sp.) have been reported and figured by KRYSTYN (1983) only from the *Kellnerites* Subzone ("X." *reitzei* Oppel Zone). Even, if we do not regard the presence of *P. ? trammeri praetrammeri* (KOZUR & MOSTLER) because of different taxonomic opinions about this taxon, then according to the data by KRYSTYN (1983) the Fellbach fauna should belong to his *Parakellnerites* Zone, in which *P. alpina* (KOZUR & MOSTLER) occurs.<sup>2)</sup>

All present reports of *P. alpina* (KOZUR & MOSTLER) come from the lower part of the "X." *reitzei* Oppel Zone, but with exception of the Fellbach section and of the condensed Epidaurus section, there is no direct ammonoid control. In the Epidaurus section this species is definitely restricted to the "X." *reitzei* Oppel Zone. In Fellbach it occurs in beds with *Parakellnerites*, but KRYSTYN (1983) believed that these beds belong to the *Nevadites* "Zone" (see above).

In the section at the road San Ulderico-Pallé investigated by MIETTO & PETRONI (1979) for conodonts and by us for radiolarians (see fig. 5), *P. alpina* (determined as *Neogondolella acuta* by MIETTO & PETRONI) occurs immediately above the Mte. Spitz Limestone in the lower part of the so-called "Formazione a nodosus", placed into the basal *avisianum* Zone by MIETTO & PETRONI. The upper range of *P. alpina* (KOZUR & MOSTLER) is well known in this section, whereas its lower range cannot be determined, because the Mt. Spitz Limestone does not contain conodonts (with exception of few conodonts from the transition to the overlying "Formazione a nodosus").

*P. alpina* (KOZUR & MOSTLER) ends in this section far below the first appearance of *P. ? trammeri trammeri* (KOZUR) that begins only above the pietra verde, according to MIETTO & PETRONI (1979) about 2 m above the base of the overlying reddish nodular limestones. The specimens determined by MIETTO & PETRONI (1979) as *Neogondolella mombergensis media* (KOZUR) are primitive representatives of *P. ? trammeri trammeri*

(KOZUR). These forms begin about 1 m above the base of the nodular limestone.

The same distribution pattern of *P. alpina* (KOZUR & MOSTLER) we have also found in several sections, where we have only conodont control for the age. In all cases *P. alpina* (KOZUR & MOSTLER) ends before *P. ? trammeri trammeri* (KOZUR) (= *G. trammeri* KOZUR sensu KRYSTYN) begins. Only in the Felsöors section, *P. ? trammeri trammeri* begins according to KOVÁCS already in the upper subzone of the "X." *reitzei* Zone. Therefore the base for placing beds with *Parakellnerites* and with rich occurrences of *P. alpina* from the Fellbach section into the *Nevadites* "Zone" by KRYSTYN (1983) is entirely unclear, the more as KRYSTYN (1983) defined the base of the *Nevadites* "Zone" with the first appearance of "*Gondolella*" *trammeri*.

The section at the road San Ulderico-Pallé is also very interesting with respect to the position of the South Alpine *Aplococeras avisianum* Zone. Sample TT 1 (see fig. 5) from the very base of the reddish nodular limestone above the pietra verde and a sample given to us by Dr. P. MIETTO from the same stratigraphic level have yielded rich radiolarian associations of the topmost *Spongosilicarmiger italicus* Zone. Already sample TT 3 (fig. 5) belongs to the Middle Fassanian *Ladinocampe multiperforata* Zone. An identical radiolarian fauna is known from the uppermost part of the pietra verde and from the lowermost part of the overlying pink nodular cherty limestones (base of the Nemesvámos Limestone Formation) of the Felsöors section, well above the last occurrence of "*Xenoprotrachyceras*" *reitzei*. So, these beds are younger than the "X." *reitzei* range Zone. However, the "X." *reitzei* Zone was always used as an Oppel zone, including all ammonoids from the pietra verde (Buchenstein Beds) of its reference section Felsöors (Balaton Highland).

MIETTO & PETRONI (1979) placed the whole pietra verde of the section at the road San Ulderico-Pallé into the *Aplococeras avisianum* Zone and the boundary of this zone against the "X." *reitzei* Zone was discriminated within the lower part of the overlying pink nodular limestones. This was in agreement with the use of these two zones in the Southern Alps. Like many other authors, MIETTO & PETRONI (1979) placed this *avisianum* Zone into the Anisian and the assumed overlying *reitzei* Zone into the Ladinian referring to the general accepted Ladinian age of the *reitzei* Zone in the Balaton Highland. Our radiolarian data, however, have shown that the whole "*reitzei* Zone" of this section is younger than the *reitzei* Oppel Zone in the Balaton Highland, whereas the *avisianum* Zone of this section corresponds to the middle and upper *reitzei* Oppel

<sup>2)</sup> According to a personal communication by KRYSTYN after finishing the stratigraphic part of this paper, he has now re-studied the ammonoid and conodont material of the Fellbach section. KRYSTYN now support the view of KOZUR & MOSTLER (1982) that the Fellbach ammonoid fauna belongs to the *Kellnerites* fauna and that *P. ? trammeri praetrammeri* (KOZUR & MOSTLER) is not a synonym of *P. ? trammeri trammeri* (KOZUR), but a more primitive form.

Zone. It ranges in younger beds than the top of the true *reitzei* Oppel Zone in its type area.

This explains the fact, why the *avisianum* Zone contains the same early Ladinian faunas as the "X." *reitzei* Zone of the Balaton Highland as already stated by KOZUR (1972 b and later papers). Moreover, our radiolarian data have confirmed the splendid correlations of TORNQUIST (1901) that the time-equivalents of the true *reitzei* Zone of the Balaton Highland are situated in the Southern Alps in beds not higher than the *Formacione a nodosus*.

Our radiolarian data are supported by the conodont data of MIETTO & PETRONI (1979). *Neogondolella transita* (KOZUR), primitive representatives of *P. trammeri trammeri* (KOZUR), including *Neogondolella mombergensis media* sensu MIETTO & PETRONI [non ! *N. mombergensis media* (KOZUR)] begin only 1 m above the base of the pink nodular limestone within the lower *Ladinocampe multiperforata* Zone and are not yet present in the underlying *pietra verde*. The same can be observed in the Felsőörs section (Balaton Highland). Both very primitive forms of *P. ? trammeri trammeri* (KOZUR) and *N. transita* (KOZUR) begin here in the lower part (but not yet in the lowermost bed) of the Nemesvámos Formation overlying here likewise *pietra verde* with ammonoids of the "X." *reitzei* Oppel Zone (including the index species of this zone). Like in the Southern Alps, both conodont species begin here within the lower *Ladinocampe multiperforata* Zone, whereas they are missing in the underlying *Spongiosilicarmiger italicus* Zone that is well dated by ammonoids as time-equivalent of the "X." *reitzei* Oppel Zone in the Felsőörs section. Only the highest *S. italicus* Zone is somewhat younger than the X. *reitzei* Oppel Zone.

So, we have the curious situation that some geologists in the Southern Alps accept the traditional Anisian-Ladinian boundary at the base of the X. *reitzei* Oppel Zone, but because of the assumed time-relations between the A. *avisianum*- and X. *reitzei* Zone (*reitzei* Zone is said to be younger than the *avisianum* Zone which is in reality contemporaneous to slightly younger), this boundary is placed above the true *reitzei* Zone.

Scientifically delicate are the attempts of KOVÁCS in KOVÁCS et al. (1990) to support the "exotic" range data of conodonts in the condensed Epidaurus sequence by changing the known conodont data from uncondensed sequences in Hungary. The Italian co-authors in KOVÁCS et al. (1990) contributed, in turn, exact data to the distribution of conodonts and ammonoids in the Southern Alps. In the well dated Stabo Freso III section *Nevadites* occurs in a single horizon. *P. ? trammeri trammeri* (KOZUR) begins in this section clearly above the appearance of *Nevadites*

and not with the first appearance of this ammonoid genus as KOVÁCS tried to prove. The first appearance of *P. ? trammeri trammeri* in the Tethys is facies related in an interval from the upper part of the "X." *reitzei* Zone up to a level above the *Nevadites* fauna. True, advanced *P. ? trammeri trammeri*, like the holotype, began only in the *E. curionii* Zone. The exact total range of *Nevadites* in the Southern Alps is unknown, but generally this genus is restricted to a narrow level in uncondensed sections of Tethyan Europe. In the condensed Epidaurus section *Nevadites* s. str. is even restricted to one layer ("Hauptlager" of *Nevadites* sensu KRYSTYN, 1983), following above a thick layer of manganese oxid indicating strong condensation. The few representatives of *Nevadites* above this level do not belong to *Nevadites* s. str. according to KRYSTYN (1983). In all uncondensed ammonoid-controlled sections *P. ? trammeri trammeri* (KOZUR) begins clearly above the appearance of *Nevadites* s.str. and not with the first appearance of this genus. This is confirmed by the data of the Italian co-authors in KOVÁCS et al. (1990). *Nevadites* is reported even from the "X." *reitzei* Oppel Zone of Vászoly (Balaton Highland, lecture VÖRÖS, Budapest 1990, determinations confirmed by KRYSTYN) considerably below the first appearance of *P. ? trammeri trammeri* in this section.

Against the known data (for the last time published by KOZUR, 1980) KOVÁCS (in KOVÁCS et al., 1990) placed the top of the Nemesvámos Limestone Formation in the Felsőörs sections into the Late Fassanian *E. curionii* Zone. However, as pointed out by KOZUR (1980), the uppermost beds of the Nemesvámos Formation in the Felsőörs section yielded both *Budurovignathus hungaricus* (KOZUR & VÉGH) and *B. mungoensis* (DIEBEL). This association is characteristic for the Middle Longobardian part of the *Protrachyceras archelaus* Zone. With the assignment of *B. hungaricus* into the *curionii* Zone, KOVÁCS tried to prove the data from the condensed Epidaurus section (KRYSTYN, 1983) that *B. hungaricus* began at the base of the *curionii* Zone. However, as shown in the ammonoid-bearing uncondensed section of Köveskál (Balaton Highland) the *E. curionii* Zone (with the index species *E. curionii*) is characterized by *B. truempyi* (HIRSCH) that is replaced near the base of the *Protrachyceras gredleri* Zone by primitive *B. hungaricus* (KOZUR & VÉGH). Joint occurrences of *B. hungaricus* (KOZUR & VÉGH) and *B. mungoensis* (DIEBEL) indicate even in the condensed Epidaurus section the presence of the *P. archelaus* Zone that is two ammonoid zones younger than the *E. curionii* Zone (see KRYSTYN, 1983).



To "prove" the simultaneous first appearance of *Nevadites* and *P. ? trammeri trammeri* (KOZUR), KOVÁCS et al. (1990) changed the taxonomy of *P. ? trammeri*. They wrote "...the holotype of their *G. praetrammeri* (see MOSTLER & KOZUR, 1982, pl. 5, Figs. 5a-b), is a true *G. trammeri* specimen ... Consequently "*G. praetrammeri*" KOZUR & MOSTLER, 1982, should be treated as a junior synonym of *G. trammeri* KOZUR, 1972." (KOVÁCS et al., 1990, p. 188). The quoted paper is KOZUR & MOSTLER (1982), not MOSTLER & KOZUR (1982). These authors did not introduce a species *G. praetrammeri*, but a subspecies *G. trammeri praetrammeri*.

This taxonomic revision of *P. ? trammeri praetrammeri* by KOVÁCS et al. (1990) was obviously influenced by the polemic and self-confident manner, in which KRYSTYN (1983) placed the *Parakellnerites* fauna of the Fellbach section with *P. ? trammeri praetrammeri* in the *Nevadites* fauna ("ganz sicher für die *Nevadites* Zone und keineswegs für die *Parakellnerites* Zone charakteristisch ..." KRYSTYN, 1983, p. 257). To prove the first appearance of *P. ? trammeri* with the first appearance of *Nevadites*, KOVÁCS et al. (1990) had therefore to change *P. ? trammeri praetrammeri* of the assumed *Nevadites* fauna of Fellbach in a typical *P. ? trammeri* as KRYSTYN (1983) did.

However, the Fellbach fauna is both according to the ammonoids (*Parakellnerites*) and according to the conodonts (*Paragondolella alpina* = *G. szaboi*; *P. ? trammeri praetrammeri*) a typical fauna of the "X." *reitzei* Zone. This is insofar interesting as all 3 conodont workers (KOVÁCS, KRYSTYN, NICORA) which favours the Ladinian base with the first appearance of *P. ? trammeri trammeri* have regarded *P. ? trammeri praetrammeri* as typical *P. ? trammeri* and indicative for Ladinian (KOVÁCS et al., 1990, KRYSTYN, 1983). So, if the ammonoids seems to indicate *Nevadites* faunas of Ladinian age, these conodont workers placed the conodonts definitely in the Ladinian, even if the ammonoids belong in reality to the "X." *reitzei* Zone. We agree, of course, with the Ladinian age of the "X." *reitzei* Zone!

As authors of both *P. ? trammeri trammeri* (KOZUR, 1972) and *P. ? trammeri praetrammeri* (KOZUR & MOSTLER, 1982) we state that the first appearance of *P. ? trammeri praetrammeri* in the lower "X." *reitzei* Zone is a distinct conodont event, roughly contemporaneous with the first appearance of *Paragondolella alpina* (KOZUR & MOSTLER, 1982) (= *Gondolella szaboi* KOVÁCS, 1983)<sup>3)</sup> and *Neogondolella mesotriassica* (KOZUR & MOSTLER). The evolution of *P. ? trammeri trammeri* from *P. ? trammeri praetrammeri* is a minor evolutionary

step within a species, unsuitable for definition of a stage boundary as well demonstrated by the misinterpretation of the latter subspecies as typical *P. ? trammeri (trammeri)* by KOVÁCS, KRYSTYN and NICORA (in KRYSTYN, 1983 and KOVÁCS et al. 1990).

Summarizing the data about the ammonoid-, conodont- and Radiolaria distribution near the Anisian-Ladinian boundary in uncondensed sequences, we point out the following:

(1) Interval between the *P. trinodosus*- and "X." *reitzei* Zone

- *Neogondolella mesotriassica* (KOZUR & MOSTLER) (= *Gondolella constricta*, morphotype γ, pars) began near the base of the "X." *reitzei* Oppel Zone. It evolved from *Neogondolella constricta* (MOSHER & CLARK). Transitional forms can be found in the "*Reiflingites*" ? *camunus* Subzone of the *P. trinodosus* Zone. In the same level or a little higher, *P. alpina* and *P. ? trammeri praetrammeri* have their first appearance.
- Drastic changes in the radiolarian faunas occurred between the top of the *Paraceratites trinodosus* Zone and the "*Xenoprotrachyceras*" *reitzei* Oppel Zone. Including still undescribed species more than 30 species disappeared and about 20 taxa appeared, among them decisive, easily recognizable and world-wide distributed Fassanian taxa, like the genera *Oertlispongia* DUMITRICĂ; KOZUR & MOSTLER, *Yeharaia* NAKASEKO & NISHIMURA, 1979, *Triassocampe deweveri* NAKASEKO & NISHIMURA, 1979, *T. scalaris* DUMITRICĂ; KOZUR & MOSTLER, 1980.

The thin, but significant ammonoid horizon with "*Reiflingites*" ? *camunus* between the originally defined *P. trinodosus*- Zone and X. *reitzei* Oppel Zone has yielded poor radiolarian faunas.

<sup>3)</sup> KOVÁCS (1983) selected a juvenile specimen as holotype, KOZUR & MOSTLER (1982) an adult specimen with especially strong reduction of the anterior platform. Identical juvenile forms and such slender adult forms figured by KOVÁCS (1983) as *Gondolella szaboi* are also frequent in our type material of *P. alpina*. As in our type material, "*G. szaboi*" is accompanied by *P. ? trammeri praetrammeri*, determined by KOVÁCS (1983) as *G. trammeri* n. subsp.

### (2) Base of the *Nevadites* Zone

- No conodont species appears or disappears exactly in this level. *Neogondolella transita* begins somewhat later.
- The changes in the radiolarian faunas somewhat below this level are not pronounced (appearance of few species at the base of the *Ladinocampe multiperforata* Zone). The Early Fasnian guideform *Spongosilicarmiger italicus* disappeared a little later. Few changes can be also observed among the Oertlispongidae KOZUR & MOSTLER. However, Oertlispongids with differentiated polar spines, the most characteristic radiolarian group of the Ladinian, appeared near the base of the lower Subzone of the *Spongosilicarmiger italicus* Zone near the base of the "X." *reitzei* Oppel Zone. From this level all important guideforms of the Ladinian are present and all later changes in the Ladinian radiolarian faunas have only modified this Ladinian radiolarian complex, with exception of the distinct change at the base of the Longobardian *B. mungoensis* Zone.

### (3) Base of the *E. curionii* Zone

- Near the base of the *E. curionii* Zone, no distinct change in the conodont fauna occurred. The first appearance of the genus *Budurovignathus* with its most primitive species, *B. truempyi* (HIRSCH) occurs within the *E. curionii* Zone.
- The rich radiolarian faunas of the *E. curionii* - and *P. gredleri* Zone are still under investigation. Their differences to the underlying faunas seem to be distinct, but no distinct changes in the radiolarian fauna occur at the base of the *E. curionii* Zone.

Regarding the radiolarian faunas, the most distinct changes occur at the base and within the lower *reitzei* Oppel Zone. With the first appearance of "X." *reitzei* in the middle part of the *reitzei* Oppel Zone a characteristic Ladinian radiolarian fauna is present; entirely different from the radiolarian fauna of the Late Anisian *Paraceratites trinodosus* Zone. Only gradual changes of this complex occurs until the base of the *Budurovignathus mungoensis* A.Z.

The *Kellnerites felschoersensis* subzone of the *reitzei* Oppel Zone has somewhat transitional character. The Nassellaria fauna displays already distinct Ladinian character (*Triassocampe deweveri*, *T. scalaris*, *Yeharaia annulata*). However, Oertlispongids with differentiated polar spine are still rare. According the radiolarian data either the "X." *reitzei* Zone s.l. (Oppel Zone including the *Kellnerites felschoersensis* subzone) or the "X." *reitzei* Zone s. str. (Oppel Zone excluding the *K. felschoersensis*

Subzone starting with the appearance of "X." *reitzei* above this subzone) are most suitable for the definition of the Anisian-Ladinian boundary. The base of the "X." *reitzei* Oppel Zone is also recognizable by conodonts (KOZUR & MOSTLER, in press).

Also in the wide-spread dasycladacean limestones and -dolomites of the Tethyan carbonate platforms the "X." *reitzei* Oppel Zone is well recognizable by the first appearance of *Diplopore annulata*. For this reasons and for priority reasons the Anisian-Ladinian boundary between the *P. trinodosus* and "X." *reitzei* Zone is here favoured.

## IV. 2. Radiolarian zonation of the Triassic

The assumed oldest Triassic radiolarians have been reported by SASHIDA (1983). They were obtained from an olistolith or tectonic block in a Jurassic olistostrome or tectonic melange. The Scythian age was assumed on the base of the conodont *Neospathodus* sp. However, the genus *Neospathodus* is still frequent in the lower part of the Early Anisian. So, the age of this fauna cannot be given more precisely than Scythian to Early Anisian. So far, only the spicular radiolarians of this fauna have been described (*Archaeosemantis venusta* SASHIDA, 1983 and *Parentactinia nakatsugawaensis* SASHIDA, 1983). According to the data by SASHIDA (1983), Nassellaria are seemingly missing from this fauna.

MARSELLA, KOZUR & D'ARGENIO (in press) found a latest Olenekian (latest Scythian) radiolarian fauna in the Lagonegro Basin of Southern Italy. This fauna is well dated by the conodonts *Neospathodus homeri* (BENDER), *N. triangularis* (BENDER), *Gladigondolella* cf. *tethydis* (HUCKRIEDE), transitional forms to *G. carinata* (BENDER). The radiolarian fauna of these beds consists exclusively of Entactinaria and Spumellaria. The description of this fauna is in preparation.

The oldest well described, but not diverse radiolarian fauna was found in the Pelsonian of the Alps (KOZUR & MOSTLER, 1981). Immediately underlying beds have yielded a Pelsonian conodont fauna with *Nicoraella germanica* (KOZUR), *N. kockeli* (TATGE) and *Neogondolella bulgarica* BURDUROV & STEFANOV, overlying beds contain an Early Illyrian conodont fauna with *Paragondolella bifurcata* BURDUROV & STEFANOV without *N. bulgarica* BURDUROV & STEFANOV. The radiolarian-bearing horizon themselves yielded only a few, stratigraphically unspecific conodonts.

Also this radiolarian fauna (for which here the *Parasepsagon robustus* Zone is introduced) consists of Entactinaria and Spumellaria, whereas Nassellaria are missing. However, this absence of Nassellaria is surely facies-controlled, because in the Late Illyrian already very diverse Nassellaria associations are known and in the Pelsonian of Romania monocyrtid and multicyrtyd Nassellaria are known (DUMITRICĂ, 1982b<sup>4</sup>). Despite the fact that the radiolarian-bearing deposits contain a pelagic conodont fauna, the low diversity of the radiolarian fauna indicates rather shallow depositional water depth.

### *Parasepsagon robustus* Zone

**Definition:** Joint occurrence of *Parasepsagon robustus* KOZUR & MOSTLER, 1981, *P. asymmetricus asymmetricus* KOZUR & MOSTLER, 1981 and *Plafkerium ? anisicum* KOZUR & MOSTLER, 1981.

**Lower boundary:** Not yet fixed, because the underlying beds have not yielded radiolarians. However, in the latest Scythian none of the above mentioned species are present. *Pentaspogodiscus anisicus* KOZUR & MOSTLER, 1981 which is frequent in the *P. robustus* Zone, is missing in the latest Scythian radiolarian faunas as well.

**Upper boundary:** Disappearance of *Parasepsagon robustus* KOZUR & MOSTLER, 1981, *P. asymmetricus asymmetricus* KOZUR & MOSTLER, 1981 and *Plafkerium ? anisicum* KOZUR & MOSTLER, 1981. First appearance of *Parasepsagon asymmetricus praetettracanthus* n. subsp., *Tiborella anisica* n. sp. and of first primitive representatives of the genus *Triassocampe* DUMITRICĂ; KOZUR & MOSTLER, 1980.

**Type locality:** Großreifling, Austria.

**Distribution:** Until now only known from the Alps. Similar, largely undescribed faunas are known from the Pelsonian of the Balaton Highland (Hungary) and of Romania.

**Remarks:** The Late Illyrian radiolarian fauna of the Balaton Highland and of the Lagonegro Basin (southern Italy) is by far richer in species. Therefore the first appearance of more than 50 taxa in the Late Illyrian reflects to a large part the insufficient knowledge of the older faunas. Therefore only the disappearance of *Parasepsagon robustus* KOZUR & MOSTLER, 1981, *P. asymmetricus asymmetricus* KOZUR & MOSTLER, 1981 and *Plafkerium ? anisicum*

cum KOZUR & MOSTLER, 1981 and the first appearance of *Parasepsagon asymmetricus praetettracanthus* n. subsp. in the overlying Late Illyrian *Tetraspinocyrtis laevis* Zone can be used for the moment to differentiate these two faunas. The latter subspecies is a transitional form between *P. asymmetricus asymmetricus* KOZUR & MOSTLER, 1981 from the *Parasepsagon robustus* Zone to the Early Ladinian *P. tettracanthus* DUMITRICĂ; KOZUR & MOSTLER, 1980. The rare occurrence and the very primitive character of the first representatives of the genus *Triassocampe* DUMITRICĂ; KOZUR & MOSTLER, 1980 in the Late Illyrian *Tetraspinocyrtis laevis* Zone indicate that this genus may not yet be present in the time-interval of the *P. robustus* Zone.

### *Tetraspinocyrtis laevis* Zone

**Definition:** Joint occurrence of several *Tetraspinocyrtis* species (*T. anisica* n. sp., *T. annuloperforata* n. sp., *T. laevis* n. sp.), *Hozmadia rotunda* (NAKASEKO & NISHIMURA, 1979) and *Tiborella anisica* n. sp. together with dominating Entactinaria (especially frequent *Parasepsagon* DUMITRICĂ, 1978, and *Pseudosepsagon* n. gen.), frequent and divers *Archaespongoprimum* (Spumellaria) and - for the first time in the radiolarian history - with a rich and highly diversified Nassellaria fauna, dominated by primitive monocyrtid forms, and among the multicyrtyd forms by diverse species of *Planispinocyrtis* KOZUR & MOSTLER, 1981, several species of *Tetraspinocyrtis*, n. gen., primitive representatives of *Anisicyrtis* KOZUR & MOSTLER, 1981, *Silicarmiger* DUMITRICĂ; KOZUR & MOSTLER, 1980 and *Spongossilicarmiger* KOZUR, 1984.

**Lower boundary:** Disappearance of *Parasepsagon asymmetricus asymmetricus* KOZUR & MOSTLER, 1981, *P. robustus* KOZUR & MOSTLER, 1981 and *Plafkerium ? anisicum* KOZUR & MOSTLER, 1981. First appearance of *Parasepsagon asymmetricus praetettracanthus* n. subsp., *Tiborella anisica* n. sp. and of first primitive representatives of the genus *Triassocampe* DUMITRICĂ; KOZUR & MOSTLER, 1980.

**Upper boundary:** Disappearance of *Tiborella anisica* n. sp. and of several primitive representatives of the Entactinaria and of the Nassellaria. First appearance of the typical Early Fasnian Nassellaria association with the genera *Oertlispongus* DUMITRICĂ; KOZUR & MOSTLER, 1980, *Yeharaia* NAKASEKO & NISHIMURA, 1979 and with diverse *Triassocampe* species among them the most characteristic Fasnian species *T. deweveri* (NA-

<sup>4</sup>) An Illyrian age cannot be excluded for this fauna.

KASEKO & NISHIMURA, 1979) and *T. scalaris* DUMITRICĂ; KOZUR & MOSTLER, 1980.

**Important species:** More than 30 important and often frequent species and subspecies have been described in the present paper from the type locality Felsőörs (see taxonomic part). Additionally the following former described species are present: *Archaeospongoprimum bispinosum* KOZUR & MOSTLER, 1981, *A. mesotriassicum asymmetricum* KOZUR & MOSTLER, 1981, *A. mesotriassicum mesotriassicum* KOZUR & MOSTLER, 1981, *Parentactinia pugnax* DUMITRICĂ, 1978, *Pentactinorbis awaensis* (NAKASEKO & NISHIMURA, 1979), *Pseudostylosphaera coccostyla compacta* (NAKASEKO & NISHIMURA, 1979), *Anisicyrtis hungarica* KOZUR & MOSTLER, 1981, *Baratuna excentrica* KOZUR & MOSTLER, 1981, *Eonapora robusta* KOZUR & MOSTLER, 1981, *Eptingium manfredi japonicum* (NAKASEKO & NISHIMURA, 1979), *Goestlingella anisica* KOZUR, 1984, *Hozmadia rotunda* (NAKASEKO & NISHIMURA, 1979), *Nabolella illyrica* (KOZUR & MOSTLER, 1981), *Neopylentonema mesotriassica* KOZUR, 1984, *Planispinocyrtis baloghi* KOZUR & MOSTLER, 1981, *Silicarmiger costatus anisicus* KOZUR & MOSTLER, 1981, *Spinotriassocampe hungarica* KOZUR, 1984, *Triassobipedis balatonica* KOZUR, 1984.

**Type locality:** Forráshegy section of Felsőörs, Balaton Highland (Hungary). Radiolarians of the *Tetraspinocyrtis laevis* Zone were found in the beds 85–90, rarely in beds 91–99; especially well preserved forms occur in the limestone bed 87 inside a tuffitic layer. This bed contains all hitherto described about 50 species of the *T. laevis* Zone, some of which are also known from the Lagonegro Basin (southern Italy) and from Japan.

**Age:** The age of the *T. laevis* Zone from the Felsőörs section is well controlled by ammonoids. The present ammonoids, including *Paraceratites trinodosus*, the index species of the *trinodosus* Zone, are listed in KOZUR (1970). The same horizon contains also some conodonts, exclusively *Neogondolella cornuta* BUDUROV & STEFANOV and very rich paleopsychrospheric ostracod faunas (KOZUR, 1970). In the Lagonegro Basin, the *T. laevis* Zone occurs in beds that can be placed by conodonts into the *Neogondolella constricta* A.Z. which corresponds to the *Paraceratites trinodosus* Zone according to KOZUR (1980).

**Distribution:** Balaton Highland (Hungary), Lagonegro Basin (southern Italy), Japan, Philippines.

**Remarks:** The *Tetraspinocyrtis laevis* Zone is the oldest known highly diverse Triassic radiolarian fauna. Including the here described new species, so far about 50 species have

been described from this Late Illyrian fauna and the description of further taxa is in press.

The richest association from the Forráshegy section of Felsőörs (Balaton Highland, Hungary) contains all species, so far known from this zone. The high diversity (nearly 80 species) in bed 87 (see fig. 3) and the presence of many Nassellaria taxa indicate rather great water depth. This is also indicated by the very rich paleopsychrospheric ostracod fauna from the same stratigraphic level of this section. They indicate water depth below 500 m (KOZUR, 1972c, 1991).

The highly interesting *Tetraspinocyrtis* species, by DEWER et al. (1990) misinterpreted in the Lagonegro Basin as Permian Albaillellacea (see taxonomic part), yielded a good link of the Balaton Highland Late Illyrian radiolarian fauna with contemporaneous associations in the Lagonegro Basin.

*Eptingium manfredi japonicum* (NAKASEKO & NISHIMURA, 1979), *Pentactinorbis awaensis* (NAKASEKO & NISHIMURA, 1979), *Pseudostylosphaera coccostyla compacta* (NAKASEKO & NISHIMURA, 1979) and *Hozmadia rotunda* (NAKASEKO & NISHIMURA, 1979) indicate the presence of the *T. laevis* Zone in the Late Illyrian of Japan. These Japanese radiolarian fauna and also Early and Late Ladinian faunas of the same region have been erroneously placed into the Late Triassic by NAKASEKO & NISHIMURA (1979). Especially important in the Late Illyrian radiolarian fauna of Japan is the frequent *Hozmadia rotunda* (NAKASEKO & NISHIMURA, 1979) that is restricted to the *T. laevis* Zone. *Eptingium manfredi japonicum* (NAKASEKO & NISHIMURA, 1979) and *Pentactinorbis awaensis* (NAKASEKO & NISHIMURA, 1979) may be also restricted to this zone.

Many Nassellaria of the *T. laevis* Zone are primitive monocyrtid forms (8 of 18 known genera of this zone). The more advanced monocyrtid genus *Sanfilippoella* KOZUR & MOSTLER, 1979 is only present by a rare and primitive species.

The multicyrtyd Nassellaria are mostly represented by primitive forms. For instance, the genus *Triassocampe* DUMITRICĂ; KOZUR & MOSTLER, 1980 s. str., with several species the most characteristic and frequent Nassellaria genus of the Early Ladinian, is in the *T. laevis* zone very rare and only represented by one primitive species. Also the most other multicyrtyd genera are only represented by one species (e. g. *Goestlingella* KOZUR & MOSTLER, 1979, *Nabolella* PETRUŠEVSKAJA, 1980, *Spinotriassocampe* KOZUR, 1984, *Annulotriassocampe* KOZUR, n. gen.), mostly distinctly more primitive than the Ladinian representatives of the same genera.

Two or more species are present among the multi-cyrtid genera *Anisicyrtis* KOZUR & MOSTLER, 1981, *Planispinocyrtis* KOZUR & MOSTLER, 1981, *Paratriassocampe* n. gen. und *Tetraspinocyrtis* n. gen. The latter genus represents primitive Nassellaria with mostly indistinct outer and inner segmentation. In the Early Ladinian only one rare species of this genus is present, before it finally disappeared. The three other genera are represented in the Ladinian by several, but more advanced species.

The rich Entactinaria fauna of the Late Illyrian *T. laevis* Zone is rather different from the likewise rich Ladinian Entactinaria fauna. *Pentactinocarpus* DUMITRICĂ, 1978 and the advanced Entactinaria families Eptingidae DUMITRICĂ, 1978 and Hindeosphaeridae KOZUR & MOSTLER, 1981 are only represented by few species: very rare *Pentactinocarpus illyricus* n. sp., very rare *Eptingium manfredi japonicum* (NAKASEKO & NISHIMURA, 1979), very rare *E. nakasekoi* n. sp., rare *Hindeosphaera balatonica* n. sp., partly frequent *Pseudostylosphaera coccostyla compacta* (NAKASEKO & NISHIMURA, 1979). In the Early Ladinian *Spongosilicarmiger italicus* Zone these genera are frequent and represented by numerous species. On the other hand, *Parentactinia* DUMITRICĂ, 1978 and *Pentactinorbis* DUMITRICĂ, 1978, rare in the Early Ladinian, are frequent in the Late Anisian *T. laevis* Zone and represented there by several species.

Only *Parentactinia pugnax* DUMITRICĂ, 1978 ranges from the Late Anisian to the Early Ladinian. All other Illyrian species or subspecies of the genera *Eptingium* DUMITRICĂ, 1979, *Hindeosphaera* KOZUR & MOSTLER, 1979, *Parentactinia* DUMITRICĂ, 1978, *Pentactinocarpus* DUMITRICĂ, 1979, *Pentactinorbis* DUMITRICĂ, 1978 and *Pseudostylosphaera* KOZUR & MOSTLER, 1981 disappeared at the top of the Late Anisian *Paraceratites trinodosus* Zone or they have been replaced by other species in the "X." *reitzei* Oppel Zone.

The Illyrian genus *Pseudosepsagon* n. gen. is not more present in the Fassanian "X." *reitzei* Oppel Zone, whereas *Sepsagon* DUMITRICĂ; KOZUR & MOSTLER, 1980 (very frequent in the Ladinian and Carnian) is not yet present in the Late Illyrian *T. laevis* Zone.

*Parasepsagon* is both in the Late Anisian and in the Early Ladinian frequent, but represented by different species in these substages.

### *Spongosilicarmiger italicus* Zone

**Definition:** Occurrence of *Spongosilicarmiger* KOZUR, 1984 without *Ladinocampe multiperforata* KOZUR, 1984. Common occurrence of *Triassocampe deweveri* (NAKASEKO & NISHIMURA, 1979), *T. scalaris* DUMITRICĂ; KOZUR & MOSTLER, 1980 and other species of the genus *Triassocampe* s. str. as well as of the genera *Oertlispongus* DUMITRICĂ; KOZUR & MOSTLER and *Yeharaia* NAKASEKO & NISHIMURA, 1979. With exception of the lower subzone frequent occurrence of Oertlispongidae, Gomberellidae (with primitive representatives rarely present since the Late Anisian) and Intermediellidae.

**Lower boundary:** First appearance of *Spongosilicarmiger italicus* KOZUR, 1984, *Triassocampe deweveri* (NAKASEKO & NISHIMURA, 1979), *T. scalaris* DUMITRICĂ; KOZUR & MOSTLER, 1980, *Yeharaia annulata* (NAKASEKO & NISHIMURA, 1979), *Oertlispongus* sp.

**Upper boundary:** First appearance of *Ladinocampe multiperforata* KOZUR, 1984, advanced species of *Anisicyrtis* (*A. alpina* n. sp., *A. nodosa* n. sp., *A. spinosa* n. sp., *A. trettoensis* n. sp.) and of *Planispinocyrtis multiperforata* n. sp.

**Important species:** See under the subzones.

**Type locality:** Passo della Gabiola section, Vicentinian Alps (Italy). Samples MD 1-MD 28 (see fig. 6). In this section the middle and upper subzone of the *S. italicus* Zone are exposed and documented by mass occurrences of well preserved radiolarians in all layers.

**Age:** Early Fassanian "X." *reitzei* Oppel Zone, well dated in the Felsöors section. The uppermost part of the *S. italicus* Zone is a little younger than the "X." *reitzei* Oppel Zone.

**Distribution:** Worldwide.

**Remarks:** The index species *S. italicus* KOZUR, 1984 ranges a little into the overlying *Ladinocampe multiperforata* Zone.

The *S. italicus* Zone, especially its upper subzone, yielded worldwide very rich and diverse radiolarian faunas with many distinctive Spumellaria, Entactinaria and Nassellaria species. This fauna is very different from the radiolarian association of the underlying *T. laevis* Zone from the Late Illyrian (in the sense of the *Paraceratites trinodosus* Zone).

The *S. italicus* Zone can be well correlated with the ammonoid zonation in the Felsöors section (Balaton Highland, Hungary). The "X." *reitzei* Oppel Zone (type locality in this section) and the *S. italicus* Zone are almost perfectly contemporaneous. Only the topmost part of the *S. itali-*

*cus* Zone is younger than the *X. reitzi* Oppel Zone. The overlying *Ladinocampe multiperforata* Zone begins in the Felsöors section somewhat below the base of the *Neogondolella transita* conodont zone a little after the top of the "X." *reitzi* Oppel Zone. By conodont control, exactly the same upper range (somewhat below the base of the *N. transita* Zone) is indicated in the Southern Alps.

The lower subzone of the *S. italicus* Zone is not documented by radiolarians in the Vicentinian Alps (Southern Alps), because its time-equivalents are here situated within the radiolarian-free Mte. Spitz Limestone (shallow-water limestone) or in a gap above the Mte. Spitz Limestone. Therefore the boundary stratotype for the lower boundary of the *S. italicus* Zone should be in the Felsöors section (Balaton Highland, Hungary), where not only the basal Fassanian lower Subzone of the *S. italicus* Zone, but also the underlying Late Illyrian *T. laevis* Zone are well documented by rich, excellently preserved radiolarian faunas. In this section the lower and upper Subzones of the *S. italicus* Zone are well documented, whereas the middle subzone yielded only rather poor radiolarian faunas. Because well preserved radiolarians are in the Felsöors section during the lower part of the Early Ladinian restricted to the subordinate limestone beds within the predominant pietra verde deposits, the Passo della Gabiola section (Vicentinian Alps) is better suitable as stratotype for the *S. italicus* Zone than the Felsöors section (Balaton Highland).

#### **Lower Subzone of the *Spongosilicarmiger italicus* Zone (*Spongosilicarmiger italicus transitus* Subzone)**

**Definition:** Occurrence of *Spongosilicarmiger italicus transitus* n. subsp. together with *Triassocampe deweveri* (NAKASEKO & NISHIMURA, 1979). *T. kahleri* n. sp., *T. scalaris baloghi* n. subsp., *T. scalaris scalaris* DUMITRICĂ; KOZUR & MOSTLER, 1980 and *Yeharaia annulata* NAKASEKO & NISHIMURA, 1979. Oertlispongidae with differentiated polar spines are rare and Interdiellidae not yet present.

**Lower boundary:** First appearance of *Spongosilicarmiger italicus transitus* n. subsp., *Paratriassocampe postornata* n. sp., *Triassocampe deweveri* (NAKASEKO & NISHIMURA, 1979), *T. kahleri* n. sp., *T. scalaris baloghi* n. subsp., *T. scalaris scalaris* DUMITRICĂ; KOZUR & MOSTLER, 1980 and *Yeharaia annulata* NAKASEKO & NISHIMURA, 1979.

**Upper boundary:** First appearance of *Oertlispongos primitivus* n. sp. (and of other *Oertlispongos* species), *Baumgartneria bifurcata* DUMITRICĂ, 1982 and of *Spongosilicarmiger italicus italicus* KOZUR, 1984.

**Important species:** *Paratriassocampe postornata* n. sp., *Spongosilicarmiger italicus transitus* n. subsp., *Triassocampe deweveri* (NAKASEKO & NISHIMURA, 1979), *T. kahleri* n. sp., *T. scalaris baloghi* n. subsp., *T. scalaris scalaris* DUMITRICĂ; KOZUR & MOSTLER, 1980, *Yeharaia annulata* NAKASEKO & NISHIMURA, 1979.

**Type locality:** Forráshegy section of Felsöors (Balaton Highland, Hungary). Lower part of the Buchenstein Formation (pietra verde with few limestone intercalations) up to limestone bed 100 (see fig. 3).

**Age:** *Kellnerites felseoersensis* Subzone of the "X." *reitzi* Oppel Zone. Well dated by ammonoids in the Felsöors section and by conodonts in the Buchberg section near Göstling.

**Distribution:** Austria, Balaton Highland (Hungary), Lagonegro Basin (southern Italy), Japan, Philippines.

**Remarks:** By the presence of *Oertlispongos* sp., *Spongosilicarmiger italicus* KOZUR, 1984, *Triassocampe deweveri* (NAKASEKO & NISHIMURA, 1979), *T. scalaris* DUMITRICĂ; KOZUR & MOSTLER, 1980 and *Yeharaia annulata*, the *S. italicus transitus* Subzone is clearly connected to the remaining part of the *S. italicus* Zone. *S. italicus transitus* n. subsp. is a transitional form between the Late Illyrian *S. priscus* n. sp. and the Fassanian *S. italicus* KOZUR, 1984. It is closer related to the latter species. *T. deweveri* (NAKASEKO & NISHIMURA, 1979), *T. scalaris* DUMITRICĂ; KOZUR & MOSTLER, 1980 and *Yeharaia annulata* NAKASEKO & NISHIMURA, 1979 belong to the most characteristic, most frequent and widest distributed Fassanian radiolarian species. *Oertlispongos* DUMITRICĂ; KOZUR & MOSTLER is the most characteristic Ladinian radiolarian genus.

There are only few long-ranging species in common with the Late Anisian *T. laevis* Zone, but they are generally also present in the higher part of the *S. italicus* Zone or even in the Middle Fassanian *L. multiperforata* Zone, like *Parentactinia pugnax* DUMITRICĂ, 1978, *Triassobipedis balatonica* KOZUR, 1984 and primitive representatives of *Annulotriassocampe* KOZUR, n. gen.

Most of the frequent Spumellaria and Entactinaria of the *S. italicus transitus* subzone cannot yet be used for stratigraphic purposes, because their detailed description is not yet possible (insufficient knowledge of their inner structures). Most of them have a long stratigraphic range throughout the Ladinian and partly Anisian and/or Late Triassic, but this range may be drastically reduced after

better knowledge of possibly different inner structures. However, the first appearance of the genus *Oertlispongius* is an important stratigraphic marker. This genus begins in the Buchberg section near Göstling, Austria (published in a separate paper) together with the first Ladinian conodonts *Neogondolella mesotriassica* (KOZUR & MOSTLER), *N. balcanica* BUDUROV & STEFANOV and *N. longa* BUDUROV & STEFANOV that appear in the Felsöőrs section and in the Southern Alps at the base of the *Kellnerites felsoeoerensis* Subzone of the *reitzei* Zone. *Oertlispongius* n.sp. is the most primitive *Oertlispongius* species transitional to the forerunner genus from the *P. trinodosus* Zone, but already a typical *Oertlispongius* with slightly curved to slightly recurved distal part of the main spine.

#### **Middle subzone of the *Spongosilicarmiger italicus* Zone (*Oertlispongius primitivus* Subzone)**

**Definition:** Joint occurrence of *Spongosilicarmiger italicus italicus* KOZUR, 1984 with *S. gabiolaensis* n. sp., primitive *Oertlispongius* species (*O. aspinosus* n. sp., *O. bispinosus* n. sp., *O. primitivus* n. sp.), without *Oertlispongius inaequispinosus inaequispinosus* DUMITRICĂ; KOZUR & MOSTLER, 1980.

**Lower boundary:** First appearance of *Spongosilicarmiger italicus italicus* KOZUR, 1984, *S. gabiolaensis* n. sp., *Oertlispongius primitivus* n. sp. (and other primitive *Oertlispongius* species), *Baumgartneria bifurcata* DUMITRICĂ, 1982, *B. recurvata* DUMITRICĂ, 1982.

**Upper boundary:** Disappearance of *Spongosilicarmiger gabiolaensis* n. sp. First appearance of *Oertlispongius inaequispinosus inaequispinosus* DUMITRICĂ; KOZUR & MOSTLER, 1980 and of *Falcispongius falciformis* DUMITRICĂ, 1982.

**Important species:** Most species of this subzone are new (see taxonomic part). Most important among these species are *Spongosilicarmiger gabiolaensis* n. sp. (frequent and restricted to this subzone) and primitive *Oertlispongius* species (frequent and very characteristic for this subzone; partly restricted to it).

Important representatives of the *O. primitivus* Subzone among the formerly described species are: *Baumgartneria bifurcata* DUMITRICĂ, 1982, *B. retrospinosa* DUMITRICĂ, 1982, *B. stellata* DUMITRICĂ, 1982, *Falcispongius calcaneus* DUMITRICĂ, 1982, *Eptingium manfredi manfredi* DUMITRICĂ, 1978, *Pentactinocarpus fusiformis* DUMITRICĂ, 1978, *Tiborella*

*magnidentata* DUMITRICĂ; KOZUR & MOSTLER, 1980, *Hozmardia reticulata* DUMITRICĂ; KOZUR & MOSTLER, 1980, *Spongosilicarmiger italicus* KOZUR, 1984, *Triassocampe deweveri* (NAKASEKO & NISHIMURA, 1979), *T. scalaris* DUMITRICĂ; KOZUR & MOSTLER, 1980, *Yeharaia annulata* NAKASEKO & NISHIMURA, 1979.

All these species are also present in the upper Subzone of the *S. italicus* Zone, several species also in the lower Subzone of this Zone, some range up to the Middle Fassanian *Ladinocampe multiperforata* Zone or even to stratigraphically still younger levels.

**Type locality:** Passo della Gabiola section, Vicentian Alps (Italy). Samples MD 1 - MD 20 (see fig. 6).

**Age:** In the Öfenbach section (Austria) this fauna begins according to the conodont fauna in the middle part of the "X." *reitzei* Oppel Zone (sample OB 45, situated 6,50 m above the Illyrian crinoid sparites). In the Felsöőrs section the *O. primitivus* Subzone begins in the middle part of the *reitzei* Oppel Zone documented by ammonoids and conodonts. There it ends within the upper "X." *reitzei* Oppel Zone.

**Distribution:** Austria, Balaton Highland (Hungary), Romania, Yugoslavia, Italy, Japan, Philippines.

**Remarks:** Within this Subzone still further subdivisions are possible. In its lowermost part *Poulpus curvispinus praecurvispinus* n. subsp. occurs (in the type locality in samples MD 1-MD 6, see fig. 6). Above this horizon, only *P. curvispinus curvispinus* DUMITRICĂ; KOZUR & MOSTLER, 1980 is present. Still higher *Baumgartneria trifurcata* n. sp. and *Oertlispongius inaequinosus longispinosus* n. subsp. appear. So, at least 3 slightly different associations can be observed within the *O. primitivus* Subzone.

#### **Upper subzone of the *Spongosilicarmiger italicus* Zone (*Oertlispongius inaequispinosus* Subzone)**

**Definition:** Joint occurrence of *Spongosilicarmiger italicus* KOZUR, 1984, *Oertlispongius inaequispinosus inaequispinosus* DUMITRICĂ; KOZUR & MOSTLER, 1980 and primitive *Falcispongius falciformis* DUMITRICĂ, 1982 without *Ladinocampe multiperforata* KOZUR, 1984.

**Lower boundary:** Disappearance of *Spongosilicarmiger gabiolaensis* n. sp.; appearance of *Oertlispongius inaequispinosus inaequispinosus* DUMITRICĂ; KOZUR &

MOSTLER, 1980 and of primitive representatives of *Falcispongius falciformis* DUMITRICĂ, 1982.

**Upper boundary:** Appearance of *Ladinocampe multiperforata*, KOZUR, advanced species of *Anisicyrtis* (*A. alpina* n. sp., *A. nodosa* n. sp., *A. spinosa* n. sp., *A. trettoensis* n. sp.) and *Planispinocyrtis multiporata* n. sp.

**Important species:** Some stratigraphic important new species of the *O. inaequispinosus* Subzone have been described in the present paper (see taxonomic part), but most of the species of this subzone have been already described in previous papers. All species described by DUMITRICĂ (1978 a, b), DUMITRICĂ; KOZUR & MOSTLER, 1980 as well as all species, described from sample VCB in KOZUR & MOSTLER (1981), all species reported by LAHM (1984) from the upper third of the Passo della Gabiola section and most species reported by GORIČAN (1990) from the Early Fassanian of Yugoslavia are derived from the upper Subzone of the *S. italicus* Zone or are also present in this subzone. Additionally, *Baumgartneria bifurcata* DUMITRICĂ, 1982, *B. retrospinosa* DUMITRICĂ, 1982, *B. stellata* DUMITRICĂ, 1982, *Falcispongius calcanus* DUMITRICĂ, 1982 and primitive representatives of *F. falciformis* DUMITRICĂ, 1982 are rather frequent in this Subzone.

**Type locality:** Passo della Gabiola section (Vicentinian Alps, Italy), samples MD 21-MD 28 (see fig. 6).

**Age:** The *O. inaequispinosus* Subzone of the *S. italicus* Zone can be well dated by ammonoids in the Felsöör section (Balaton Highland, Hungary). It corresponds here to the upper part of the "X." *reitzei* Oppel Zone and to the basal part of the overlying Nemesvámos Limestone Formation before the first appearance of *Neogondolella transita* (KOZUR & MOSTLER).

**Distribution:** Worldwide. One of the best described Triassic radiolarian faunas of the world.

**Remarks:** None of numerous species of the *O. inaequispinosus* Subzone of the *S. italicus* Zone are restricted to this subzone. Despite this fact, the *O. inaequispinosus* Subzone can be well distinguished both from the underlying *O. primitivus* Subzone and from the overlying *Ladinocampe multiperforata* Zone. The majority of the species is identical with the middle and partly also with the lower Subzone of the *S. italicus* Zone. Some of these species disappeared at the top of the *O. inaequispinosus* Subzone (= top of the *S. italicus* Zone). On the other hand, all species that appeared at the base or inside the *O. inaequispinosus* Subzone continue into the overlying *Ladinocampe multiperforata* Zone, e.g. *Oertlispongius inaequispinosus inaequispinosus* DUMITRICĂ; KOZUR & MOSTLER, 1980 and *Falcispongius falciformis* DU-

MITRICĂ, 1982. Also many other species, known since the lower and middle subzone of the *S. italicus* Zone, continue into the *Ladinocampe multiperforata* Zone. However, this zone is distinguished from the upper Subzone of the *S. italicus* Zone by the first appearance of some species, e.g. *Ladinocampe multiperforata* KOZUR, 1984, advanced species of *Anisicyrtis* KOZUR & MOSTLER, 1981 and of *Planispinocyrtis* KOZUR & MOSTLER, 1981.

Within the upper Subzone of the *S. italicus* Zone a further detailed subdivision is possible, e.g. by the development within the genus *Oertlispongius* DUMITRICĂ; KOZUR & MOSTLER, 1980. In the lower part of the *O. inaequispinosus* Subzone (samples MD 21-MD 24 in the Passo della Gabiola type section, see fig. 6) primitive *Oertlispongius* species and *O. inaequispinosus longispinosus* n. subsp. are still present beside the advanced, increasingly frequent *O. inaequispinosus inaequispinosus* DUMITRICĂ; KOZUR & MOSTLER, 1980. Then an interval follows, where the only representative of the genus *Oertlispongius* is *O. inaequispinosus inaequispinosus* DUMITRICĂ; KOZUR & MOSTLER, 1980 and in the topmost part of this Subzone additionally *O. inaequispinosus tumidospinus* n. sp. is present. Similar subdivisions are possible by evaluation of the phylomorphogenetic development within a few other genera.

If the radiolarian faunas are very rich, the evaluation of the phylomorphogenetic lines within some spumellarian and nassellarian genera allows in this time-interval nearly a bed by bed correlation of different South Alpine sections, but also of these sections with sections in the Balaton Highland. For instance, the samples MD 26, MD 27 of the type locality Passo della Gabiola (see fig. 6) with mass occurrences of *O. inaequispinosus inaequispinosus* DUMITRICĂ; KOZUR & MOSTLER, 1980 without other *Oertlispongius* species corresponds to the sample VCB (Val di Cremo), TT 1 (road cut between San Ulderico and Pallé, see fig. 5), sample FD 1 (section No. 2 of the Mte. Fallison outcrops, see fig. 7) and samples FD 5-7 (section Nr. 3 of the Mte. Fallison outcrops, see fig. 7). More than 50 identical species are present in all these samples, some of them are not known from the under- and overlying beds that contain also some species not present in the mentioned samples.

The stratigraphic level of samples MD 21-22 of the Passo della Gabiola section (see fig. 6) corresponds to the stratigraphic level of sample FÖ 110 of the Felsöör section in the Balaton Highland (see fig. 3). Below this horizon *O. inaequispinosus inaequispinosus* DUMITRICĂ; KOZUR & MOSTLER, 1980 is not yet present, above it



this subspecies is dominant and a little higher all less advanced species and subspecies of *Oertlispongius* DUMITRICĂ; KOZUR & MOSTLER, 1980 disappeared.

### ***Ladinocampe multiperforata* Zone**

**Definition:** Occurrence of *Ladinocampe multiperforata* KOZUR, 1984, advanced *Anisicyrtis* species (*A. alpina* n. sp., *A. nodosa* n. sp., *A. spinosa* n. sp., *A. trettoensis* n. sp.) and *Planispinocyrtis multiporata* n. sp.

**Lower boundary:** First appearance of *Ladinocampe multiperforata* KOZUR, 1974, advanced *Anisicyrtis* species (*A. alpina* n. sp., *A. nodosa* n. sp., *A. spinosa* n. sp., *A. trettoensis* n. sp.) and of *Planispinocyrtis multiporata* n. sp.

**Upper boundary:** Not yet definitely fixed, but within the *E. curionii* ammonoid zone several species appeared that have to be still described (KOZUR & MOSTLER, in press). To avoid the use of nomina nuda, the final definition of the upper boundary of the *L. multiperforata* Zone will be given only in this forthcoming paper.

From previously described taxa, the genus *Hungarosaturnalis* KOZUR & MOSTLER, 1983 appeared in the overlying radiolarian zone, but remains rare until the base of the *Muelleritortis cochleata* Zone (Middle and Late Longobardian).

**Important species:** Most species of the upper subzone of the underlying *Spongosilicarmiger italicus* Zone continue into the *Ladinocampe multiperforata* Zone. Among the frequent and distinct species of the upper *S. italicus* Zone only the following species disappeared near the base of the *L. multiperforata* Zone: *Spongosilicarmiger italicus* KOZUR, 1984 (still rarely present in the lower part of the *L. multiperforata* Zone), *Baumgartneria bifurcata* DUMITRICĂ, 1982, *B. stellata* DUMITRICĂ, 1982, and *B. trifurcata* DUMITRICĂ, 1982.

Some species appeared at the base and inside the *L. multiperforata* Zone (see taxonomic part) which allow a distinction to the underlying zone. The frequency of other species, like *Oertlispongius inaequispinosus* DUMITRICĂ; KOZUR & MOSTLER, 1980 has considerably dropped within the *L. multiperforata* Zone.

**Type locality:** Road cut between San Ulderico and Pallé (Vicentinian Alps, Italy), interval from samples TT 3 - TT 18 (see fig. 5).

**Age:** Interval between the "*Xenoprotrachyceras*" *reitzei* Oppel Zone and the upper *Eoprotrachyceras curionii* Zone (only the very base of this interval belongs to the uppermost part of the underlying *S. italicus* Zone).

Radiolarians of the *L. multiperforata* Zone begin in the Felsöors section (Balaton Highland, Hungary) somewhat below the base of the *Neogondolella transita* Zone a little above the top of the ammonoid faunas of the "*X. reitzei* Oppel Zone. In the Köveskál section (Balaton Highland, Hungary), the *L. multiperforata* Zone ends below the ammonoid- and conodont-proven upper *E. curionii* Zone with *Budurovignathus truempyi*. The lower boundary of the *L. multiperforata* Zone can not be defined in this section because of the bad outcrop conditions below the upper Fassanian.

In the type locality of the *L. multiperforata* Zone (see above) the very rich and well-preserved radiolarian fauna of this zone occurs in conodont-bearing limestones that can be placed in the *Neogondolella transita* Zone. They contain *N. transita* (KOZUR & MOSTLER) and primitive representatives of *Paragondolella ? trammeri trammeri* (KOZUR). Only in the lowermost 80 cm of the *L. multiperforata* Zone these conodonts are still missing. Because this conodont fauna, accompanied by the radiolarian fauna of the *L. multiperforata* Zone, begins in the Felsöors section a little above the top of the *X. reitzei* Oppel Zone and ends in the Köveskál section below the ammonoid- and conodont- proven upper *E. curionii* Zone, both the *N. transita* Zone and the *L. multiperforata* belong to the interval between the "*X. reitzei* Oppel Zone and the upper *E. curionii* Zone.

**Remarks:** In the lower part of the *L. multiperforata* Zone, *Spongosilicarmiger italicus* KOZUR, 1984 is still rarely present. This short stratigraphic level is only documented in the samples FD 2-4 (section 1 of the Mte. Fallison outcrops, see fig. 7).

*L. multiperforata* KOZUR, 1984 is accompanied in the lower subzone by *L. annuloperforata* n. sp., in the upper subzone by *L. vicentinensis* n. sp.

### ***Ladinocampe annuloperforata* Subzone**

**Definition:** Occurrence of *Ladinocampe annuloperforata* n. sp. together with advanced *Anisicyrtis* species (*A. alpina* n. sp., *A. nodosa* n. sp., *A. spinosa* n. sp., *A. trettoensis* n. sp.), *Conospongocyrtis conica* n. sp. and *Triassospongocyrtis longispinosa* n. sp.

**Lower boundary:** See lower boundary of the zone.

**Upper boundary:** Disappearance of *Conospongocyrtis conica* n. sp., *Ladinocampe annuloperforata* n. sp. and *Triassocampe longispinosa* n. sp. Appearance of *Conospongocyrtis cephaloconica* n. sp., *Ladinocampe vicentinensis* n. sp. and *Spongolophophaena longa* n. sp.

Important species: The Entactinaria fauna is nearly identical with that of the underlying upper subzone of the *S. italicus* Zone.

Moderate changes occurred within the Spumellaria faunas. Among the stratigraphically important Oertlispongidae KOZUR & MOSTLER, 1980 *Baumgartneria bifurcata* DUMITRICĂ, 1982, *B. stellata* DUMITRICĂ, 1982 and *B. trifurcata* DUMITRICĂ disappeared and *Falcispongius postcalcareus* n. sp. appeared. *Oertlispongius inaequispinosus* DUMITRICĂ; KOZUR & MOSTLER, 1980 continued into the *L. annuloperforata* Subzone and is in the lower part of this subzone still frequent. Then its frequency clearly dropped. *Falcispongius calcaneus* DUMITRICĂ, 1982, *F. praefalciformis* n. sp., *Oertlispongius inaequispinosus tumidospinosus* n. sp., *Paroertlispongius multinodosus* KOZUR & MOSTLER, 1981 and *P. weddigei* (LAHM, 1984) continued only into the lower part of the *L. annuloperforata* Subzone. *Falcispongius falciformis* DUMITRICĂ, 1982 remained in the whole subzone frequent.

Among the Nassellaria some typical and frequent Fassanian guideforms, such as *Poulpus curvispinus* DUMITRICĂ; KOZUR & MOSTLER, 1980, *Silicarmiger costatus costatus* DUMITRICĂ; KOZUR & MOSTLER, 1980, *Triassocampe scalaris* DUMITRICĂ; KOZUR & MOSTLER, 1980, *Triassospongyocytis longispinosa* n. sp. and *Yeharaia annulata* NAKASEKO & NISHIMURA, 1979 continued from the *S. italicus* Zone into the *L. annuloperforata* Subzone of the *L. multiperforata* Zone. On the other hand, typical Early Fassanian guideforms, like *Spongosilicarmiger italicus* KOZUR, 1984 disappeared at or a little above the base of the *L. annuloperforata* Subzone.

The characteristic Middle Fassanian genus *Ladinoampe* KOZUR, 1984 becomes frequent. *L. multiperforata* KOZUR, 1984 appears. *L. annuloperforata* appears already in the middle subzone of the *Spongosilicarmiger italicus* Zone, but remains very rare throughout most of this zone. Only in the uppermost *S. italicus* Zone *L. annuloperforata* becomes common.

Distinct changes occurred within the genus *Anisicyrtis* KOZUR & MOSTLER, 1981. Some species, like *A. deweveri* n. sp. and *A. italicus* n. sp. continued from the *S. italicus* Zone into the *L. annuloperforata* Subzone, but several advanced species, like *A. alpina* n. sp., *L. nodosa* n. sp., *A. spinosa* n. sp. and *A. trettoensis* n. sp. appeared within the *L. annuloperforata* Subzone.

A distinct change in the species composition occurred within the Monicastericidae n. fam. *Monicasterix prisca* n. sp. and *Tubotriassocyrtis annulata* n. sp. disappe-

ared and *M. alpina* n. sp., *M. brevituba* n. sp., and *T. latituba* n. sp. appeared. However, the exact range of these rare species is difficult to recognize.

The genus *Planispinocyrtis* KOZUR & MOSTLER, 1981 is represented in the *L. annuloperforata* Subzone by some new species. Especially important is the appearance of the frequent *P. multiporata* n. sp.

Within the Spongotriassocyrtidae n. fam. some changes can be observed. On one side, *Triassospongyocytis longispinosa* n. sp. continued from the *S. italicus* Zone into the *L. annuloperforata* Subzone of the *L. multiperforata* Zone. On the other hand, *Conospongyocytis conica* n. sp., and *Spongolophophaena parvispinosa* n. sp. appeared in this subzone.

**Type locality:** Road cut San Ulderico-Pallé (Vicentinian Alps, Italy). Interval from samples TT 3 - TT 8 (see fig. 5). **Age:** See under the *L. multiperforata* Zone. The *L. annuloperforata* Subzone corresponds to the lower part of the interval between the "X." *reitzii* Oppel Zone and the upper *E. curionii* Zone.

**Distribution:** Southern Alps (Italia), Yugoslavia, Balaton Highland (Hungary), Asiatic Tethys.

**Remarks:** Within the *L. annuloperforata* Subzone two different associations can be distinguished. In the lower part of this subzone *Falcispongius calcaneus* DUMITRICĂ, 1982, *F. praefalciformis* n. sp., *Paroertlispongius multinodosus* KOZUR & MOSTLER, 1981, *Oertlispongius inaequispinosus tumidospinosus* n. subsp., *Paroertlispongius weddigei* (LAHM, 1984) and *Spongosilicarmiger italicus* KOZUR, 1984 are still present. Moreover, in the lower part of the subzone *Oertlispongius inaequispinosus inaequispinosus* DUMITRICĂ; KOZUR & MOSTLER, 1980 is still very frequent. The radiolarian fauna of this lower part of the *L. annuloperforata* Subzone is rather different from the remaining Subzone and displays transitional character to the radiolarian fauna of the underlying upper subzone of the *S. italicus* Zone. However, this interval is so short, that a discrimination of a further Subzone seems not to be necessary. On the other hand, these subdivisions within the *L. annuloperforata* Subzone allow also for this Subzone such a bed by bed correlation for rich radiolarian faunas of the Southern Alps and the Balaton Highland as in the upper subzone of the *S. italicus* Zone (see there).

### *Ladinocampe vicentinensis* Subzone

**Definition:** Joint occurrence of *Ladinocampe vicentinensis* n. sp., *L. multiperforata* KOZUR, 1984 and *Conospongocyrtis cephaloconica* n. sp.

**Lower boundary:** Disappearance of *Conospongocyrtis conica* n. sp., *Ladinocampe annuloperforata* n. sp., *Spongolophophaena parvispinosa* n. sp., *Triassospongocyrtis longispinosa* n. sp. Appearance of *Conospongocyrtis cephaloconica* n. sp., *Ladinocampe vicentinensis* n. sp., *Spongolophophaena longa* n. sp.

**Upper boundary:** See under upper boundary of the *L. multiperforata* Zone.

**Important species:** Most species of the *L. annuloperforata* Subzone continued into the *L. vicentinensis* Subzone. However, *Conospongocyrtis conica* n. sp., *Ladinocampe annuloperforata* n. sp., *Monicasterix alpina* n. sp., *M. brevituba* n. sp., *Spongolophophaena parvispinosa* n. sp. and *Triassospongocyrtis longispinosa* n. sp. disappeared near the top of the *L. annuloperforata* Subzone. *Conospongocyrtis cephaloconica* n. sp., *Ladinocampe vicentinensis* n. sp., *Triassocampe longicephalis* n. sp. and *Triassospongocyrtis ruesti* n. sp. appeared at the base or inside the *L. vicentinensis* Subzone.

**Type locality:** Road cut San Ulderico-Palle, interval of samples TT 10 (?), TT 12 - TT 18 (see fig. 5).

**Age:** See under *L. multiperforata* Zone. The *L. vicentinensis* Subzone corresponds probably to the lower *E. curionii* Zone but neither the ammonoid/ nor conodont control is good.

**Distribution:** Southern Alps and Lagonegro Basin (Italy), Yugoslavia, Balaton Highland (Hungary), Asiatic Tethys.

### Late Fassanian to Early Longobardian interval

Two clearly separable radiolarian zones are present in this interval. Because the species that we have choicened as index species for these zones have not yet been described, we will establish these zones in an other paper together with the description of the stratigraphically important species of these zones (KOZUR & MOSTLER, in press).

### *Muelleritortis cochleata* Zone

**Definition:** Dominant occurrence of *Muelleritortis cochleata* (NAKASEKO & NISHIMURA, 1970) against *Tri-*

*tortis kretaensis* (KOZUR & KRAHL, 1984). Frequent representatives of *Hungarosaturnalis* KOZUR & MOSTLER, 1983.

**Lower boundary:** First appearance of *Muelleritortis cochleata* NAKASEKO & NISHIMURA, 1979).

**Upper boundary:** Beginning of the *Tritortis kretaensis* dominance against *Muelleritortis cochleata* (NAKASEKO & NISHIMURA, 1979).

**Important species:** Most of the species of this zone will be described in forthcoming papers (KOZUR, in press, KOZUR & MOSTLER, in press). However, none of these species are better suitable as index species as the already described *Muelleritortis cochleata* (NAKASEKO & NISHIMURA, 1979) which is very frequent, world-wide distributed and easily recognizable. The hungarosaturnalis are other important guide forms, but they begin already before this Zone and continue in the overlying Zone. However, they are only frequent in the *M. cochleata* Zone.

**Type locality:** Outcrop at the cemetery of Köveskál (Balaton Highland, Hungary).

**Age:** *Muelleritortis cochleata* (NAKASEKO & NISHIMURA, 1979) begins simultaneously with the conodont species *Budurovignathus mungoensis* (DIEBEL). This stratigraphic level corresponds to the base of the Middle Longobardian (base of the *Protrachyceras archelaus* Zone).

The upper boundary of the *M. cochleata* Zone is only known from the Dallapuszta section in the Darnóhegy area (northern Hungary). The conodont fauna of the boundary level is rather unspecific. In higher parts of the overlying *Tritortis kretaensis* Zone a Cordevolian conodont fauna with *Budurovignathus mirautae* (KOVÁCS & KOZUR), *Paragondolella foliata foliata* BUDUROV, *P. foliata inclinata* (KOVÁCS) and very primitive *P. tadpole* (HAYASHI) is present. Therefore the boundary between the *M. cochleata*- and the *T. kretaensis* Zone corresponds either to the Longobardian-Cordevolian boundary or it lies within the highest Longobardian.

**Distribution:** Worldwide.

**Remarks:** The lower boundary is defined by the appearance of *Muelleritortis cochleata* (NAKASEKO & NISHIMURA, 1979) within a well documented phylogenetic line. The still undescribed forerunner of this species occurs in the Early Longobardian, immediately below the first appearance of *M. cochleata* (NAKASEKO & NISHIMURA, 1979). Therefore the lower boundary of the *M. cochleata* Zone is not a facies boundary as it could be concluded from the sudden appearance of numerous specimens of *M. cochleata* (NAKASEKO & NISHIMURA, 1979).

The *M. cochleata* Zone can be well correlated with the conodont- and ammonoid stratigraphy in the Balaton Highland, especially in the Köveskál section (base of the *Budurovignathus mungoensis* A.Z. = base of the *Protrachyceras archelaus* Zone).

In the lower part of the *M. cochleata* Zone the genus *Tritortis* KOZUR, 198 is missing or very rare. It is represented by a different species (*T. balatonica* KOZUR, 1988) then in the overlying *T. kretaensis* Zone. In the highest part of the *M. cochleata* Zone the genus *Tritortis* became more frequent, but the genus *Muelleritortis* KOZUR, 1988 dominates still against the genus *Tritortis* KOZUR, 1988. *Tritortis kretaensis* (KOZUR & KRAHL, 1984) appeared in this level, but still with the subspecies *T. kretaensis subcylindrica* KOZUR, 1988. The typical *T. kretaensis kretaensis* (KOZUR & KRAHL, 1984) appeared only immediately before the base of the *T. kretaensis* Zone that is characterized by a sudden increase in frequency of *T. kretaensis* (KOZUR & KRAHL, 1984) and a simultaneous drop in frequency of *M. cochleata* (NAKASEKO & NISHIMURA, 1979). After this event *M. cochleata* (NAKASEKO & NISHIMURA, 1979) is very rare (about 1 specimen per 500–1000 specimens of *T. kretaensis*) and it disappeared still within the lower *T. kretaensis* Zone. The rather abrupt change in the *Muelleritortis cochleata-Tritortis kretaensis* ratio is not facies-controlled, because it occurs in the Dallapuszta section in a level without facies changes (within red radiolarites) and both species have been found in different facies (red, green and gray radiolarites, red, gray and black cherty or chert-free limestones) and do not seem facies-controlled other than their restriction to pelagic rocks.

### *Tritortis kretaensis* Zone

**Definition:** Dominant occurrence of *Tritortis kretaensis* (KOZUR & KRAHL, 1984) against *Muelleritortis cochleata* (NAKASEKO & NISHIMURA, 1979).

**Lower boundary:** Beginning of the clear dominance of *Tritortis kretaensis* (KOZUR & KRAHL, 1984) against *Muelleritortis cochleata* (NAKASEKO & NISHIMURA, 1979) immediately after the first appearance of *T. kretaensis kretaensis* (KOZUR & KRAHL, 1984).

**Upper boundary:** Disappearance of *Tritortis kretaensis* (KOZUR & KRAHL, 1984).

**Important species:** Most species of this zone are still undescribed and will be published in a separate paper (KOZUR, in press). The most important species of this zone is

*T. kretaensis* (KOZUR & KRAHL, 1984). Advanced Oertlispongidae KOZUR & MOSTLER, 1980 (*Spongoserrula* DUMITRICĂ, 1982) and *Hungarosaturnalis* KOZUR & MOSTLER, 1983 were still present, but also the first primitive true saturnalids (*Palaeosaturnalis* DONOFRIO & MOSTLER, 1978) were rarely present. The immediate forerunner of the genus *Xiphotheca* DE WEVER, 1979 is frequent in deep-water deposits (red radiolarites).

**Type locality:** Dallapuszta (Darnóhegy region, northern Hungary). Block of red bedded Ladinian-Cordevolian radiolarites in a melange of Jurassic age.

**Age:** The higher part of the *T. kretaensis* Zone belongs according to its conodont fauna with *Budurovignathus mirautae* (KOVÁCS & KOZUR), *Paragondolella foliata* BUDUROV, *P. foliata inclinata* (KOVÁCS) and primitive *P. tadpole* (HAYASHI) to the Cordevolian. In the lower part of this zone only very few juvenile specimens of *P. foliata foliata* BUDUROV and *P. foliata inclinata* (KOVÁCS) are present. This fauna belongs either to the highest Longobardian or to the basal Cordevolian.

**Distribution:** Hungary, Greece, Asiatic Tethys.

**Remarks:** No section is known, where the *T. kretaensis* Zone is directly overlain by the Middle Carnian *Tetraporobrachia haeckeli* Zone. Between both zones extreme changes in the radiolarian faunas occurred. Nearly 100 species, many genera and some families appeared for the first time in the *Pseudosaturniforma carnica* Zone. For this reason it is probably that still a further zone is present between these two zones.

### *Tetraporobrachia haeckeli* Zone

**Definition:** Joint occurrence of *Palaeosaturnalis triassicus* (KOZUR & MOSTLER, 1972), *Parapoulpus oertlii* KOZUR & MOSTLER, 1979, *Pseudosaturniforma carnica* KOZUR & MOSTLER, 1979, *Spongostylus carnicus* KOZUR & MOSTLER, 1979, *Tetraporobrachia haeckeli* KOZUR & MOSTLER, 1979, and several species of *Veghicyclia*, e.g. *V. austriaca* KOZUR & MOSTLER, 1972.

**Lower boundary:** Appearance of *Spongostylus carnicus* KOZUR & MOSTLER, 1979, *Tetraporobrachia haeckeli* KOZUR & MOSTLER, 1979 and many other species of the *T. haeckeli* Zone.

**Upper boundary:** Not yet fixed, because the next younger radiolarian faunas are poor, the next younger rich faunas are of Early Norian age.

**Important species:** Almost all species of the *T. haeckeli* Zone have been described by KOZUR & MOSTLER (1972, 1978, 1979, 1981) from the localities Göstling and Großreifling (Northern Calcareous Alps, Austria) and KOZUR & MOCK in KOZUR & MOSTLER (1981) from the Pieninic Klippen Belt (Western Carpathians, ČSFR). Only very few additional taxa have been described by KOZUR & MOSTLER (1983) and LAHM (1984) from the above mentioned localities in Austria.

In the Southern Tethys (Western Sicily, Greece) *Xiphotheca karpenissionensis* DE WEVER, 1979 is additionally present and very frequent.

**Type locality:** Großreifling, Austria.

**Age:** Julian (Middle Carnian). See also discussion about the age of this fauna in chapter 2.

**Distribution:** Worldwide.

**Remarks:** The *T. haeckeli* Zone of the Southern Tethys contains some additional species that are not present in the Northern Tethys, like *Xiphotheca karpenissionensis* DE WEVER, 1979 and some new *Veghicyclia* species. The accompanying conodont fauna indicates for these faunas the same Julian age as for the typical assemblages in the Northern Tethys. The Southern Tethys displays seemingly during the Ladinian and Carnian somewhat different radiolarian faunas than the Northern Tethys. Similar or still considerably stronger differences display the Ladinian - Middle Carnian North- and South Tethyan conodont-, holothurian- and ostracod faunas.

#### *Nakasekoellus inkensis* Zone

**Definition:** Range of *Nakasekoellus inkensis* KOZUR, n. sp.

**Lower boundary:** First appearance of *Nakasekoellus inkensis* KOZUR n. sp.

**Upper boundary:** Disappearance of *Nakasekoellus inkensis* KOZUR n. sp.

**Important species:** The few known species of this zone have been described in the appendix to this paper. Some of the species are described in open nomenclature.

**Type locality:** Borehole Inke-1, SW Hungary.

**Age:** The presence of the genera *Nakasekoellus* KOZUR, 1984 and *Pachus* BLOME, 1984 indicate that this fauna is younger than the *S. carnicus* Zone. On the other hand, *N. inkensis* KOZUR n. sp. is more primitive than the Norian representatives of *Nakasekoellus*. For this reason a Late Carnian age is indicated, but a late Middle Carnian age cannot be excluded.

**Distribution:** All present genera have worldwide distribution, but they are represented outside Hungary by other (stratigraphically younger) species. For this reason, we can assume a worldwide distribution of this zone, but radiolarians of this stratigraphic level have been so far only found in the borehole Inke-1.

#### *Capnodoce ruesti* Zone

**Definition:** Range of *Capnodoce ruesti* KOZUR & MOCK, 1981.

**Lower boundary:** Appearance of *Capnodoce ruesti* KOZUR & MOCK, 1981 and *Kahlerosphaera norica* KOZUR & MOCK, 1981

**Upper boundary:** Disappearance of *Capnodoce ruesti* KOZUR & MOCK, 1981.

**Important species:** *Capnodoce fragilis* BLOME, 1983, *C. malaca* BLOME, 1983, *C. ruesti* KOZUR & MOCK, 1981, *C. sarisa* DE WEVER, 1979, *Capnuchosphaera carpathica* KOZUR & MOCK, 1981, *C. deweveri* KOZUR & MOSTLER, 1979, *C. triassica* DE WEVER, 1979, *Kahlerosphaera ? aspinosa* KOZUR & MOCK, 1981, *K. norica* KOZUR & MOCK, 1981, *Nakasekoellus striatus* (BLOME, 1984), *Pachus firmus* BLOME, 1984, *Paronaella norica* KOZUR & MOCK, 1981, *Poulpus noricus* (KOZUR & MOCK, 1981), *P. piabyx* DE WEVER, 1979, *Sulovella constricta* KOZUR & MOCK, 1981, *Syringocapsa batodes* DE WEVER, 1979, *Triarcella arcuata* KOZUR & MOCK, 1981, *T. sulovens* KOZUR & MOCK, 1981, *Veghia sulovens* KOZUR & MOCK, 1981, *Vinassaspongia transitus* KOZUR & MOCK, 1981, *Xiphotheca longa* KOZUR & MOCK, 1981, numerous saturniids (e.g. *Palaeosaturnalis rari-denticulatus* KOZUR & MOCK, 1981), and numerous undescribed Nassellaria.

**Type locality:** Road cut at Mte. Fatocchio near Palazzo Adriano, Sicily (Italy).

**Age:** Lower Norian.

**Distribution:** Worldwide.

**Remarks:** Only a small part of the radiolarians of this zone has been described. A further subdivision of this zone seems to be possible.

## *Livarella densiporata* Zone

**Definition:** Range of *Livarella densiporata* KOZUR & MOSTLER, 1981.

**Lower boundary:** First appearance of *Livarella densiporata* KOZUR & MOSTLER, 1981.

**Upper boundary:** Disappearance of *Livarella densiporata* KOZUR & MOSTLER, 1981. Appearance of *Relanus hettangicus* KOZUR & MOSTLER, 1991.

**Important species:** This zone is characterized by *Canoptum rhaeticum* KOZUR & MOSTLER, 1981, *Livarella densiporata* KOZUR & MOSTLER, 1981, *Praecitriduma mostleri* KOZUR, 1984 and by several frequent species of the genus *Saturnosphaera* TICHIMIROVA, 1975. Type locality: Zlambachgraben (Austria).

**Age:** Rhaetian proven by *Misikella posthernsteini* KOZUR & MOCK and other Rhaetian conodonts.

**Distribution:** Worldwide.

**Remarks:** Only a small part of the species has been described. Investigations of continuous Rhaetian sections from the Lagonegro Basin yielded rich radiolarian faunas, especially *Canoptum rhaeticum* KOZUR & MOSTLER, 1981 and early saturnalids (KOZUR, in prep.). However, even very rich radiolarian faunas of the *L. densiporata* zone from radiolarites and cherty limestones yielded in general only few species represented by very much specimens.

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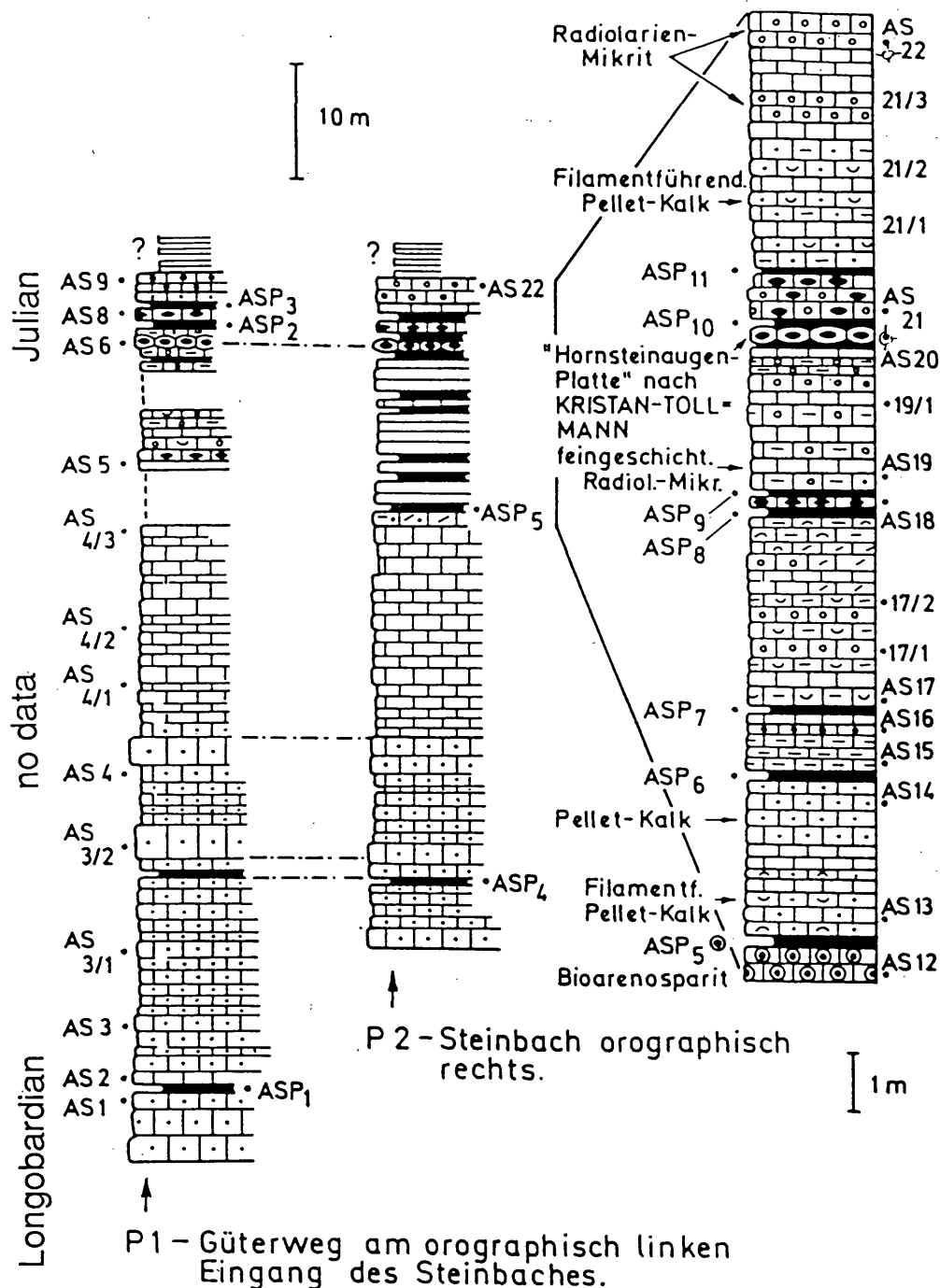
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**Fig. 1:** The radiolarians from level Y 6 up to level AS 22 are identical with the radiolarians from the *Austrotrachyceras austriacum* Zone of the Großreiffling (Scheiblinggraben) section, the type section of the *Tetraporobrachia haeckeli* Zone. Conodont zones of this and following figures after KOZUR (1980, 1989). The *Gladigondolella tethydis* Interval Zone is replaced by the term *Gladigondolella tethydis* – *Paragondolella polygnathiformis* Interval Zone without changes of its definition, stratigraphic range and correlation. This Zone is characterized by the Unitary Association of *Gladigondolella tethydis* (HUCKRIEDE) and *Paragondolella polygnathiformis* (BUDUROV). Below this zone, *Budurovignathus* species are additionally present. Above this zone, *Gladigondolella* is missing.

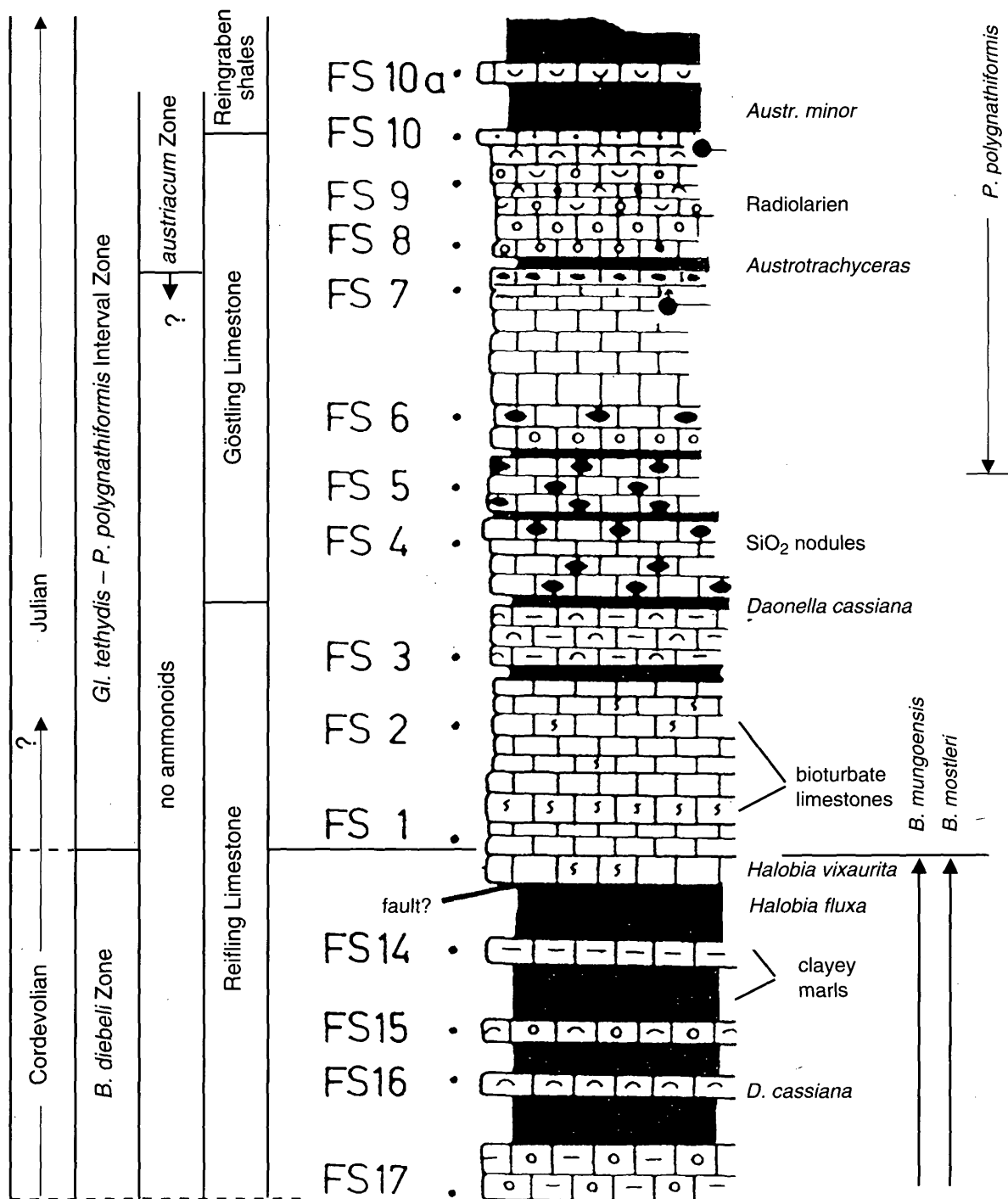


Fig. 2 (explanation on page 177)

**Fig. 2:** This section is the type section of the *Tetraporobrachia haeckeli* Zone. It was for the first time published (with conodont-, holothurian- and roveacrinid data) by MOSTLER & SCHEURING (1974), later re-studied by KRYSTYN (1978).

The radiolarians of this section have been published by KOZUR & MOSTLER (1972, 1978, 1979 a, b, 1980, 1981, 1983). Later, the radiolarians of the same level (only sample Gß 1, level FS 8) have been listed and re-described by LAHM (1984). Using the sample data of MOSTLER & SCHEURING (1974), KRYSTYN (1991) published this section under “supplemented and changed after KRYSTYN, 1978, radiolarian faunas after LAHM, 1984”.

A detailed ammonoid zonation was given by KRYSTYN (1991) despite the fact that ammonoids begin only 0.60 m below the Reingraben Beds (Raingraben Beds sensu KRYSTYN, 1991). The conodont data of KRYSTYN (1991) are in contrast both to the data of MOSTLER & SCHEURING (1974) and of LAHM (1984). The first authors reported *Budurovignathus mungoensis* (DIEBEL) and *B. mostleri* (KOZUR) up to level FS 1 in the middle part of beds that KRYSTYN (1991) placed without ammonoid data in the *aonoides* Subzone of his *aonoides* Zone s.l. (including the *aon* Zone).

LAHM (1984) reported from his sample Gß 3 (by KRYSTYN erroneously designated as sample Gß 2 that was not mentioned by LAHM) of level FS 1 *Budurovignathus mungoensis* (? perhaps *B. mostleri*, in any case surely *Budurovignathus*) and *Neocavitella tatrica* (ZAWIDZKA).

KRYSTYN (1991) however, reported the stratigraphically youngest *Budurovignathus* (*B. mostleri*) from sample FS 17 (upper part of his *aon* Subzone), about 5 m below sample FS 1 and Gß 3 (*B. mungoensis* was not reported by KRYSTYN, 1991). The coinciding conodont data of both MOSTLER & SCHEURING (1974) and LAHM (1984) have been changed by KRYSTYN (1991), obviously to fit the conodont data in his “ammonoid” zonation that was established between level FS 17 and FS 7 without the occurrence of any ammonoids. The base of his *aon* **ammonoid** Subzone was defined by the first appearance of the **conodont** *Paragondolella polygnathiformis* despite the fact that this species begins in ammonoid- and conodont-bearing samples near the base of the *Frankites sutherlandi* Zone (= *F. regoledanum* Zone) that KRYSTYN (1991) placed (likewise without ammonoid data) below his *aon* Subzone. The upper boundary of his *aon* Subzone was placed at the beginning of thick clayey marls, the base of the *austriacum* Zone at the boundary between Reif- and Göstling Limestone. None of these lithologic boundaries is confirmed by any paleontologic data.

Our radiolarian fauna from the uppermost part of the Göstling Limestone (samples FS 8, 9) occurs above the level of *Austrotrachyceras patrodum*, reported by KRYSTYN (1991) from the first shale intercalation below the Reingraben Beds. This radiolarian fauna belongs therefore to the *Austrotrachyceras austriacum* Zone of the Middle Carnian. The same age is indicated by correlation with the radiolarian fauna from the Middle Carnian of Sosio Valley (Sicily, Italy).

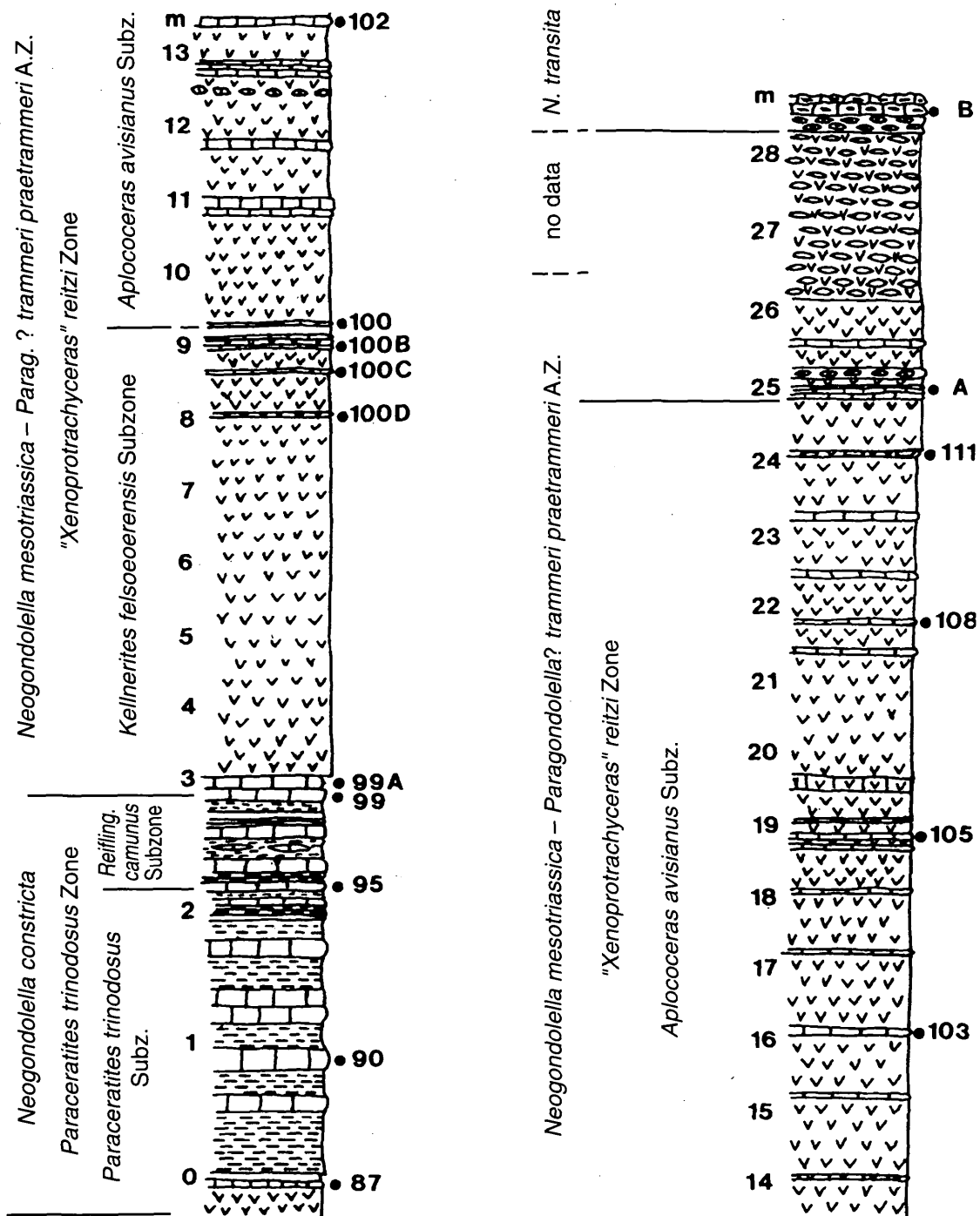


Fig. 3: The Forráshegy section near Felsőörs (Balaton Highland, Hungary) is the type locality of "*Xenoprotrachyceras*" *reitzi* and the reference section for the *reitzi* Oppel Zone. it is the type section of the lower *Spongosilicarmiger italicus* Zone (*S. italicus transitus* Subzone). The samples FÖ 87 – FÖ 111 correspond to the bed numbers.



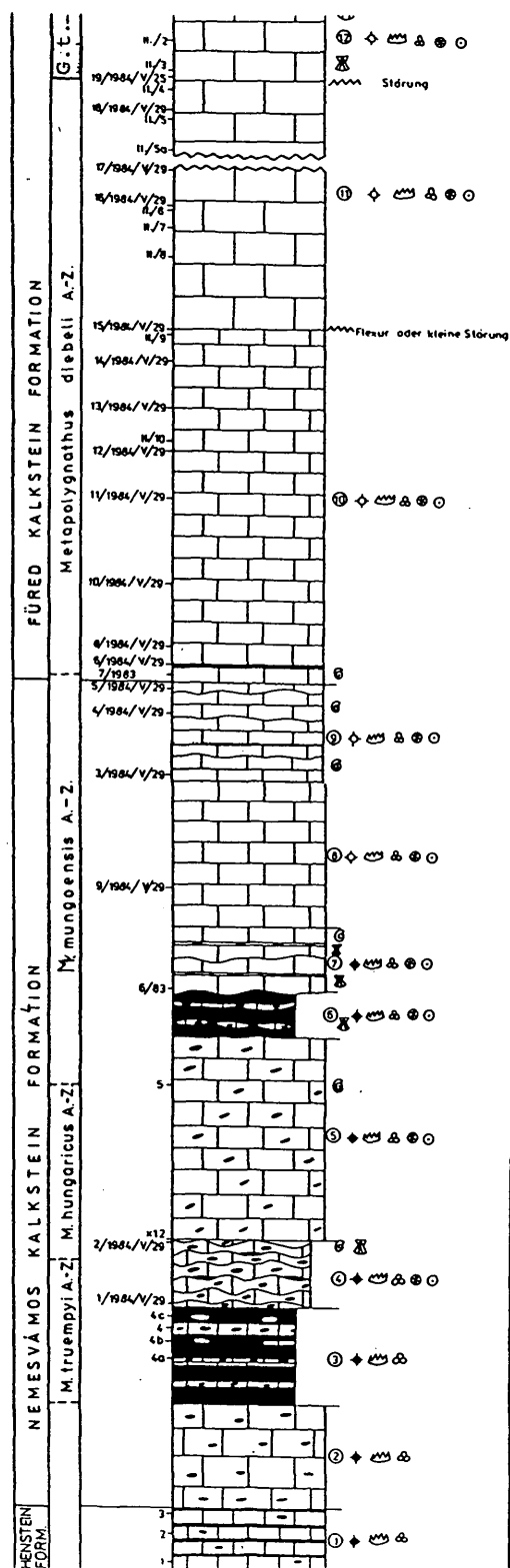
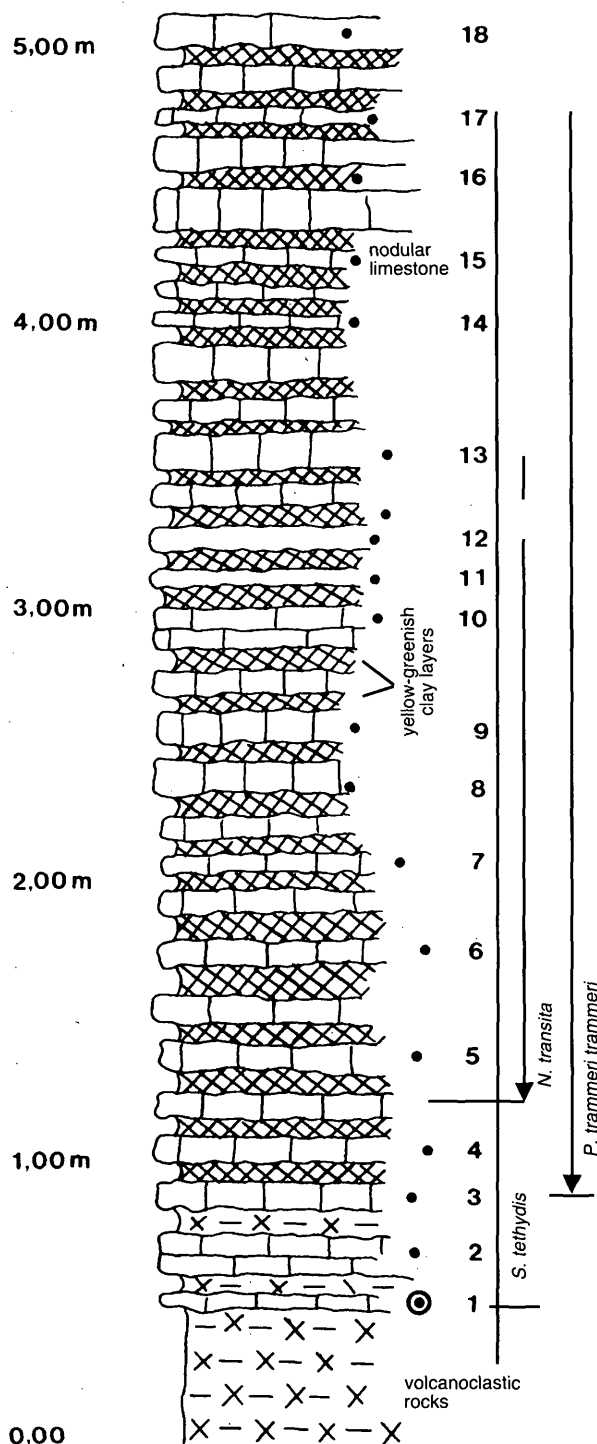


Fig. 4: Section at the cemetery of Köveskál (Balaton Highland, Hungary). Type section of the *Muelleritortis cochleata* Zone. I: Light yellowish-gray or pinkish-gray thick-bedded micritic limestones (Füred Limestone Formation and similar limestone [beds 8] in the uppermost Nemessvámos Formation. II: Thick-bedded, brownish, pink, pinkish-gray or yellowish-gray micritic limestone with brownish, yellowish-brownish, rarely reddish cherty nodules. III: Pink, pinkish-gray, reddish, brownish or brownish-violet nodular limestone. If indicated, with reddish cherty nodules. IV: Greenish tuffites. V: Violet-brownish bed-



ded limestone with thin marly or tuffitic intercalations. VI: Gray, partly siliceous bedded limestones, separated by thin layers of greenish tuffites. VII: Bed numbers. 1-8: Fossils; 1: ammonoids, 2: bivalves, 3: radiolarians, not calcified, 4: radiolarians, calcified, 5: conodonts, 6: foraminifers, 7: holothurian sclerites, 8: crinoids, including roveacrinids. G.t. - P.p. = *Gladigondolella tethydis* - *Paragondolella polygnathiformis* Interval Zone.

Fig. 5: San Ulderico section, position of samples TT 1 - TT 18.

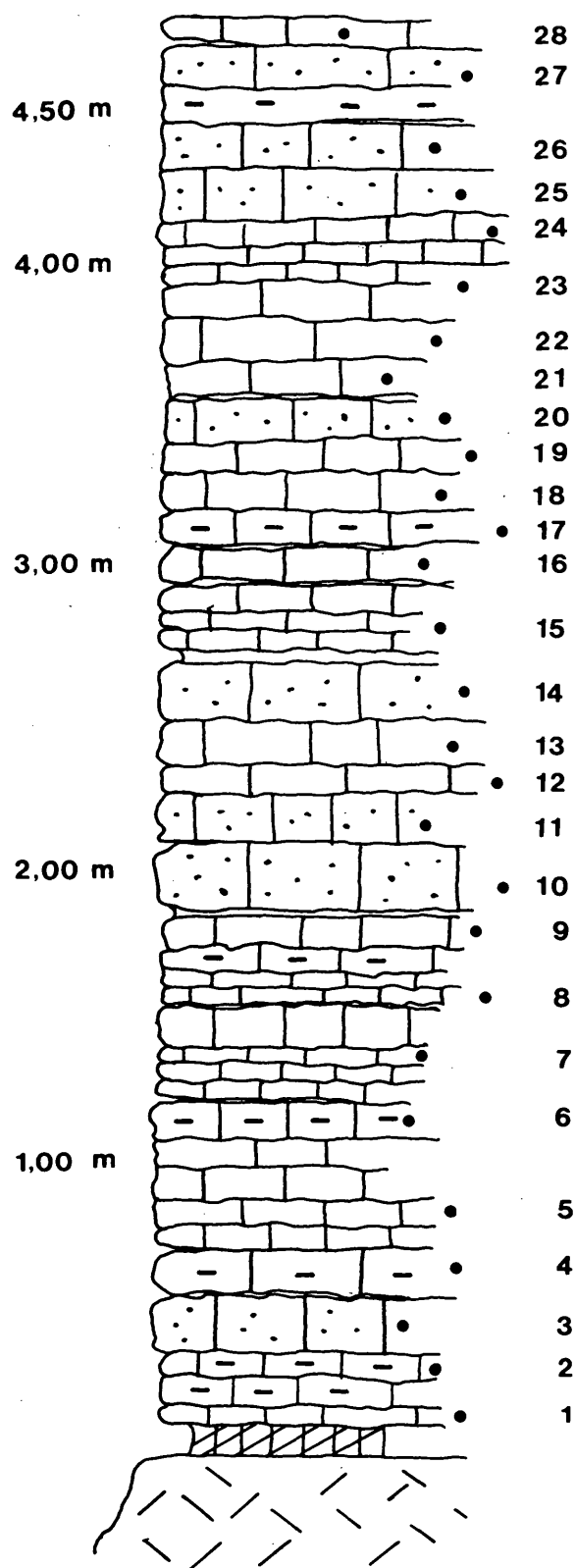


Fig. 6 Recoaro (Passo della Gabiola) section, position of samples MD 1 – MD 28.

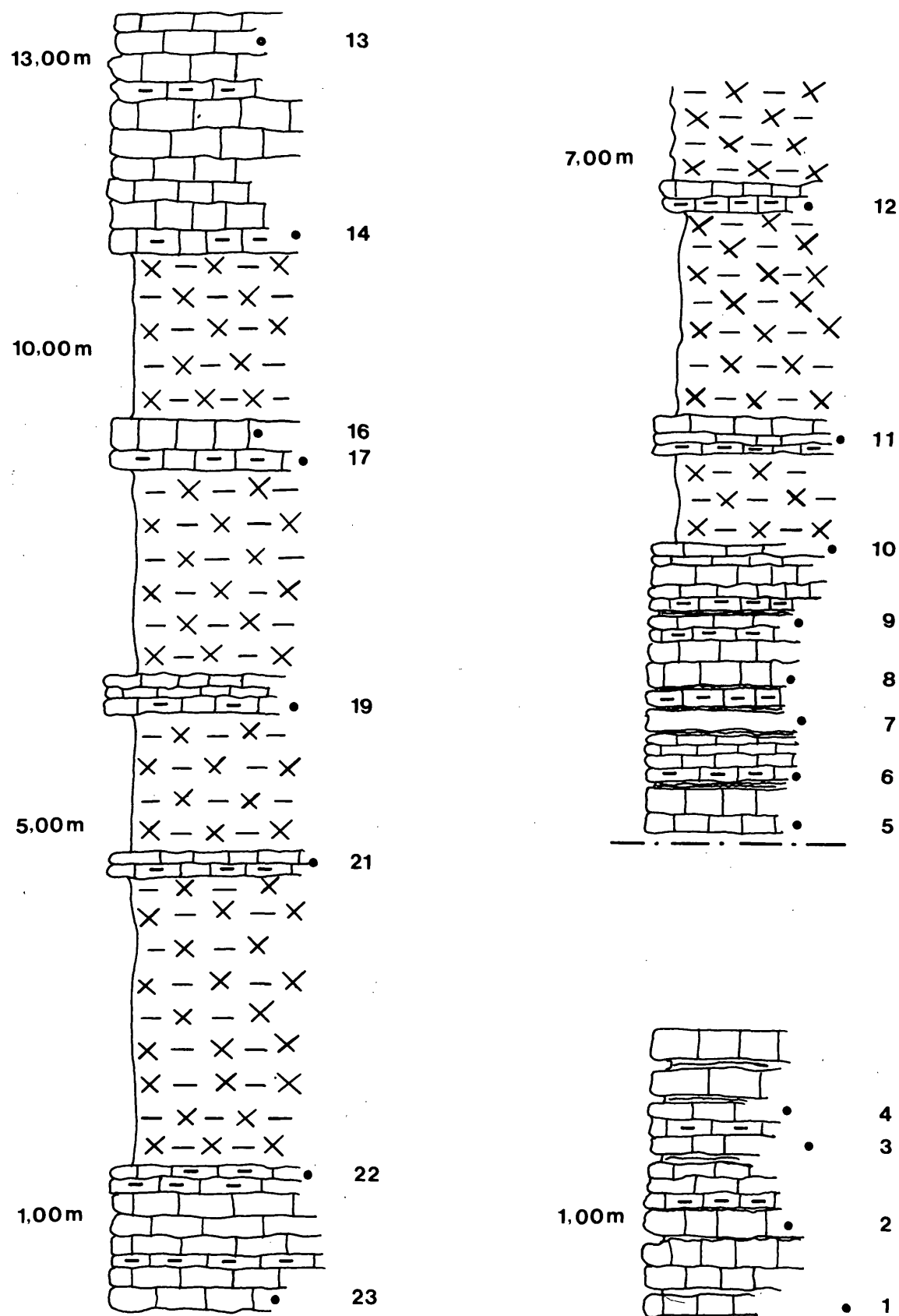


Fig. 7: Outcrops along the road Mte. Spitz – Mte. Fallison, position of samples FD 1 – FD 23.

	Series	Stage	Lithology - Fossils
T R I A S S I C	Upper Triassic	Rhaetian	Pelagic, whitish to light-gray calcilutites, some greenish-gray marls. Conodonts.
		Norian	Pelagic, gray, cherty, calcilutites and calcarenites, partly with slump-breccias. Halobia, Monotis, ammonoids, conodonts, radiolarians.
		Upper Carnian	Pelagic, gray or brown calcarenites, calcirudites, gray shales. Halobia, conodonts, radiolarians, ostracods, trace fossils.
		Middle Lower	Pelagic greenish-gray to pink nodular limestones, greenish-gray, reddish, rarely violet shales and marls, very few thin red radiolarites. "Posidonia" wengensis, Daonella, ammonoids, conodonts (Gladigondolella, Paragondolella trammeri, Budurovignathus spp., Pseudofurnishius spp.).
	Middle Triassic	Upper Ladinian	Pelagic, greenish-gray to pink nodular, siliceous to cherty limestones, greenish tuffites, in the lower part greenish to gray radiolarites. Conodonts, radiolarians.
		Lower	
		Anisian	
	Lower Triassic	Olenekian - Brahmanian	unknown
P E R M I A N	Upper Permian = Lopingian	Changxingian	Red, above all in the lower part also light-gray, deep-water claystones, with few thin intercalations of calcarenites. Claystones with albailellid radiolarians, deep-water sponge spicules, paleopsychrospheric ostracods and few conodonts. Calcarenites with mass occurrences of pelagic conodonts, deep-water sponge spicules, paleopsychrospheric deep-water ostracods.
		Dzhulfian	
	Middle Permian = Guadalupian	Capitanian	unknown
		Wordian	Gray, yellowish weathering claystones. Conodonts (M. siciliensis), radiolarians.
		Roadian	Olistostrome Unit: Matrix of gray claystone with reworked sand and garnet grains. Olistoliths up to 1 m diameter consisting of turbiditic sandstones, siltstones (often with flute casts and plant debris) and rarely of sandy calcarenites. Matrix with conodonts (Mesogondolella phosphoriensis, Sweetognathus subsymmetricus), albailellid radiolarians and sporomorphs. Olistoliths with conodonts (M. idahoensis, M. intermedia), albailellid radiolarians and sporomorphs.
	Lower Permian	Cathedralian	Gray and red flyschoid turbidites: Graded sandstones, partly fine-conglomeratic, siltstones, shales and few calcarenites. Agglutinating foraminifers, conodonts, deep-water trace fossils, in calcarenites also fusulinids, ammonoids, trilobites, brachiopods, bryozoans, calcareous algae.
		Artinskian	

Fig. 8 a: Deep basin sequence of the Sicilian paleogeographic unit of western Sicily. ■ = Radiolarian-bearing parts of the sequence.

	Series	Stage	Lithology - Fossils
T R I A S S I C	Upper Triassic	Norian	Pelagic, gray, cherty, calcilutites and calcarenites, spotty marls. Conodonts, radiolarians.
		Upper	
		Middle Carnian	Pelagic, gray-brown calcarenites, calcirudites, mudstones. Conodonts, radiolarians, ostracods.
		Lower	Pelagic gray and reddish limestones. Conodonts, radiolarians.
	Middle Triassic	Upper Ladinian	Pelagic, red, partly gray limestones with basic volcanics. Conodonts ( <i>Gladigondolella</i> , <i>Paragondolella trammeri</i> , <i>Budurovignathus</i> spp.), radiolarians.
		Lower	Pelagic, red, strongly siliceous limestones. Conodonts, radiolarians.
		Upper Anisian	Pelagic, filamentous, greenish-grey, tuffitic limestones. Conodonts, radiolarians.
		Middle -Lower	Pelagic, micritic pink and gray limestones. Conodonts. Calcified radiolarians.
	Lower Triassic = Scythian	Olenekian	Pelagic, reddish, marly micritic limestones, variegated limestone conglomerates. Conodonts, foraminifers, few calcified radiolarians.
			Siltstones, finesandstones, few marly or redeposited limestones. Conodonts, including reworked Permian shallow-water and pelagic conodonts.
		Brahmanian	Pyritic marls, siltstones, redeposited limestones. Pelagic and shallow-water conodonts, reworked Permian pelagic and shallow-water conodonts.
			Redeposited, graded, fineconglomeratic to calcarenitic pyritic limestones. Pelagic and shallow-water conodonts, including reworked Permian ones.
P E R M I A N	Upper Permian = Lopingian	Changxingian	Red mudstones with deep-water fauna (e.g. foraminifers with <i>Bathysiphon</i> , paleopsychrospheric ostracods, pelagic conodonts), subordinately gray mudstones with the same fauna, thick redeposited calcareous sandstones and calcarenites with pelagic and shallow-water fauna (conodonts, fusulinids, sponge spicules).
		? Dzhulfian	
	Guadalupian	Capitanian - Roadian	Megabreccias, matrix-supported olistostromes with shallow-water, slope and base of slope limestones. Shallow-water and pelagic fossils, ammonoids fusulinids, sponges, echinoderms, conodonts etc.
	Lower Permian	Cathedralian	
		Artinskian	Pelagic dark-gray siliceous limestones and marls. Albaillellacean radiolarians, conodonts.

Fig. 8 b: Permian slope facies and its cover of the Sicanian paleogeographic realm in western Sicily. ■ = Radiolarian-bearing deposits.

Stage/ Subst.		Ammonoid Zone	Conodont Zone	Radiolarian Zone	Conodont events	Radiolarian events	
C A R N I A N	C o r r e s p o n d e n c e	Trachyceras aon	G. tethydis I.Z.	?			
	Frankites sutherlandi	Budurovignathus diebeli	Muelleritortis kretaensis	*-P. tadpole *-P. polygnathiformis noah P. polygnathiformis polygnathiformis B. diebeli	*** *Paleosaturnalis *-T. kretaensis kretaensis		
L A D I N I A N	L o n g o b.	Protrachyceras archelaus	Budurovignathus mungoensis	Muelleritortis cochleata	*-B. mostleri +-B. hungaricus B. mungoensis	*** *Muelleritortis cochleata	
		Protrachyceras gredleri	Budurovignathus hungaricus		B. hungaricus		
	F a s s a n i a n	Eoprotrachyc. curionii	Budurovignathus truempyi		*-B. truempyi	↑ ↑ *-Hungarosaturnalis + ↓ Ladinocampe	
		Nevadites fauna	Neogondolella transita	upper	Ladinocampe multiperforata	*-N. transita	+ *-Ladinocampe vicentinensis Ladinocampe annuloperforata
					lower		+Spongosilicarmiger italicus *-Ladinocampe multiperforata
					upper		*-O. inaequispinosus inaequispinosus Falcispongius falciformis
		"Xenoprotr." reitzi	Neogondolella mesotriassica - Paragondolella ? trammeri praetrammeri	Spongosi- licarmiger italicus		*** ↑ Intermediellidae Monicastericidae Ladinocampe S. italicus italicus Oertlispongius primitivus Falcispongius calcaneus Baumgartneria, Falcispongius	
				lower		Oertlispongius, Yeharaia Triassocampe deweveri, T. scalaris Silicarmiger italicus transitus	
					↑ *-P. alpina ↓ *-N. mesotriassica * P. ? t. praetrammeri	***	
	A N I S I A N	I l l y r i a n	Paraceratites trinodosus	Neogondolella constricta	Tetraspinocyrtis laevis		+ Pseudosepsagon Parentactinia lata Pentactinocarpus awaensis Pentactinorbis dumitricai Tetraspinocyrtis levis
						+P. bifurcata	primitive Triassocampe and several other Nassellaria
	P l. fauna	Bulogites zoldianus	Neog. bulgarica Nicor. germanica	Parasepsagon robustus	+ Neogon. bulgarica Nicoraella germanica	*** + Parasepsagon robustus	

Fig. 9: Illyrian-Cordevolian conodont and radiolarian zonations and their mutual correlations.  
Vertical distances not time-related. \*: First appearance of a taxon. +: Disappearance of a taxon.  
\*\*\*: Worldwide recognizable first order event in Triassic radiolarian evolution.

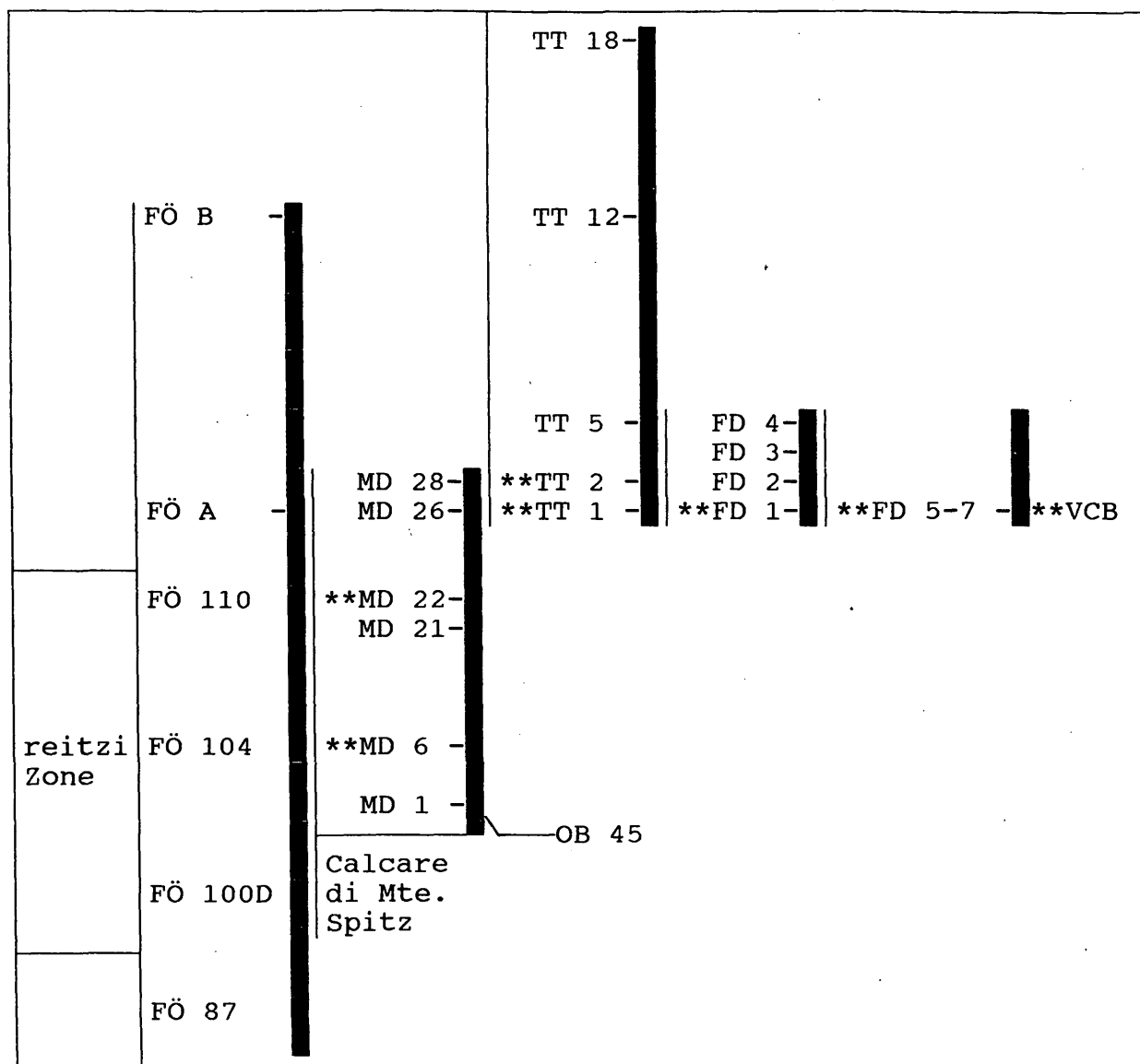


Fig. 10: Corelation of some levels of the investigated Late Anisian-Early Ladinian sections. Vertical distances not time- or thickness-related. ■ = radiolarian-bearing intervals. Samples drawn in the same horizontal level have the same age (subzone, level within a subzone), but samples some centimeters below and above these samples may have the same fauna. \*\* Detailed correlations in sample level possible. In these cases some centimeters above or below the correlated samples somewhat different faunas (age-related differences) are present. The level of the upper boundary of the Calcare Mte. Spitz is indicated. The range of the reitzi Zone in its type section in Felsöors is shown.

## Explanation of plates

### Plate 1

- Figs. 1, 2: *Eptingium manfredi robustum* KOZUR & MOSTLER, 1981, sample MD 27, x 160, rep.-no. KoMo 1994 I-335, fig. 1: equatorial view, fig. 2: oblique lateral view.  
Fig. 3: *Eptingium manfredi manfredi* DUMITRICĂ, 1978, sample FD 6, x 160, rep.-no. KoMo 1994 I-368.  
Fig. 4: *Eptingium manfredi japonicum* (NAKASEKO & NISHIMURA, 1979), sample FÖ 87, x 300, rep.-no. KoMo 1994 I-561.  
Fig. 5: *Eptingium nakasekoi* n. sp., holotype, sample FÖ 87, x 300, rep.-no. KoMo 1994 I-138.  
Fig. 6: *Polystephanidium clavator* DUMITRICĂ, 1978, sample TT 3, x 300, rep.-no. KoMo 1994 I-900.  
Fig. 7: *Hindeosphaera ? balatonica* n. sp. holotype, sample FÖ 87, x 300, rep.-no. KoMo 1994 I-112.  
Fig. 8: *Pseudostylosphaera coccostyla compacta* (NAKASEKO & NISHIMURA, 1979), sample FÖ 87, x 130, rep.-no. KoMo 1994 I-124.  
Fig. 9: *Pseudostylosphaera postjaponica* n. sp. holotype, sample MD 18, x 100, rep.-no. KoMo 1994 I-588.  
Fig. 10: *Pseudostylosphaera postjaponica* n. sp. sample MD 13, x 150, rep.-no. KoMo 1994 I-589.  
Figs. 11, 12: *Pentactinia pygnax* DUMITRICĂ, 1978, different views of the same specimen, sample FÖ 87, x 500, rep.-no. KoMo 1994 I-103

### Plate 2

- Fig. 1: *Pentactinia lata* n. sp., holotype, sample FÖ 87, x 540, rep.-no. KoMo 1994 I-104.  
Fig. 2: *Pentactinocapsa quadripes* DUMITRICĂ, 1978, sample MD 22, x 260, rep.-no. KoMo 1994 I-323.  
Figs. 3, 5: *Pentactinocarpus acanthicus* DUMITRICĂ, 1978; Fig. 3: sample TT 16, x 150, rep.-no. KoMo 1994 I-351; fig. 5: sample FD 17, x 180, rep.-no. KoMo 1994 I-370.  
Fig. 4: *Pentactinocarpus fusiformis* DUMITRICĂ, 1978, sample FD 5, x 150, rep.-no. KoMo 1994 I-336.  
Figs. 6, 7: *Pentactinocarpus tetracanthus* DUMITRICĂ, 1978; fig. 6: sample MIETTO, red nodular limestones immediately above the pietra verde of the San Ulderico section (MIETTO & PETRONI, 1979), x 150, rep.-no. KoMo 1994 I-550; fig. 7: sample B, x 180, rep.-no. KoMo 1994 I-164.  
Figs. 8, 9: *Heptacladus crassispinosus* DUMITRICĂ, KOZUR & MOSTLER, 1980; fig. 8: sample VCB, x 350, rep.-no. KoMo 1994 I-901; fig. 9: sample FÖ 87, x 350, rep.-no. KoMo 1994 I-98.  
Figs. 10, 11: *Pentactinocapsa awaensis* (NAKASEKO & NISHIMURA, 1979), sample FÖ 87, x 300, rep.-no. KoMo 1994 I-107.

### Plate 3

- Figs. 1, 2: *Pentactinocarpus illyricus* n. sp., holotype, sample FÖ 87, x 320, rep.-no. KoMo 1994 I-557.  
Fig. 3: *Heptacladus crassispinus* DUMITRICA, KOZUR & MOSTLER, 1980, sample VCB, x 150, rep.-no. KoMo 1994 I-173.  
Figs. 4, 5: *Pentactinorbis dumitricai* n. sp., holotype, upper view, stereo pictures, sample FÖ 87, x 300, rep.-no. KoMo 1994 I-99.  
Figs. 6, 7: *Pentactinorbis dumitricai* n. sp., lateral view, stereo pictures, sample FÖ 87, x 300, rep.-no. KoMo 1994 I-100.  
Fig. 8: *Heptacladus crassispinus* DUMITRICA, KOZUR & MOSTLER, 1980, sample FÖ 87, x 350, rep.-no. KoMo 1994 I-902.

### Plate 4

- Figs. 1, 2: *Pentactinorbis kozuri* DUMITRICA, 1978, sample MD 25, x 300, rep.-no. KoMo 1994 I-332.  
Figs. 3, 4: *Pentactinorbis pessagnoii* n. sp., holotype, lateral view, sample FÖ 87, x 360, rep.-no. KoMo 1994 I-104.  
Figs. 5-9: *Sepsagon ladinicus* n. sp.; fig. 5: x 100, sample VCB, rep.-no. KoMo 1994 I-558; figs. 6, 7: sample VCB, rep.-no. KoMo 1994 I-904, fig. 6: x 100, fig. 7: detail of the same specimen, x 300; fig. 8: inner



shell visible, x 130, sample MD 8, rep.-no. KoMo 1994 I-554; fig. 9: holotype, x 130, sample VCB, rep.-no. KoMo 1994 I-555.

Fig. 10: *Sepsagon robustus* LAHM, 1984, sample MD 28, 150 x, rep.-no. KoMo 1994 I-559.

## Plate 5

Fig. 1: *Sepsagon robustus* LAHM, 1984, sample VCB, 320 x, rep.-no. KoMo 1994 I-556.

Fig. 2: *Sepsagon longispinosus* (KOZUR & MOSTLER, 1979), sample FS 8, x 320, rep.-no. KoMo 1994 I-547.

Fig. 3: *Parasepsagon asymmetricus praetetracanthus* n. subsp., holotype, sample FÖ 87, rep.-no. KoMo 1994 I-137.

Figs. 4, 5: *Parasepsagon tetracanthus* DUMITRICĂ, KOZUR & MOSTLER, 1980, sample VCB, x 100; fig. 4: rep.-no. KoMo 1994 I-546; fig. 5: rep.-no. KoMo 1994 I-559.

Fig. 6: *Sepsagon robustus* LAHM, 1984, x 180, sample MD 28, rep.-no. KoMo 1994 I-905.

Figs. 7–9: *Pseudosepsagon pentaspinosus* n. gen. n. sp., holotype, sample FÖ 87, rep.-no. KoMo 1994 I-108, fig. 7, x 200, enlarged shell, stereo pictures, x 600.

## Plate 6

Fig. 1: *Pseudosepsagon illyricus* n. sp., holotype, sample FÖ 87, x 360, rep.-no. KoMo 1994 I-109.

Figs. 2, 4: *Tiborella florida tortilis* n. subsp., holotype, sample TT 13, rep.-no. KoMo 1994 I-607, fig. 2: x 260, fig. 4: detail of the shell, x 660.

Fig. 3: *Tiborella anisica* n. sp., inner structure well visible, x 200, sample FÖ 87, rep.-no. KoMo 1994 I-87.

Fig. 5: *Tiborella* cf. *anisica* n. sp., x 320, sample FÖ 87, rep.-no. KoMo 1994 I-906.

Fig. 6: *Tiborella anisica* n. sp., inner layer of shell visible, x 300, sample FÖ 87, rep.-no. KoMo 1994 I-608.

Figs. 7, 8: *Tiborella anisica* n. sp., holotype, stereo pictures, x 300, sample FÖ 87, rep.-no. KoMo 1994 I-86.

## Plate 7

Figs. 1, 2: *Archaeospongoprunum bispinosum* KOZUR & MOSTLER, 1981, sample FÖ 87; fig. 1: x 150, rep.-no. KoMo 1994 I-90; fig. 2: x 200, rep.-no. KoMo 1994 I-32.

Fig. 3: *Archaeospongoprunum mesotriassicum mesotriassicum* KOZUR & MOSTLER, 1981, x 150, rep.-no. KoMo 1994 I-33.

Fig. 4: *Archaeospongoprunum mesotriassicum asymmetricum* KOZUR & MOSTLER, 1981, x 150, sample FÖ 87, rep.-no. KoMo 1994 I-31.

Fig. 5: *Archaeospongoprunum brevispinosum* n. sp., holotype, x 220, sample FÖ 110, rep.-no. KoMo 1994 I-89.

Fig. 6: *Archaeospongoprunum tetraspinosum* n. sp., holotype, x 190, sample FÖ 87, rep.-no. KoMo 1994 I-93.

Figs. 7, 8: *Archaeospongoprunum trispinosum* n. sp., sample FÖ 87; fig. 7: holotype, x 220, rep.-no. KoMo 1994 I-91; fig. 8: x 300, rep.-no. KoMo 1994 I-92.

Fig. 9: *Tamonella rarispinosa* n. sp., holotype, x 260, sample MD 22, rep.-no. KoMo 1994 I-325.

Fig. 10: *Gomberellus longobardicus* n. sp., x 100, sample 7/29/12/87, rep.-no. CK 1188 VII-79.

Fig. 11: *Gomberellus unispinosus* n. sp., holotype, x 260, rep.-no. KoMo 1994 I-730.

Figs. 12–14: *Gomberellus hircicornus* DUMITRICĂ, KOZUR & MOSTLER, 1980; fig. 12: x 240, sample MD 22, rep.-no. KoMo 1994 I-327; figs. 13, 14: sample TT 7, rep.-no. KoMo 1994 I-260, fig. 13: lateral view, x 340, fig. 14: oblique lateral-polar view, x 430.

## Plate 8

Figs. 1, 3, 6: *Gomberellus longobardicus* n. sp., section Köveskál, cemetery, fig. 1: sample 6, x 320, rep.-no. KoMo 1994 I-733; fig. 3: 65 cm below sample 6, x 260, rep.-no. KoMo 1994 I-732; fig. 6: holotype, x 200, sample 7/29/12/87, rep.-no. CK 1188 VII-65.

- Fig. 2: *Gomberellus trispinosus posterus* n. subsp., holotype, x 260, sample TT 7, rep.-no. KoMo 1994 I-731.  
 Figs. 4, 5, 7: *Gomberellus trispinosus trispinosus* n. sp., holotype, sample MD 11, rep.-no. KoMo 1994 I-300, fig. 4: lateral view, x 200, fig. 5: upper view, x 320, fig. 7: oblique lateral view, x 200.  
 Figs. 8–10: *Gomberellus fissus* n. sp., holotype, sample MD 9, rep.-no. KoMo 1994 I-296, fig. 8 oblique upper view, x 300, fig. 9: lower view, x 320, fig. 10: lateral view, x 200.

## Plate 9

- Figs. 1, 2: *Karnospongella transita* n. sp., x 260; fig. 1: holotype, sample TT 7, rep.-no. KoMo 1994 I-263; fig. 2: sample MD 18, rep.-no. KoMo 1994 I-735.  
 Fig. 3: *Kulacella recoaroensis* KOZUR & MOSTLER, 1981, x 260, sample VCB, rep.-no. KoMo 1994 I-91.  
 Figs. 4, 5: *Cryptostephanidium verrucosum* DUMITRICĂ, 1978, x 180, sample VCB, rep.-no. KoMo 1994 I-122, fig. 4: equatorial view, fig. 5: lateral view.  
 Figs. 6, 8: *Praegomberellus pulcher* n. gen. n. sp., sample FÖ 87; fig. 6: x 300, rep.-no. KoMo 1994 I-129; fig. 8: holotype, x 180, rep.-no. KoMo 1994 I-128.  
 Fig. 7: *Pentaspongodiscus mesotriassicus* DUMITRICĂ, 1978, x 160, sample VCB, rep.-no. KoMo 1994 I-166.  
 Fig. 8: *Pentaspongodiscus ladinicus* DUMITRICĂ, 1978, x 160, sample VCB, rep.-no. KoMo 1994 I-544.  
 Fig. 10: *Pentaspongodiscus ruesti* KOZUR & MOSTLER, 1981, x 200, sample VCB, rep.-no. KoMo 1994 I-167.

## Plate 10

- Fig. 1, 4, 7, 13: *Oertlispongos inaequispinosus inaequispinosus* DUMITRICĂ, KOZUR & MOSTLER, 1980, sample VCB; fig. 1: x 150, rep.-no. KoMo 1994 I-402 C; fig. 4: specimen with curved second polar spine, x 130, rep.-no. KoMo 1994 I-402 A; fig. 7: x 150, rep.-no. KoMo 1994 I-402 D.; fig. 13: transitional form to *O. inaequispinosus longispinosus* n. subsp., x 180, rep.-no. KoMo 1994 I-402 B.  
 Figs. 2, 3: *Oertlispongos inaequispinosus unispinosus* n. subsp., sample VCB; fig. 2: x 200, rep.-no. KoMo 1994 I-622 A; fig. 3: holotype, x 150, rep.-no. KoMo 1994 I-622.  
 Fig. 5: *Oertlispongos* cf. *inaequispinosus longispinosus* n. subsp., x 150, sample MD 25, rep.-no. KoMo 1994 I-400.  
 Fig. 6: *Oertlispongos inaequispinosus tumidospinosus* n. subsp., holotype, x 200, sample MD 27, rep.-no. KoMo 1994 I-390.  
 Fig. 8: *Oertlispongos* sp., x 130, sample MD 22, rep.-no. KoMo 1994 I-620.  
 Fig. 9: *Oertlispongos aspinosus aspinosus* n. sp., holotype, x 130, sample MD 1, rep.-no. KoMo 1994 I-392 B.  
 Fig. 10: *Paroertlispongos hermi* (LAHM, 1984), x 100, sample MD 1, rep.-no. KoMo 1994 I-171.  
 Fig. 11: *Oertlispongos inaequispinosus longispinosus* n. subsp., holotype, x 180, sample MD 18, rep.-no. KoMo 1994 I-397.  
 Fig. 12: *Oertlispongos aspinosus curvatus* n. subsp., holotype, x 130, sample MD 1, rep.-no. KoMo 1994 I-394.

## Plate 11

- Fig. 1: *Oertlispongos bispinosus* n. sp., holotype, x 200, sample MD 1, rep.-no. KoMo 1994 I-624.  
 Fig. 2, 6: *Oertlispongos inaequispinosus longispinosus* n. subsp.; fig. 2: x 200, sample FD 6, rep.-no. KoMo 1994 I-403; x 150, sample MD 22, rep.-no. KoMo 1994 I-398.  
 Figs. 3, 5: *Paroertlispongos hermi* (LAHM, 1984), x 110; fig. 3: sample MD 25, rep.-no. KoMo 1994 I-727; fig. 5: sample FD 17, rep.-no. KoMo 1994 I-377.  
 Fig. 4, 10: *Oertlispongos primitivus* n. sp., sample MD 1; fig. 4: x 200, rep.-no. KoMo 1994 I-392 A; fig. 10: holotype, x 150, rep.-no. KoMo 1994 I-392 C.  
 Fig. 7: *Oertlispongos* cf. *inaequispinosus longispinosus* n. subsp., x 130, sample MD 1, rep.-no. KoMo 1994 I-394.  
 Fig. 8: *Paroertlispongos obliquus* n. sp., holotype, x 160, sample T13, rep.-no. KoMo 1994 I-729.

- Fig. 9: *Oertlispongos inaequispinosus tumidospinosus* n. subsp., x 200, sample MD 28, rep.-no. KoMo 1994 I-391.
- Fig. 11: *Oertlispongos* cf. *inaequispinosus longispinosus* n. subsp., x 150, sample MD 22, rep.-no. KoMo 1994 I-398

## Plate 12

- Figs. 1, 4–6, 8, 9: *Baumgartneria retrospina* DUMITRICĂ, 1978; fig. 1: x 120, sample TT 2, rep.-no. KoMo 1994 I-343; fig. 4: x 180, sample TT 7, rep.-no. KoMo 1994 I-264; Fig. 5: 150, sample FD 5, rep.-no. KoMo 1994 I-365; fig. 6: x 150, sample TT 7, rep.-no. KoMo 1994 I-241; fig. 8: x 200, sample TT 5, rep.-no. KoMo 1994 I-369; fig. 9: x 150, sample MD 1, rep.-no. KoMo 1994 I-169.
- Figs. 2, 11: *Baumgartneria yehae* n. sp.; fig. 2: x 100, sample MIETTO, red nodular limestones immediately above the pietra verde of the San Ulderico section (MIETTO & PETRONI, 1979), rep.-no. KoMo 1994 I-549; fig. 11: holotype, x 200, sample FD 17, rep.-no. KoMo 1994 I-371.
- Fig. 3: *Baumgartneria retrospina semicircularis* n. subsp., x 120, sample TT 4, rep.-no. KoMo 1994 I-345.
- Fig. 7: *Paroertlispongos rarispinosus* KOZUR & MOSTLER, 1981, x 120, sample T 7, rep.-no. KoMo 1994 I-264.
- Fig. 10: *Paroertlispongos multispinosus* KOZUR & MOSTLER, 1981, x 120, sample TT 7, rep.-no. KoMo 1994 I-723.
- Figs. 12–14: *Paroertlispongos weddigei* LAHM, 1984; fig. 12: x 100, sample MIETTO, red nodular limestones immediately above the pietra verde of the San Ulderico section (MIETTO & PETRONI, 1979), rep.-no. KoMo 1994 I-548; fig. 13: x 60, sample MIETTO, red nodular limestones immediately above the pietra verde of the San Ulderico section (MIETTO & PETRONI, 1979), rep.-no. KoMo 1994 I-550; fig. 14: x 100, MD 28, rep.-no. KoMo 1994 I-725.

## Plate 13

- Fig. 1: *Baumgartneria stellata* DUMITRICĂ, 1978, x 200, sample MD 9, rep.-no. KoMo 1994 I-637.
- Figs. 2, 9: *Baumgartneria transita* n. sp.; fig. 2: x 200, sample MD 22, rep.-no. KoMo 1994 I-319; fig.: holotype, x 300, sample MD 21, rep.-no. KoMo 1994 I-331.
- Figs. 3, 5, 6, 10: *Baumgartneria bifurcata* DUMITRICĂ, 1978; fig. 3: x150, sample MD 1, rep.-no. KoMo 1994 I-170; fig. 5: x 240, sample MD 19, rep.-no. KoMo 1994 I-314; fig. 6: x 300, sample MD 27, rep.-no. KoMo 1994 I-333; fig. 10: x 220, sample MD 18, rep.-no. KoMo 1994 I-312.
- Figs. 4, 11: *Paroertlispongos multispinosus* KOZUR & MOSTLER, 1981, sample VCB; fig. 4: x 200, rep.-no. KoMo 1994 I-792; fig. 11: x 140, rep.-no. KoMo 1994 I-194.
- Fig. 7: *Baumgartneria trifurcata* DUMITRICĂ, 1978, x 320, sample MD 18, rep.-no. KoMo 1994 I-638.
- Fig. 8: *Turospogon trispinosus* n. gen. n. sp., upper view, holotype, x 100, sample TT 7, rep.-no. KoMo 1994 I-262 (lateral view of the same specimen on pl. 14, fig. 10).

## Plate 14

- Fig. 1: *Falcispongos praefalciformis* n. sp., advanced forms, transitionalo to *F. falciformis* DUMITRICĂ, 1978, x 130, sample MD 22, rep.-no. KoMo 1994 I-632.
- Figs. 2, 12: *Falcispongos falciformis* DUMITRICĂ, 1978, primitive forms; fig. 2: x 200, sample TT 8, rep.-no. KoMo 1994 I-347; fig. 12: x 300, sample TT 3, rep.-no. KoMo 1994 I-626.
- Figs. 3, 4, 7, 11: *Falcispongos priscus* n. sp., x 200; fig. 3: holotype, sample MD 1, rep.-no. KoMo 1994 I-625; fig. 4: sample TT 7, rep.-no. KoMo 1994 I-633; fig. 7: sample TT 7, rep.-no. KoMo 1994 I-358; fig. 11: sample TT 7, rep.-no. KoMo 1994 I-324.
- Figs. 5, 8, 9: *Falcispongos postcalcareus* n. sp., x 150; fig. 5: primitive form, sample TT 14, rep.-no. KoMo 1994 I-628; fig. 8: holotype, sample TT 7, rep.-no. KoMo 1994 I-627; fig. 9: sample TT 14, rep.-no. KoMo 1994 I-650.
- Fig. 6: Transitional form between *Falcispongos praefalciformis* n. sp. and *F. falciformis* DUMITRICĂ, 1978, x 120, sample MD 22, rep.-no. KoMo 1994 I-320.

Fig. 10: *Turospungus trispinosus* n. gen. n. sp., lateral view, holotype, x 200, sample TT 7, rep.-no. KoMo 1994 I-262 (upper view of the same specimen on pl. 13, fig. 8).

## Plate 15

- Figs. 1, 8: *Paurinella curvata spinosa* n. subsp.; fig. 1: holotype, x 160, sample TT 2, rep.-no. KoMo 1994 I-339; fig. 8: x 150, sample VCB, rep.-no. KoMo 1994 I-197.
- Figs. 2, 3: *Paurinella curvata tenuispinosa* n. subsp., sample MD 32; fig. 2: holotype, x 180, rep.-no. KoMo 1994 I-338; fig. 3: equatorial view, third spine not visible, x 160, rep.-no. KoMo 1994 I-793.
- Fig. 4: *Paurinella latispinosa* n. sp., holotype, x 300, sample Köveskál 6, rep.-no. KoMo 1994 I-792.
- Figs. 5, 6: *Neopaurinella ladinica* n. sp., sample FD 17, rep.-no. KoMo 1994 I-404, fig. 5: oblique equatorial-lateral view, x 130, fig. 6: lateral view, x 110.
- Fig. 7: *Paurinella mesotriassica* KOZUR & MOSTLER, 1981, holotype (see also pl. 16, fig. 4), x 150, sample VCB, rep.-no. KoMo 1980 I-23.
- Figs. 9, 11: *Paurinella aequispinosa* KOZUR & MOSTLER, 1981, sample VCB; fig. 9: x 200, rep.-no. KoMo 1994 I-913; fig. 11: x 180, rep.-no. KoMo 1994 I-196.
- Fig. 10: *Paurinella balatonica* n. sp., holotype, x 180, sample FÖ 104, rep.-no. KoMo 1994 I-86.
- Fig. 12: *Tetrapaurinella tetrahedrica* n. sp., x 150, sample MD 5, rep.-no. KoMo 1994 I-285.
- Figs. 13, 14: *Paurinella ? inaequispinosa* n. sp., x 160, sample VCB; fig. 13: rep.-no. KoMo 1994 I-915; fig. 14: holotype, rep.-no. KoMo 1994 I-200.
- Fig. 15: *Paurinella trettoensis* n. sp., holotype, x 130, sample TT 13, rep.-no. KoMo 1994 I-791.

## Plate 16

- Fig. 1: *Paurinella ? longispinosa* n. sp. holotype, x 180, sample MD 6, rep.-no. KoMo 1994 I-186.
- Fig. 2: *Paurinella cf. mesotriassica* KOZUR & MOSTLER, 1981, x 180, sample VCB, 797.
- Fig. 3: *Paurinella tornata* n. sp., holotype, x 180, sample MD 13, rep.-no. KoMo 1994 I-11.
- Fig. 4: *Paurinella mesotriassica* KOZUR & MOSTLER, 1981, holotype (see also pl. 15, fig. 7), x 150, rep.-no. KoMo 1980 I-23.
- Fig. 5: *Paurinella acutispinosa* n. sp., holotype, x 130, sample Köveskál 6, rep.-no. KoMo 1994 I-790.
- Fig. 6: *Neopaurinella ladinica* n. sp., holotype, x 100, sample VCB, rep.-no. KoMo 1994 I-198.
- Fig. 7: *Neopaurinella tumidospina* n. sp., holotype, x 200, sample VCB, rep.-no. KoMo 1994 I-199.
- Fig. 8: *Katorella bifurcata* KOZUR & MOSTLER, 1981, x 200, sample VCB, rep.-no. KoMo 1980 I-20.
- Fig. 9: *Tetrapaurinella discoidalis* n. sp., holotype (see also pl. 17, fig. 4, x 200, sample VCB, rep.-no. KoMo 1994 I-201).
- Figs. 10, 12: *Katorella trifurcata* n. sp.; fig. 10: holotype, x 200, sample VCB, rep.-no. KoMo 1994 I-210; fig. 12: x 300, sample Köveskál 6, rep.-no. KoMo 1994 I-792.
- Fig. 11: *Discokatorella tetraspina* n. sp., holotype, x 200, sample MD 1, rep.-no. KoMo 1994 I-172.

## Plate 17

- Figs. 1, 2: *Paurinella trispinosa* (LAHM, 1984), x 250, sample VCB, rep.-no. KoMo 1994 I-203, fig. 1: lateral view, fig. 2: oblique equatorial view.
- Figs. 3, 5: *Tetrapaurinella tetrahedrica* n. sp., x 180, sample VCB; fig. 3: holotype, rep.-no. KoMo 1994 I-202; fig. 5: rep.-no. KoMo 1994 I-202.
- Fig. 4, 6: *Tetrapaurinella discoidalis* n. gen. n. sp., sample VCB; fig. 4: holotype, oblique equatorial view (see also pl. 16, fig. 9), x 200, rep.-no. KoMo 1994 I-201; fig. 6: x 160, rep.-no. KoMo 1994 I-796.
- Figs. 7, 8: *Sarla ? anisica* n. sp., FÖ 87; fig. 7: x 180, rep.-no. KoMo 1994 I-155; fig. 8: x 200, rep.-no. KoMo 1994 I-928.
- Figs. 9, 10: *Anisicyrtis hungarica* KOZUR & MOSTLER, 1981, sample FÖ 87, rep.-no. KoMo 1994 I-929, fig. 9: x 300, fig. 10: spicular system, x 1200.
- Fig. 11: *Anisicyrtis mocki* n. sp., holotype, x 440, sample FÖ 87, rep.-no. KoMo 1994 I-56.

## Plate 18

- Figs. 1–4, 8: *Anisicyrtis hungarica* KOZUR & MOSTLER, 1981, sample FÖ 87; fig. 1: x 360, rep.-no. KoMo 1994 I-53; fig. 2: x 320, rep.-no. KoMo 1994 I-54; fig. 3: x 360, rep.-no. KoMo 1994 I-55; fig. 4: spicular system, x 2000; fig. 8: holotype, oblique upper-lateral view, x 600, rep.-no. KoMo 1980 I-93.
- Figs. 5, 6: *Anisicyrtis foremanae* n. sp., x 260; fig. 5: sample 6, rep.-no. KoMo 1994 I-471; fig. 6: holotype, sample TT 8, rep.-no. KoMo 1994 I-357.
- Fig. 7, 10: *Anisicyrtis mocki* n. sp., sample FÖ 87; fig. 7: x 260, rep.-no. KoMo 1994 I-55 B; fig. 10: x 540, rep.-no. KoMo 1994 I-58, Because of the oblique lateral view, only the elevated basal part of the cephalis below horn V is visible. The remaining part of the moderately large cephalis is so dark in the photo that it will not be visible after printing; its outline is therefore indicated by a white line.
- Fig. 9: *Anisicyrtis goricanæ* n. sp., holotype, x 300, sample FD 6, rep.-no. KoMo 1994 I-457.
- Fig. 11: *Anisicyrtis* cf. *foremanae* n. sp., x 300, sample FÖ 110, rep.-no. KoMo 1994 I-462.
- Fig. 12: *Anisicyrtis conica* n. sp., holotype, x 200, sample FÖ 87, rep.-no. KoMo 1994 I-77.
- Fig. 13: *Anisicyrtis mocki* n. sp., spicular system, x 1600, sample FÖ 87, rep.-no. KoMo 1994 I-57.

## Plate 19

- Figs. 1, 2: *Anisicyrtis goricanæ* n. sp.; fig. 1: x 300, sample 110, rep.-no. KoMo 1994 I-462; fig. 2: x 360, sample MD 18, rep.-no. KoMo 1994 I-463.
- Fig. 3: *Anisicyrtis* cf. *nodosa* n. sp., transitional form to *A. italica*, x 260, sample TT 3, rep.-no. KoMo 1994 I-468.
- Fig. 4: *Anisicyrtis postillyrica* n. sp., holotype, x 260, sample FÖ 100 D, rep.-no. KoMo 1994 I-76.
- Figs. 5, 7: *Anisicyrtis italica* n. sp., sample MD 12; fig. 5: holotype, x 260, rep.-no. KoMo 1994 I-455; fig. 7: x 260, rep.-no. KoMo 1994 I-473.
- Figs. 6, 8, 9: *Anisicyrtis nodosa* n. sp.; fig. 6: holotype, x 340, sample TT 5, rep.-no. KoMo 1994 I-450; fig. 8: x 240, sample T 12, rep.-no. KoMo 1994 I-278; fig. 9: x 220, sample TT 3, rep.-no. KoMo 1994 I-455.
- Fig. 10: *Anisicyrtis trettoensis postera* n. subsp., holotype, x 260, sample TT 16, rep.-no. KoMo 1994 I-453.
- Figs. 11–14: *Anisicyrtis spinosa* n. sp.; fig. 11: x 320, sample TT 7, rep.-no. KoMo 1994 I-244; fig. 12: x 260, sample TT 5, rep.-no. KoMo 1994 I-478; fig. 13: x 320, sample TT 7, rep.-no. KoMo 1994 I-245; fig. 14: x 300, sample TT 5, rep.-no. KoMo 1994 I-481.
- Fig. 15: *Anisicyrtis trettoensis trettoensis* n. sp., holotype, x 200, sample TT 7, rep.-no. KoMo 1994 I-247.

## Plate 20

- Figs. 1, 2: *Anisicyrtis trettoensis trettoensis* n. sp., sample TT 7; fig. 1: holotype, x 230, rep.-no. KoMo 1994 I-246; fig. 2: x 260, rep.-no. KoMo 1994 I-247 A..
- Fig. 3: *Anisicyrtis recoaroensis deweveri* n. subsp., holotype, x 300, sample TT 7, rep.-no. KoMo 1994 I-243.
- Figs. 4, 5: *Anisicyrtis recoaroensis recoaroensis* n. sp.; fig. 4: holotype, x 300, sample VCB, rep.-no. KoMo 1994 I-161; fig. 5: x 320, sample MD 12, rep.-no. KoMo 1994 I-470.
- Figs. 6, 7: *Goestlingella toempeae* n. sp., holotype, sample MD 8, rep.-no. KoMo 1994 I-252, fig. 6: spicular system, x 2200; fig. 7: x 300.
- Figs. 8, 10–12: *Monicasterix prisca* n. sp., sample VCB; fig. 8, 12: rep.-no. KoMo 1994 I-529, fig. 8: x 260, fig. 12: lower side of the same specimen, x 720; figs. 10, 11: holotype, rep.-no. KoMo 1994 I-528, fig. 10: lower side, x 860, fig. 11: lateral view, x 440.
- Fig. 9: *Monicasterix brevituba* n. sp., holotype, x 400, sample TT 3, rep.-no. KoMo 1994 I-526.

## Plate 21

- Figs. 1–3, 5, 7: *Monicasterix alpina* n. gen. n. sp., holotype, sample TT 7, rep.-no. KoMo 1994 I-253, fig. 1: lateral view, x 360, fig. 2: somewhat oblique lateral view, x 400, fig. 3: detail of the upper part, x 600, fig. 5: lower view, x 720, fig. 7: spicular system, x 1500.
- Figs. 4, 6: *Monicasterix gabiolaensis* n. sp., holotype, sample MD 9, fig. 4: x 320, fig. 6: lower view, x 780.

- Figs. 8, 10: *Tubotriassocyrtis latotuba* n. sp., holotype, sample TT 3, rep.-no. KoMo 1994 I-531, fig. 8: lateral view, fig. 10: oblique lower view, x 800.
- Figs. 9, 11: *Tubotriassocyrtis annulata* n. sp., holotype, sample VCB, rep.-no. KoMo 1994 I-532, fig. 8L lower view, x 780, fig. 11: lateral view, x 480.

## Plate 22

- Fig. 1: *Tubotriassocyrtis angustituba* n. gen. n. sp., holotype, x 300, sample TT 3, rep.-no. KoMo 1994 I-530.
- Figs. 2, 4–9: *Ladinocampe annuloperforata* n. sp.; fig. 2: x 240, sample TT 3, rep.-no. KoMo 1994 I-501; figs. 4–6: holotype, sample TT 5, rep.-no. KoMo 1994 I-491, fig. 4: x 200, fig. 5: detail of the upper part of the test, x 600, fig. 6: detail of the middle part of the test, x 600; fig. 7: x 200, sample TT 3, rep.-no. KoMo 1994 I-498; fig. 8: transitional form to *L. multiperforata* KOZUR, 1984, x 240, sample T 3, rep.-no. KoMo 1994 I-500; fig. 9: view from the opposite side of the columella, x 260, sample TT 7, rep.-no. KoMo 1994 I-232.
- Figs. 3, 11–14: *Ladinocampe multiperforata* KOZUR, 1984; fig. 3: x 180, sample TT 3, rep.-no. KoMo 1994 I-581; figs. 11, 12: two different lateral views of the same specimen, x 220, sample T 7, rep.-no. KoMo 1994 I-230; figs. 13, 14: sample TT 7, rep.-no. KoMo 1994 I-231, fig. 13: oblique lower view, x 600, fig. 14: lateral view, x 240.
- Fig. 10: *Ladinocampe latiannulata* n. sp., holotype, x 200, sample TT 3, rep.-no. KoMo 1994 I-492.

## Plate 23

- Figs. 1, 2: *Ladinocampe multiperforata* KOZUR, 1984; fig. 1: x 220, sample TT 7, rep.-no. KoMo 1994 I-231; fig. 2: x 200, sample TT 16, rep.-no. KoMo 1994 I-505.
- Fig. 3: *Ladinocampe* cf. *vicentinensis* n. sp., x 220, sample TT 10, rep.-no. KoMo 1994 I-360.
- Figs. 4, 5: *Ladinocampe vicentinensis* n. sp.; fig. 4: x 240, sample TT 18, rep.-no. KoMo 1994 I-494; fig. 5: holotype, x 300, sample TT 16, rep.-no. KoMo 1994 I-495.
- Figs. 6–9, 12: *Planispinocyrtis baloghi* KOZUR & MOSTLER, 1981, sample FÖ 87; figs. 6, 7, 12: holotype, rep.-no. KoMo 1980 I-75, fig. 6: upper view, x 600, figs. 7, 12: two different, somewhat oblique lateral views, x 400; figs. 8, 9: rep.-no. KoMo 1994 I-48, fig. 8: lower view, spicular system, x 720, fig. 9: lateral view, x 300.
- Figs. 10, 11: *Planispinocyrtis* ? *annulata* n. sp., sample TT 13; fig. 10: x 220, rep.-no. KoMo 1994 I-566; fig. 11: holotype, x 200, rep.-no. KoMo 1994 I-567.
- Fig. 13: *Planispinocyrtis* ? *gabiolaensis* n. sp., holotype, x 260, sample MD 1, rep.-no. KoMo 1994 I-568.
- Fig. 14: *Planispinocyrtis brevis* n. sp., holotype, x 360, sample FÖ 87, rep.-no. KoMo 1994 I-46.

## Plate 24

- Figs. 1–3: *Planispinocyrtis haeckeli* n. sp., sample TT 7; figs. 1, 3: holotype, rep.-no. KoMo 1994 I-236, fig. 1: lateral view, x 240, fig. 3: oblique lateral-lower view, x 360; fig. 2: x 220, rep.-no. KoMo 1994 I-237.
- Figs. 4–7: *Planispinocyrtis illyrica* n. sp., sample FÖ 87; figs. 4, 6: holotype, rep.-no. KoMo 1994 I-43, fig. 4: lateral view, x 260, fig. 6: lower view, spicular system, x 600; fig. 5: x 400, rep.-no. KoMo 1994 I-44.
- Figs. 8, 10, 11: *Planispinocyrtis* ? *longispinosa* n. sp., holotype, sample Köveskál 4 B, 0,1 m below sample Köveskál 4, rep.-no. KoMo 1994 I-571, fig. 8: lateral view, x 260, fig. lower view, spicular system, x 600, fig. 11: oblique lateral view, x 320.
- Figs. 9, 12: *Planispinocyrtis macrocephalis* n. sp., holotype, sample FÖ 87, rep.-no. KoMo 1994 I-47, fig. 9: lateral view, x 400, fig. 12: lower view, spicular system, x 730.

## Plate 25

- Figs. 1, 6: *Planispinocyrtis multiporata annuloporata* n. subsp., fig. 1: holotype, x 300, sample TT 7, rep.-no. KoMo 1994 I-239; fig. 6: x 260, sample TT 16, rep.-no. KoMo 1994 I-360.
- Figs. 2, 4, 8: *Planispinocyrtis pulchra globulata* n. subsp., holotype, sample FÖ 87, rep.-no. KoMo 1994 I-42, fig. 2: lateral view, x 260, fig. 4: oblique lateral-lower view, x 440, fig. 8: lower view, x 400.
- Figs. 3, 5, 9: *Planispinocyrtis multiporata multiporata* n. sp., sample TT 7; fig. 3: lateral view, x 300, rep.-no. KoMo 1994 I-238; figs. 5, 9: holotype, rep.-no. KoMo 1994 I-540, fig. 5: oblique lateral-lower view, x 300, fig. 9: spicular system, x 2000.
- Figs. 7, 14: *Planispinocyrtis praecursor* n. sp., sample FÖ 100 D, fig. 7: holotype, x 260, rep.-no. KoMo 1994 I-74; fdig. 14: x 300, rep.-no. KoMo 1994 I-75.
- Figs. 10, 11: *Planispinocyrtis* ? *nishimurai* n. sp.; fig. 10: x 320, sample TT 3, rep.-no. KoMo 1994 I-569; fig. 11: holotype, x 300, sample T 6, rep.-no. KoMo 1994 I-570.
- Fig. 12: *Planispinocyrtis pelsoensis* n. sp., holotype, x 320, sample FÖ 110, rep.-no. KoMo 1994 I-533.
- Fig. 13: *Planispinocyrtis* cf. *praecursor* n. sp., x 260, sample TT 3, rep.-no. KoMo 1994 I-541.

## Plate 26

- Fig. 1: *Planispinocyrtis paronai* n. sp., holotype, x 320, sample TT 13, rep.-no. KoMo 1994 I-571.
- Fig. 2: *Planispinocyrtis pulchra pulchra* n. sp., holotype, x 300, sample FÖ 87, rep.-no. KoMo 1994 I-41.
- Figs. 3, 4, 9: *Planispinocyrtis* ? *thoraciglobulosa* n. sp., holotype, sample TT 16, rep.-no. KoMo 1994 I-362, fig. 3: lateral view, x 260, fig. 4: other lateral view, x 300, fig. 9: lower view, x 400.
- Figs. 5, 6, 10: *Planispinocyrtis* ? *truempyi* n. sp., holotype, sample MD 1, rep.-no. KoMo 1994 I-173, fig. 5: lateral view, x 260, fig. 6: detail of the apical part, x 690, fig. 10: other lateral view, x 230.
- Fig. 7: *Spinotriassocampe carnica* n. sp., holotype, x 100, Rupe del Passo di Burgio (Sosio Valley area), sample S 8, rep.-no. CK 1188 VII-82.
- Figs. 8, 11, 12, 14: *Spinotriassocampe longobardica* n. sp.; fig. 8: x 180, sample 7/29/12/87, rep.-no. CK 1188 VII-87; figs. 11, 12: holotype (see also pl. 27, figs. 6, 8), 0.65 cm below sample Köveskál 6/83, rep.-no. KoMo 1994 I-615, fig. 11: x 160, fig. 12: detail from the lower part of the test, x 600; fig. 14: x 240, 0.65 cm below sample Köveskál 6/83, rep.-no. KoMo 1994 I-617.
- Fig. 13: *Spinotriassocampe mesofassanica* n. sp., holotype (see also pl. 27, figs. 2, 9), x 160, sample TT 3, rep.-no. KoMo 1994 I-228.

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- Figs. 1, 2, 5, 9: *Spinotriassocampe mesofassanica* n. sp.; fig. 1: x 230, sample TT 7, rep.-no. KoMo 1994 I-619; figs. 2, 9: holotype (see also pl. 26, fig. 13), sample TT 3, rep.-no. KoMo 1994 I-228, fig. 2: detail of the middle part, x 580, fig. 9: detail of the apical part, x 960; fig. 5: detail of the distal part of another specimen, sample TT 7, rep.-no. KoMo 1994 I-619.
- Fig. 3: *Spinotriassocampe eofassanica* n. sp., holotype, x 200, sample MD 12, rep.-no. KoMo 1994 I-613.
- Figs. 4, 6, 8: *Spinotriassocampe longobardica* n. sp., 0.65 cm below sample Köveskál 6/83; fig. 4: x 200, rep.-no. KoMo 1994 I-616; figs. 6, 8: holotype (see also pl. 26, figs. 11, 12), x 600, rep.-no. KoMo 1994 I-615, fig. 6: detail from the middle part of the test, fig. 8: detail of the apical part.
- Fig. 7: *Spinotriassocampe transita* n. sp., holotype, x 260, sample TT 5, rep.-no. KoMo 1994 I-618.

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- Figs. 1-4, 9, 11: *Pararuesticyrtium mediofassanicum* n. sp.; figs. 1, 11: sample TT 7, rep.-no. KoMo 1994 I-227, fig. 1: x 260, fig. 11: detail of the distal part of the test, x 520; fig. 2: primitive form, x 260, sample TT 2, rep.-no. KoMo 1994 I-933; fig. 3: x 260, sample TT 7, rep.-no. KoMo 1994 I-759; fig. 4: holotype, x 260, sample T 13, rep.-no. KoMo 1994 I-758; fig. 9: advanced form, x 260, sample TT 18, rep.-no. KoMo 1994 I-757.
- Figs. 5, 6, 10, 12: *Pararuesticyrtium eofassanicum* n. sp.; fig. 5: x 260, sample MD 18, rep.-no. KoMo 1994 I-317;

figs. 6, 10: holotype, sample MD 21, rep.-no. KoMo 1994 I-330, fig. 6: x 260, fig. 10: lower view, x 500; fig. 12: x 260, sample MD 21, rep.-no. KoMo 1994 I-821.

Figs. 7, 8: *Pararuesticyrtium constrictum* n. sp., holotype, sample TT 16, rep.-no. KoMo 1994 I-760, fig. 7: detail from the middle part of the test, x 600, fig. 8: entire specimen, x 260.

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Figs. 1, 2: *Sanfilipoella laevis* n. sp., holotype, sample FÖ 87, rep.-no. KoMo 1994 I-17, fig. 1: lateral view, x 300, fig. 2: lower view, spicular system, x 540.

Figs. 3, 4, 7: *Hozmadia rotunda* (NAKASEKO & NISHIMURA, 1979), sample FÖ 87, fig. 3: lateral view, x 230, rep.-no. KoMo 1994 I-4; figs. 4, 7: rep.-no. KoMo 1994 I-15, fig. 4: somewhat oblique lateral view, x 200, fig. 7: lower view of the same specimen, x 600.

Figs. 5, 6: *Hozmadia longicephalis* n. sp., holotype, sample FÖ 87, rep.-no. KoMo 1994 I-525, fig. 5: lateral view, x 540, fig. 6: lower view, x 1000.

Figs. 9–10: *Poulpus illyricus* n. sp., sample FÖ 87; fig. 8: somewhat oblique lateral view, x 540, rep.-no. KoMo 1994 I-7; figs. 9, 10: rep.-no. KoMo 1994 I-8, fig. 9: lower view, spicular system, x 540, fig. 10: lateral view, x 450.

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Figs. 1–3, 5: *Eonapora fassanica* n. sp.; figs. 1, 5: holotype, sample MD 3, rep.-no. KoMo 1994 I-178, fig. 1: lateral view, x 200, fig. 5: lower view, spicular system, x 740; figs. 2, 3: sample MD 1, rep.-no. KoMo 1994 I-174, fig. 2: lower view, spicular system, x 360, fig. 3: lateral view, x 220.

Figs. 4, 7: *Hozmadia spinosa* n. sp. holotype, sample FÖ 87, rep.-no. KoMo 1994 I-10, fig. 4: lateral view, x 400, fig. 7: lower view, spicular system, x 450.

Figs. 6, 9: *Eonapora longispinosa* n. sp.; fig. 6: holotype, sample T 5, x 240, rep.-no. KoMo 1994 I-606, fig. 9: x 150, sample TT 7, rep.-no. KoMo 1994 I-574.

Figs. 8, 11: *Eonapora robusta* KOZUR & MOSTLER, 1981, x 360, sample FÖ 87; fig. 8: damaged specimen, cephalic spicular system and arches well visible in lateral view, rep.-no. KoMo 1994 I-11; fig. 11: velum short, fragile, rep.-no. KoMo 1994 I-940.

Fig. 10: *Eonapora transita* n. sp., holotype, x 250, sample TT 12, rep.-no. KoMo 1994 I-250.

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Figs. 1, 2, 5–10: *Hozmadia costata* n., sp., sample FÖ 87; fig. 1: x 360, rep.-no. KoMo 1994 I-2, figs. 2, 8, 9, 10: holotype, rep.-no. KoMo 1994 I-1, fig. 2: lower view, spicular system, x 540, fig. 7: lateral view, x 360, fig. 8: other lateral view, x 360, fig. 9: lower view, x 400, fig. 10: detail of the spicular system, x 1000.

Fig. 3: *Hozmadia koveskallensis* n. sp., holotype, x 180, sample Köveskál 4 B, 0,1 m below sample Köveskál 4, rep.-no. KoMo 1994 I-612.

Fig. 4: *Hozmadia reticulata* DUMITRICĂ, KOZUR & MOSTLER, 1980, x 320, sample FÖ 110, rep.-no. KoMo 1994 I-82.

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Figs. 1, 2, 4: *Poulpus illyricus* n. sp., x 400, sample FÖ 87; figs. 1, 2. specimen with corroded wall, horns in prolongation of V and 2 I present, rep.-no. KoMo 1994 I-9a; fig. 4: holotype, rep.-no. KoMo 1994 I-7.

Figs. 5, 8: *Poulpus curvispinus curvispinus* DUMITRICĂ, KOZUR & MOSTLER, 1980; fig. 5: primitive form, x 400, sample MD 9, rep.-no. KoMo 1994 I-610; fig. 8: x 200, sample Köveskál 4 B, 0,1 m below sample Köveskál 4, rep.-no. KoMo 1994 I-610.

Figs. 3, 6, 7: *Poulpus curvispinus praecurvispinus* n. subsp.; fig. 3: x 320, sample MD 5, rep.-no. KoMo 1994 I-282; figs. 6, 7: holotype, x 360, sample MD 2, rep.-no. KoMo 1994 I-277, fig. 6: oblique lateral-upper view, fig. 7: lateral view.



- Fig. 9, 12: *Poulpus gracilis* n. sp., holotype, sample FÖ 87, , rep.-no. KoMo 1994 I-18, fig. 9: lateral view, x 300, fig. 12: lower view, x 400.
- Figs. 10, 11: *Poulpus longicephalis* n. sp., holotype, x 260, sample FÖ 87, rep.-no. KoMo 1994 I-6, fig. 10: lower view, spicular system, fig. 11: oblique lateral-lower view.

### Plate 33

- Figs. 1–5, 7–9, 13: *Silicarmiger costatus anisicus* KOZUR & MOSTLER, 1981, sample FÖ 87; fig. 1: x 200, rep.-no. KoMo 1994 I-33; fig. 2: x 200, rep.-no. KoMo 1994 I-33 C; fig. 3: x 200, rep.-no. KoMo 1994 I-33 B, figs. 4, 7, 13: x 200, rep.-no. KoMo 1994 I-33 A, fig. 4: lower view, spicular system, fig. 7: somewhat oblique lateral view, fig. 13: lateral view; fig. 5, 9: rep.-no. KoMo 1994 I-33, fig. 5: lateral view, x 200, fig. 9: lower view, spicular system, x 1000; Fig. 8, x 200, rep.-no. KoMo 1994 I-33 D.
- Figs. 6, 15, 16: *Silicarmiger costatus costatus* DUMITRICĂ, KOZUR & MOSTLER, 1980; fig. 6: x 100, sample MIETTO, red nodular limestones immediately above the pietra verde of the San Ulderico section (MIETTO & PETRONI, 1979), rep.-no. KoMo 1994 I-552, figs. 15, 16: sample TT 16, rep.-no. KoMo 1994 I-354, fig. 15: x 200, fig. 16: x 600.
- Fig. 10: *Silicarmiger costatus magnicornus* n. subsp., x 300, sample T 16, rep.-no. KoMo 1994 I-360.
- Figs. 11, 12, 14: *Silicarmiger curvatus* KOZUR & MOSTLER, 1979, fig. 11: x 200, Köveskál cemetery, 0.65 m below sample 6/83, rep.-no. KoMo 1994 I-580; figs. 12, 14: sample S 8, rep.-no. KoMo 1994 I-574, fig. 12: x 250, fig. 14: detail, x 550.

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- Figs. 1, 2: *Silicarmiger latus mediospinosus* n. subsp., sample TT 6, rep.-no. KoMo 1994 I-358 a; fig. 1: lateral view, x 260, fig. 2: lower view, spicular system, x 360.
- Figs. 3, 4, 9: *Silicarmiger latus latus* n. sp.; figs. 3, 4: primitive form, sample Köveskál 4 B, 0.1 m below sample Köveskál 4, , rep.-no. KoMo 1994 I-584, fig. 3: lower view, x 260, fig. 4: lateral view, x 200; fig. 9: holotype, x 160, Köveskál cemetery section, 0.65 m below 6/83, rep.-no. KoMo 1994 I-578.
- Figs. 5, 6, 10: *Nofrema trispinosa* DUMITRICĂ, KOZUR & MOSTLER, 1980, sample MD 27, rep.-no. KoMo 1994 I-334, fig. 5: lower view, x 260, fig. 6: detail of the apical part, x 560, fig. 10: lateral view, x 160.
- Fig. 7: *Silicarmiger costatus magnicornus* n. subsp., holotype, x 150, sample TT 7, rep.-no. KoMo 1994 I-576.
- Fig. 8: *Silicarmiger costatus costatus* DUMITRICĂ, KOZUR & MOSTLER, 1980, x 200, sample TT 16, rep.-no. KoMo 1994 I-575.

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- Fig. 1: DUMITRICĂ n. subsp., holotype, x 200, sample TT 14, rep.-no. KoMo 1994 I-577.
- Figs. 2, 5: *Silicarmiger latus latus* n. sp., Köveskál cemetery section, 0.65 cm below sample 6/83; fig. 2: x 200, rep.-no. KoMo 1994 I-583, fig. 5: x 150, rep.-no. KoMo 1994 I-585.
- Figs. 3, 6, 9, 11: *Spongossilicarmiger gabiolaensis curvatospinus* n. subsp.; fig. 3: x 160, sample MD 1, rep.-no. KoMo 1994 I-597; fig. 6: x 220, sample MD 18, rep.-no. KoMo 1994 I-595; figs. 9, 11: holotype, sample MD 1, rep.-no. KoMo 1994 I-592, fig. 9: detail of the apical spine, x 400, fig. 11: lateral view, x 180.
- Fig. 4: *Silicarmiger latus mediospinosus* n. subsp., holotype, x 100, sample TT 16, rep.-no. KoMo 1994 I-358.
- Fig. 7: *Spongossilicarmiger italicus italicus* KOZUR, 1984, x 150, sample MD 12, rep.-no. KoMo 1994 I-378.
- Fig. 8: *Spongossilicarmiger gabiolaensis gabiolaensis* n. sp., x 130, sample MD 19, rep.-no. KoMo 1994 I-591.
- Fig. 10: *Spongossilicarmiger italicus transitus* n. subsp., x 150, sample FÖ 100 D, rep.-no. KoMo 1994 I-383.
- Figs. 12, 13: *Spongossilicarmiger posterus* n. sp., sample MD 28, rep.-no. KoMo 1994 I-601, fig. 12: x 250, fig. 13: detail of the apical part, x 540.

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- Fig. 1: *Spongosilicarmiger* cf. *gabiolaensis gabiolaensis* n. sp., transitional form to *Spongosilicarmiger italicus* KOZUR, 1984, x 200, sample MD 1, rep.-no. KoMo 1994 I-585.
- Figs. 2, 3: *Spongosilicarmiger posterus* n. sp., holotype, sample \_\_28, rep.-no. KoMo 1994 I-600, fig. 2: detail of the apical part, x 440, fig. 3: lateral view, x 180.
- Figs. 4, 5, 7, 8, 10: *Spongosilicarmiger gabiolaensis gabiolaensis* n. sp., figs. 4, 5, 8: holotype, sample MD 20, rep.-no. KoMo 1994 I-386, fig. 4: x 200, fig. 5: detail of the distal part, x 500, 8: detail of the apical part, x 550; figs. 7, 10: sample MD 18, rep.-no. KoMo 1994 I-593, fig. 7: detail of the apical part, x 480, fig. 10: x 180.
- Fig. 6: *Spongosilicarmiger italicus transitus* n. subsp., holotype, x 150, sample 100 D, rep.-no. KoMo 1994 I-384.
- Figs. 9, 11: *Spongosilicarmiger priscus* n. sp., holotype, sample FÖ 87, rep.-no. KoMo 1994 I-385, fig. 9: oblique lower view, x 250, fig. 11: 160 x.

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- Figs. 1, 5, 6, 9, 10: *Spongosilicarmiger italicus italicus* KOZUR, 1984; fig. 1: x 220, sample MD 25, rep.-no. KoMo 1994 I-586; figs. 5, 6: sample MD 1, rep.-no. T 5822, fig. 5: detail of the distal part, x 400, fig. 6: lower view, x 300; figs. 9, 10: sample MD 9, rep.-no. KoMo 1994 I-587, fig. 9: x 160, fig. 10: detail of the distal part, x 540.
- Figs. 2–4: *Spongosilicarmiger gabiolaensis curvatospinus* n. subsp., sample MD 2, rep.-no. KoMo 1994 I-385, fig. 2: detail of the apical spine, x 540, fig. 3: total view, x 160, fig. 4: detail of the apical part of the test below the apical spine.
- Fig. 7: *Spongosilicarmiger* cf. *gabiolaensis gabiolaensis* n. sp., x 100, sample MIETTO, red nodular limestones immediately above the pietra verde of the San Ulderico section (MIETTO & PETRONI, 1979), rep.-no. KoMo 1994 I-603.
- Fig. 8: *Spongosilicarmiger gabiolaensis gabiolaensis* n. sp., apical part, x 200, sample MD 20, rep.-no. KoMo 1994 I-590

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- Figs. 1, 3, 5: *Spongolophophaena globocephalis* n. gen. n. sp., sample TT 7; figs. 1, 3: holotype, rep.-no. KoMo 1994 I-233, fig. 1: spicular system, x 660, fig. 3: x 200; fig. 5: x 200, rep.-no. KoMo 1994 I-234.
- Figs. 2, 4: *Spongolophophaena longa* n. sp., x 200; fig. 2: holotype, sample TT 18, rep.-no. KoMo 1994 I-509; fig. 4: sample T 12, rep.-no. KoMo 1994 I-510.
- Figs. 6, 7, 9: *Conospongocyrtis cephaloconica* n. gen. n. sp.; figs. 6, 9: holotype, sample TT 13, rep.-no. KoMo 1994 I-513, fig. 6: x 200, fig. 9: detail of the wall surface, x 560; fig. 7: x 200, sample TT 18, rep.-no. KoMo 1994 I-514.
- Figs. 8, 11: *Triassospongocyrtis cylindrica* n. sp., holotype, sample Köveskál 6 A, rep.-no. KoMo 1994 I-515, fig. 8: lateral view, x 130, fig. 11: oblique lateral-lower view, x 150.
- Fig. 10: *Conospongocyrtis conica* n. sp., holotype, x 260, sample TT 7, rep.-no. KoMo 1994 I-511.

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- Figs. 1-3, 6, 7, 9: *Triassospongocyrtis longispinosa* n. gen. n. sp.; figs. 1, 2: holotype, sample TT 2, rep.-no. KoMo 1994 I-342, fig. 1: lateral view, x 200, fig. 2: lower view, spicular system, x 260; figs. 3, 6: sample MD 12, rep.-no. KoMo 1994 I-306, fig. 3: lower view, spicular system, x 320, fig. 6: detail of the spicular system, x 720; fig. 7: x 200, sample TT 7, rep.-no. KoMo 1994 I-518, fig. 9: lower view, spicular system, x 400, sample FÖ 110, rep.-no. KoMo 1994 I-307.
- Figs. 4, 8: *Triassospongocyrtis ruesti* n. sp., holotype, sample TT 16, rep.-no. KoMo 1994 I-516, fig. 4: x 130, fig. 8: lower view, x 160.
- Figs. 5, 10: *Triassospongocyrtis yaoi* n. sp., holotype, sample Köveskál 4 A, fig. 5: x 200, fig. 10: lower view, spicular system, x 220.

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- Fig. 1: *Tetraspinocyrtis anisica* n. sp., holotype, x 400, sample FÖ 87, rep.-no. KoMo 1994 I-52.  
Figs. 2, 3, 8: *Tetraspinocyrtis annuloporida* n. sp., sample FÖ 87; figs. 2, 3: rep.-no. KoMo 1994 I-51 A, fig. 2: upper view, x 780, fig. 3: lateral view, x 500; fig. 8: holotype, x 400, rep.-no. KoMo 1994 I-51.  
Figs. 4–6, 10, 12: *Tetraspinocyrtis laevis* n. gen. n. sp., sample FÖ 87; fig. 4: x 420, rep.-no. KoMo 1994 I-403, figs. 5, 6, 10: holotype, rep.-no. KoMo 1994 I-402, figs. 5, 6: two different lateral views, x 440, fig. 10: spicular system; fig. 12: x 400, rep.-no. KoMo 1994 I-941.  
Figs. 7, 9, 11: *Tetraspinocyrtis fassanica* n. sp., holotype, sample VCB, rep.-no. KoMo 1994 I-401, fig. 7: oblique lateral-lower view, x 400, fig. 9: lower view, x 600, fig. 11: lateral view, x 360.

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- Figs. 1–4, 7, 13, 15–18: *Annulotriassocampe campanilis longiporata* n. subsp.; figs. 1, 2: sample FÖ 100 D, rep.-no. KoMo 1994 I-66, fig. 1: x 300, fig. 2: detail of the middle part of the test; figs. 3, 4: sample MD 12, rep.-no. KoMo 1994 I-304, fig. 3: x 300, fig. 4: detail of the middle part of the test, x 720; figs. 7, 15: holotype, sample TT 7, rep.-no. KoMo 1994 I-225, fig. 7: x 300, fig. 15: detail of the apical part, x 690; fig. 13: x 200, sample FÖ 110, rep.-no. KoMo 1994 I-841; fig. 16: x 300, sample FÖ 104, rep.-no. KoMo 1994 I-69; fig. 17: x 200, sample TT 16, rep.-no. KoMo 1994 I-355; fig. 18: x 260, sample FÖ 100 D, rep.-no. KoMo 1994 I-950.  
Figs. 5, 6, 8, 12: *Annulotriassocampe spinosa* n. sp.; figs. 5, 6: holotype, sample TT 7, rep.-no. KoMo 1994 I-824, fig. 5: detail of the apical part, x 600, 6: x 240; fig. 8: x 360, sample TT 5, rep.-no. KoMo 1994 I-869; fig. 12: x 240, sample FÖ 110, rep.-no. KoMo 1994 I-824  
Figs. 9–11: *Annulotriassocampe campanilis campanilis* n. sp.; fig. 9: holotype, x 240, sample FÖ 87, rep.-no. KoMo 1994 I-34; fig. 10: x 240, sample FÖ 87, rep.-no. KoMo 1994 I-34 A, fig. 11: x 260, sample FÖ 100 D, rep.-no. KoMo 1994 I-951.  
Fig. 14: *Annulotriassocampe* cf. *campanilis campanilis* n. sp., x 300, sample MD 1, rep.-no. KoMo 1994 I-837.

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- Fig. 1: *Triassocampe deweveri velata* n. subsp., holotype, x 300, sample TT 5, rep.-no. KoMo 1994 I-774.  
Fig. 2: *Triassocampe postdeweveri* n. sp., holotype, x 240, siliceous Köveskál cemetery section, limestone 0.1 m below sample 4, rep.-no. KoMo 1994 I-743  
Fig. 3: *Triassocampe cylindrica* n. sp., holotype, x 200, sample FÖ 87, rep.-no. KoMo 1994 I-406.  
Fig. 4: *Triassocampe kahleri* n. sp., holotype, x 260, sample FÖ 100 D, rep.-no. KoMo 1994 I-62.  
Figs. 5, 6: *Annulotriassocampe eoladinica* n. sp., sample TT 6, fig. 5: x 200, rep.-no. KoMo 1994 I-830, fig. 6: holotype, x 260, rep.-no. KoMo 1994 I-827.  
Figs. 7, 8, 10, 11: *Paratriassocampe gaetanii* n. gen. n. sp.; fig. 7: x 300, sample MD 28, rep.-no. KoMo 1994 I-764; fig. 8: x 300, sample MD 1, rep.-no. KoMo 1994 I-305; fig. 10: holotype, x 240, sample MD 28, rep.-no. KoMo 1994 I-762; fig. 11: x 240, sample MD 22, rep.-no. KoMo 1994 I-765.  
Fig. 9: *Paratriassocampe* cf. *gaetanii* n. gen. n. sp., x 300, sample MD 1, rep.-no. KoMo 1994 I-822.  
Fig. 12: *Paratriassocampe ornata* n. sp., holotype, 300 x, sample FÖ 87, rep.-no. KoMo 1994 I-35.  
Fig. 13: *Striatotriassocampe* ? n. sp., x 260, sample MD 9, rep.-no. KoMo 1994 I-788.  
Figs. 14, 15: *Paratriassocampe* ? *brevis* n. sp., sample FÖ 110; fig. 14: x 400, rep.-no. KoMo 1994 I-769, fig. 15: holotype, x 360, rep.-no. KoMo 1994 I-768.  
Fig. 16: *Paratriassocampe postornata* n. sp., holotype, x 300, sample FÖ 100 D, rep.-no. KoMo 1994 I-63.

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- Figs. 1, 5, 6: *Pseudotriassocampe hungarica* n. gen. n. sp., sample FÖ 110; figs. 1, 5: rep.-no. KoMo 1994 I-701, fig. 1: x 300, fig. 5: detail from the middle and distal part of the test, x 600; fig. 6: holotype, x 260, rep.-no. KoMo 1994 I-72.  
Fig. 2: *Pseudotriassocampe angustiannulata* n. sp., holotype, x 300, sample FÖ 87, rep.-no. KoMo 1994 I-405.

- Figs. 4, 10: *Striatotriassocampe nodosoannulata* n. gen. n. sp., fig. 4: x 200, sample TT 5, rep.-no. KoMo 1994 I-785, fig. 10: holotype, x 240, sample TT 13, rep.-no. KoMo 1994 I-784.
- Fig. 9: *Pseudotriassocampe longispinosa* n. sp., holotype, x 120, sample TT 6, rep.-no. KoMo 1994 I-702.
- Figs. 3, 7, 8: *Striatotriassocampe laeviannulata* n. sp., holotype; sample MD 28, rep.-no. KoMo 1994 I-787, fig. 3: x, fig. 7: detail of the middle part of the test, x 440, fig. 8: detail of the apical part of the test, x 600.
- Figs. 11, 12, 15, 16: *Pararuesticyrtium ? illyricum* KOZUR & MOSTLER, 1981, fig. 11: x 240, sample MD 22, rep.-no. KoMo 1994 I-769, fig. 12: x 260, sample TT 3, rep.-no. KoMo 1994 I-770; fig. 15: x 240, sample TT 7, rep.-no. KoMo 1994 I-226; fig. 16: x 240, sample LÖ 110 D, rep.-no. KoMo 1994 I-61.
- Fig. 13: *Pararuesticyrtium cf. eofassanicum* n. sp., x 260, sample MD 22, rep.-no. KoMo 1994 I-821 A.
- Fig. 14: *Pararuesticyrtium trettoense* n. sp., holotype, x 220, sample TT 3, rep.-no. KoMo 1994 I-761.

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- Figs. 1–6, 10–12: *Triassocampe scalaris scalaris* DUMITRICA, KOZUR & MOSTLER, 1980; fig. 1: x 260, MD 18, rep.-no. KoMo 1994 I-770, fig. 2: x 200, sample MD 18, rep.-no. KoMo 1994 I-712; fig. 3: x 200, sample TT 7, rep.-no. KoMo 1994 I-748 (see also pl. 45, figs 1, 2 for details of the test); fig. 4: x 220, sample MD 12, rep.-no. KoMo 1994 I-706; fig. 5: x 220, sample MD 2, rep.-no. KoMo 1994 I-276, fig. 6: x 320, sample MD 18, rep.-no. KoMo 1994 I-707; fig. 10: x 240, sample MD 1, rep.-no. KoMo 1994 I-708; fig. 11: x 220, sample MD 18, rep.-no. KoMo 1994 I-711; fig. 12: x 220, sample MD 13, rep.-no. KoMo 1994 I-713.
- Fig. 7: *Triassocampe nishimurai* n. sp., x 200, sample FÖ 110, rep.-no. KoMo 1994 I-770.
- Figs. 8, 9, 13: *Triassocampe scalaris* DUMITRICA, KOZUR & MOSTLER, 1980, advanced forms; fig. 8: x 300, sample TT 13, rep.-no. KoMo 1994 I-740; fig. 9: x 250, sample TT 7, rep.-no. KoMo 1994 I-745 (for details of the middle part of the test see pl. 45, fig. 3); fig. 13: x 200, sample TT 5, rep.-no. KoMo 1994 I-746 (for details of the middle part of the test see pl. 45, fig. 7).
- Fig. 14: *Triassocampe deweveri pauciconstricta* n. subsp., x 240, sample FÖ 110, rep.-no. KoMo 1994 I-773.
- Fig. 15: *Triassocampe transita* n. sp., holotype, 300 x, sample MD 18, rep.-no. KoMo 1994 I-755.
- Figs. 16, 17: *Triassocampe scalaris baloghi* n. subsp.; fig. 16: holotype, x 320, sample FÖ 100 D, rep.-no. KoMo 1994 I-716, fig. 17: x 260, sample MD 1, rep.-no. KoMo 1994 I-711.

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- Figs. 1, 2: *Triassocampe scalaris scalaris* DUMITRICA, KOZUR & MOSTLER, 1980, x 600, sample TT 7, rep.-no. KoMo 1994 I-748 (total view of the specimen see on pl. 44, fig. 3), fig. 1: detail of proximal part of the test, fig. 2: detail of distal part of the test.
- Fig. 3: *Triassocampe scalaris* DUMITRICA, KOZUR & MOSTLER, 1980, advanced form, detail of the middle part of the test, x 600, sample TT 7, rep.-no. KoMo 1994 I-745 (for total view of the specimen see pl. 44, fig. 9).
- Figs. 4, 9–11: *Triassocampe nishimurai* n. sp., sample FÖ 110; fig. 4: x 200, rep.-no. KoMo 1994 I-770; figs. 9–11: holotype, rep.-no. KoMo 1994 I-773, fig. 9: detail of the middle part of the test, x 600, fig. 10: detail of the apical part of the test, x 600, fig. 11: x 260.
- Fig. 5: *Triassocampe longicephalis* n. sp., holotype, x 300, sample TT 13, rep.-no. KoMo 1994 I-752.
- Fig. 6: *Triassocampe deweveri* (NAKASEKO & NISHIMURA, 1979), advanced form, x 260, sample MD 1, rep.-no. KoMo 1994 I-742.
- Fig. 7: *Triassocampe scalaris* DUMITRICA, KOZUR & MOSTLER, 1980, advanced form, detail of the middle part of the test (for total view of the specimen see pl. 44, fig. 13), x 600, sample TT 5, rep.-no. KoMo 1994 I-746.
- Fig. 8: *Triassocampe striata* n. sp., holotype, x 320, sample TT 3, rep.-no. KoMo 1994 I-777.

#### Plate 46

- Figs. 1–4, 12: *Yeharaia transita* n. sp., fig. 1: x 260, sample MD 13, rep.-no. KoMo 1994 I-721; fig. 2: x 260, sample TT 7, rep.-no. KoMo 1994 I-489; figs. 3, 12: holotype, sample MD 13, rep.-no. KoMo 1994 I-310, fig. 3: x 260, fig. 12: detail of the middle part of the test, x 780; fig. 4: x 260, sample MD 12, rep.-no. KoMo 1994 I-953.

- Fig. 5: *Yeharaia lata* n. sp., holotype, sample TT 14, rep.-no. KoMo 1994 I-700.  
 Figs. 6–11, 13: *Yeharaia annulata* NAKASEKO & NISHIMURA, 1979; fig. 6: x 260, sample TT 7, rep.-no. KoMo 1994 I-229, figs. 7, 13: sample TT 14, rep.-no. KoMo 1994 I-487, fig. 7: x 200, fig. 13: detail of the apical part, x 730; fig. 8: x 200, sample MD 21, rep.-no. KoMo 1994 I-329; figs. 9, 11: sample TT 7, rep.-no. KoMo 1994 I-229 A, fig. 9: x 330, fig. 11: detail of the middle portion of the test, x 660, fig. 10: x 260, sample TT 14, rep.-no. KoMo 1994 I-488

#### Plate 47

- Fig. 1: *Triassocampe striata* n. sp., sample TT 7, x 300, rep.-no. KoMo 1994 I-778.  
 Fig. 2: *Triassocampe scalaris scalaris* DUMITRICA, KOZUR & MOSTLER, 1980, sample MD 28, x 200, rep.-no. KoMo 1994 I-749.  
 Fig. 3: *Triassocampe scalaris scalaris* DUMITRICA, KOZUR & MOSTLER, 1980, primitive form, sample FÖ 100 D, x 240, rep.-no. KoMo 1994 I-717.  
 Figs. 4, 5: *Yeharaia annulata* NAKASEKO & NISHIMURA, 1979, x 400; fig. 4: sample FÖ 100 D, rep.-no. KoMo 1994 I-490, fig. 5: sample FÖ 110, rep.-no. KoMo 1994 I-491.  
 Fig. 6: *Oertlispongos inaequispinosus inaequispinosus* DUMITRICA, KOZUR & MOSTLER, 1980, sample MIETTO, red nodular limestones immediately above the pietra verde of the San Ulderico section (MIETTO & PETRONI, 1979), x 100, rep.-no. KoMo 1994 I-551 A.  
 Fig. 7: *Oertlispongos inaequispinosus* DUMITRICA, KOZUR & MOSTLER, 1980, sample FÖ 110, x 220, rep.-no. KoMo 1994 I-537.  
 Fig. 8: *Oertlispongos aspinosus* n. sp., sample OB 45, equivalents of the early Fassanian *reitzei* Zone (about middle part) from a microfauna with *Paragondolella alpina* (KOZUR & MOSTLER), 3.25 m above the Late Anisian crinoidal sparites, x 130, rep.-no. KoMo 1994 I-395.  
 Fig. 9: *Ladinocampe annuloperforata* n. sp., x 200, sample MD 28, rep.-no. KoMo 1994 I-499.  
 Fig. 10: *Triassocampe cylindrica* n. sp., long morphotype, x 260, sample FÖ 87, rep.-no. KoMo 1994 I-407.  
 Fig. 11: *Paroertlispongos hermi* (LAHM, 1984), x 130, sample FD 17, x 130, rep.-no. KoMo 1994 I-377 A.  
 Figs. 12, 13: *Anisicyrtis cf. mocki* n. sp., spewcimen with rather distinct outer layer, sample FÖ 87, rep.-no. KoMo 1994 I-55 A, fig. 12: x 360, fig. 13: spicular system, x 1800.

Plate 1

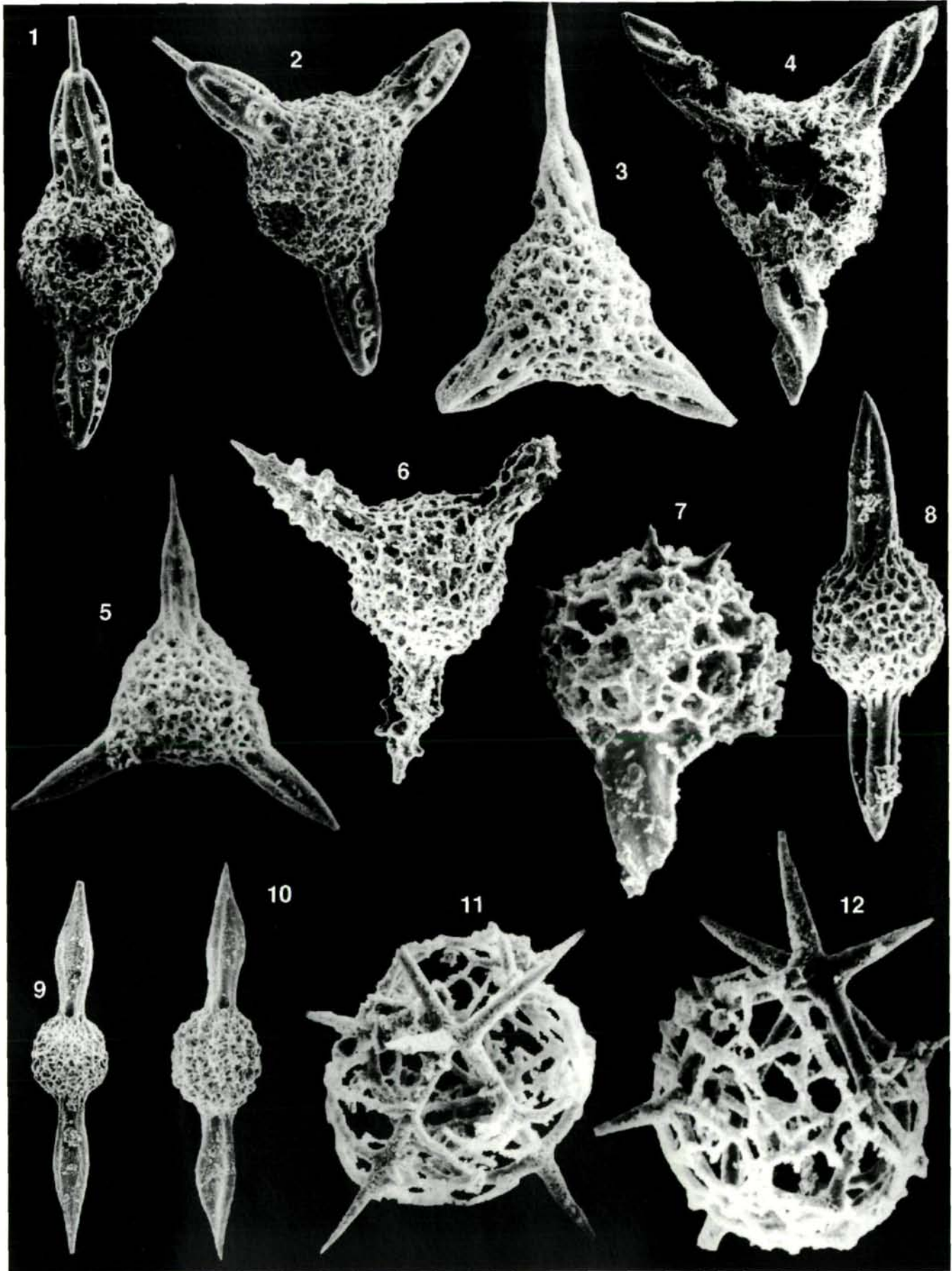




Plate 2

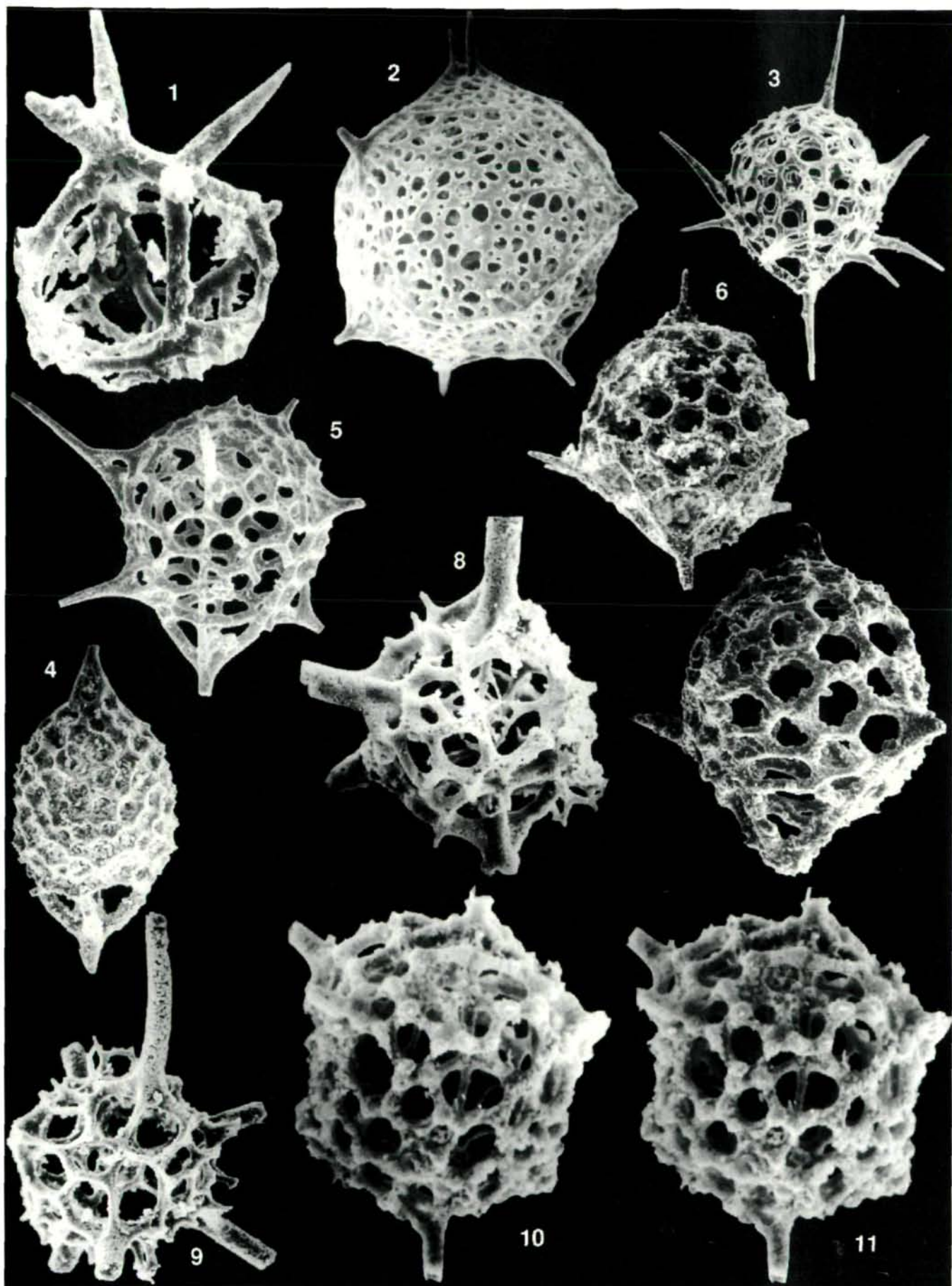


Plate 3

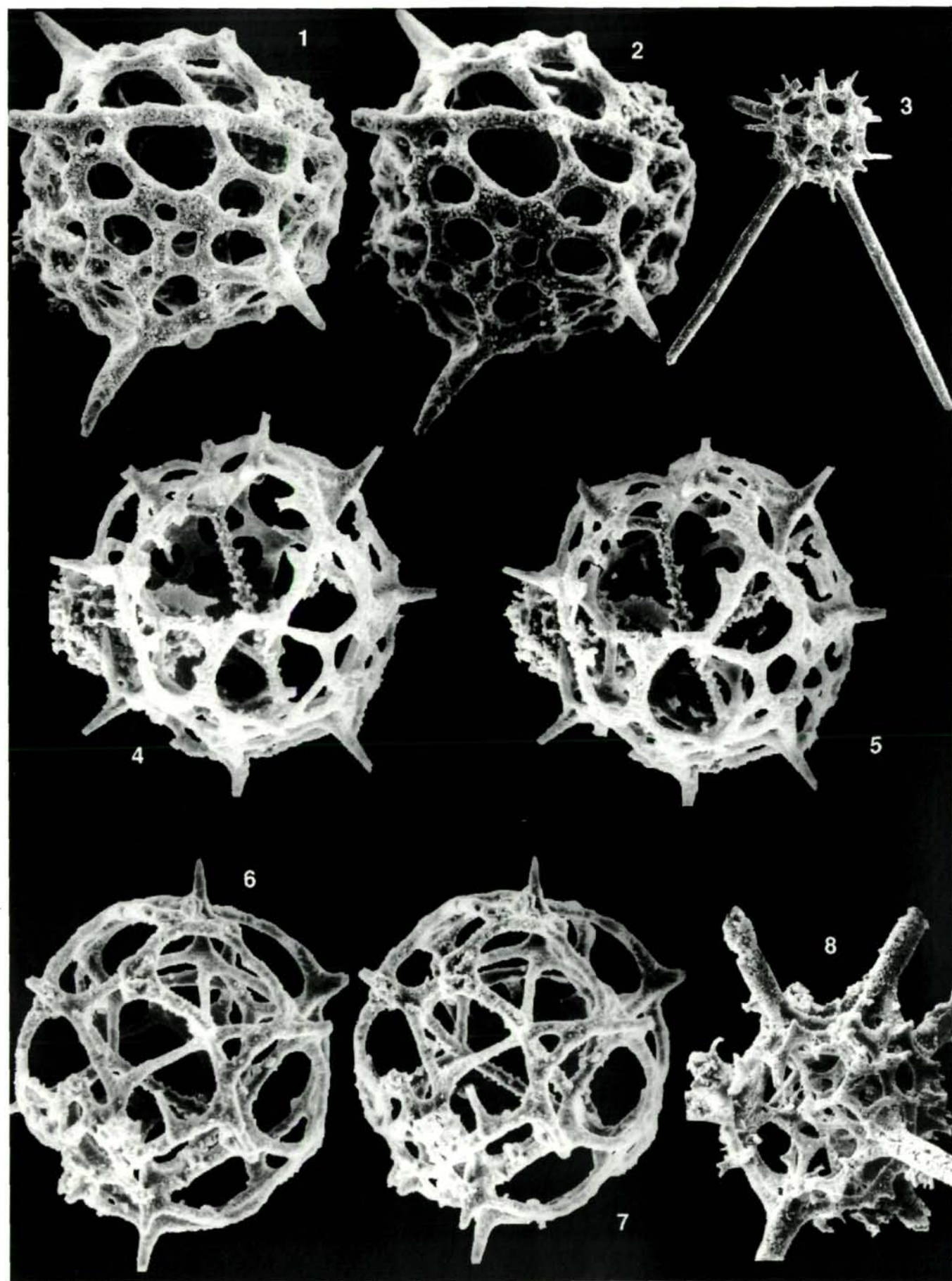




Plate 4

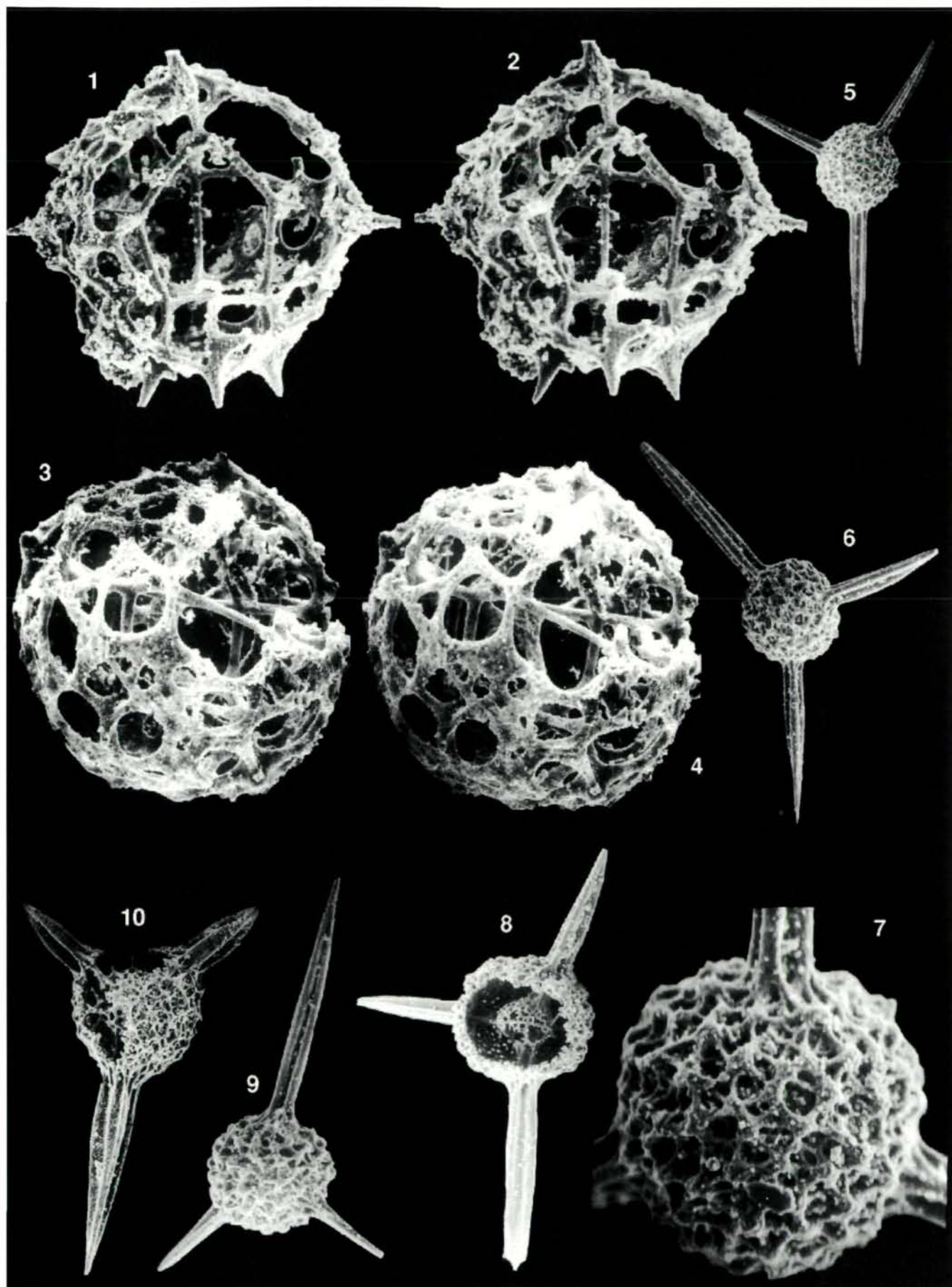


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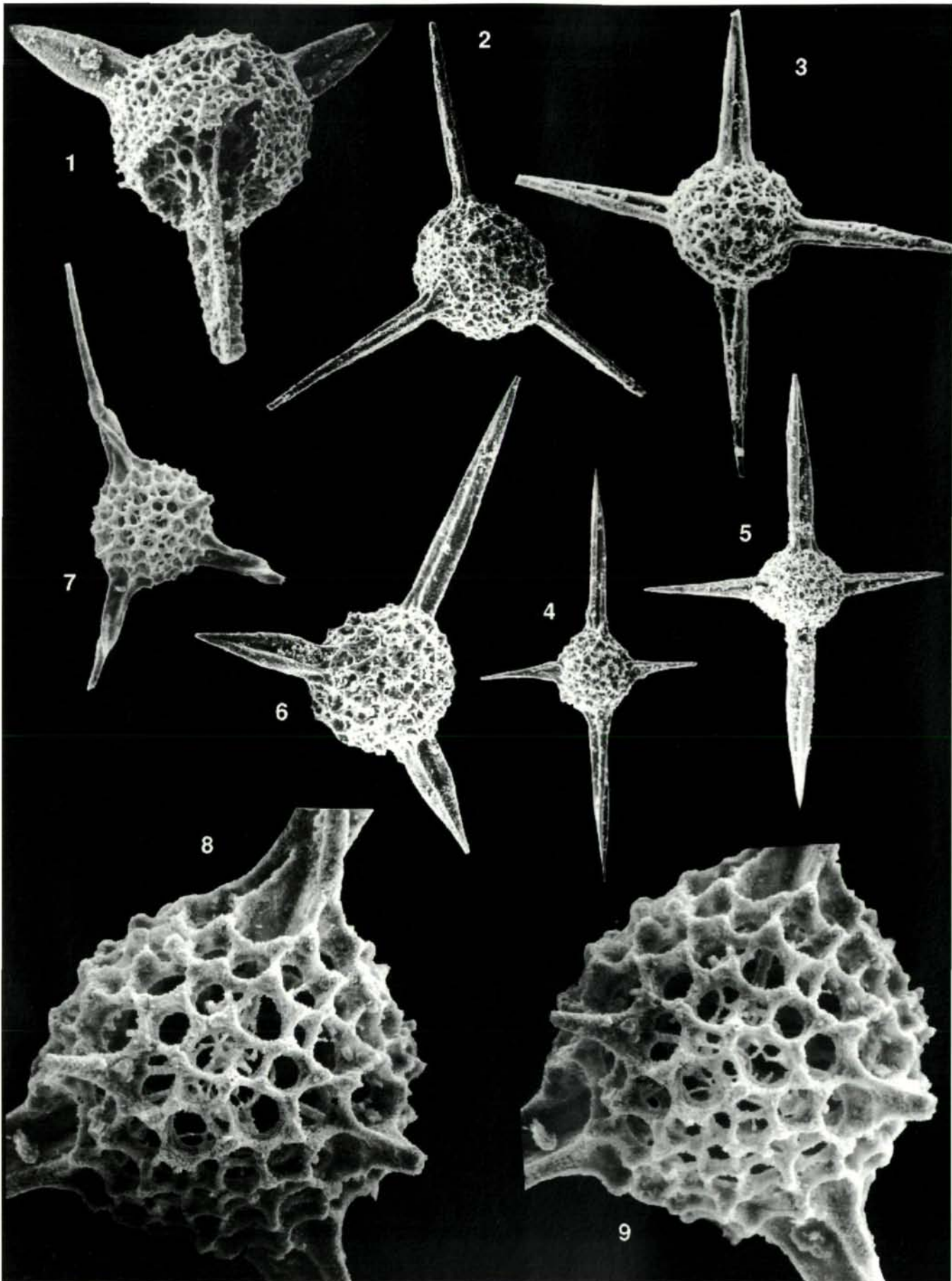




Plate 6

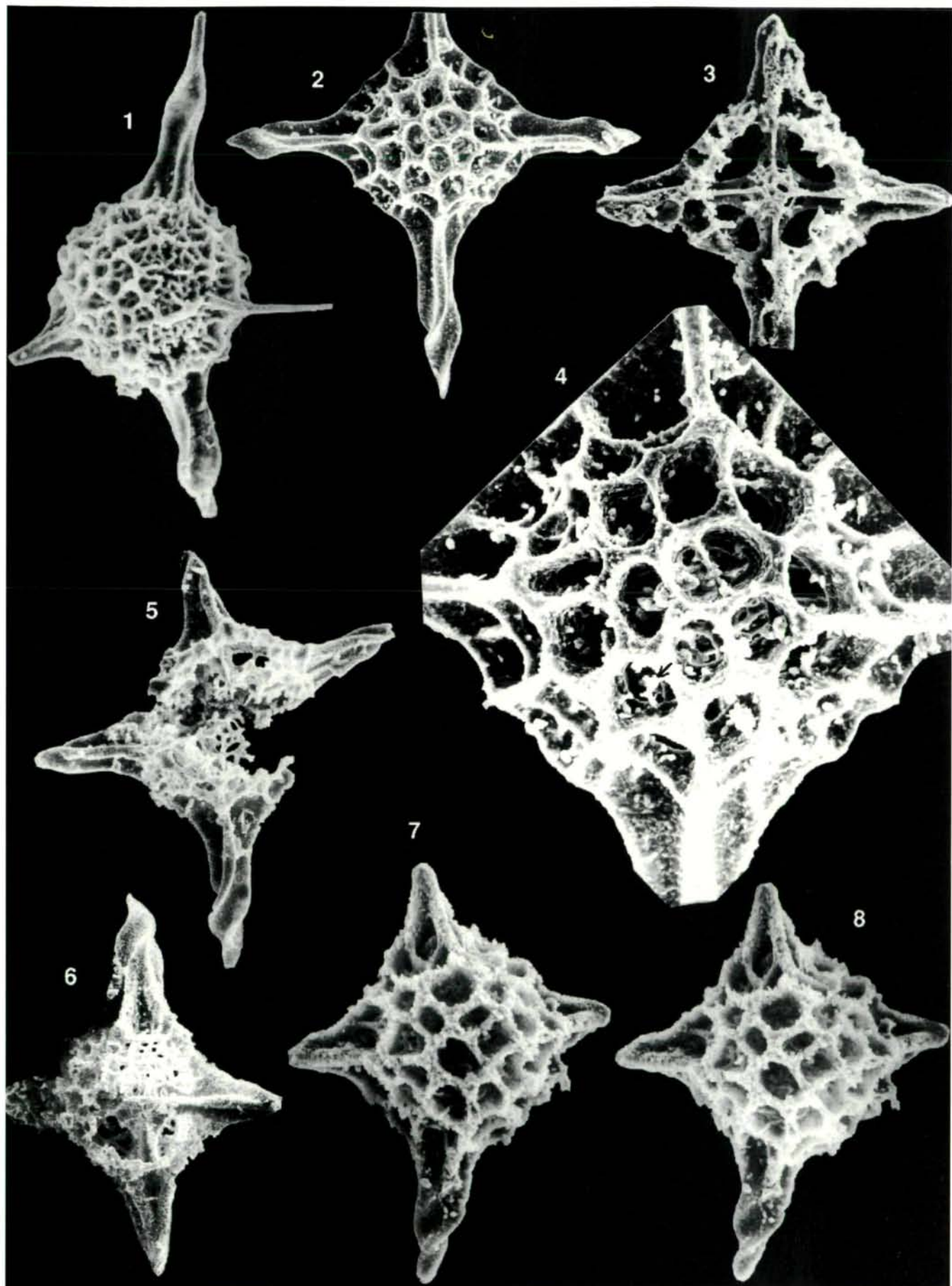


Plate 7

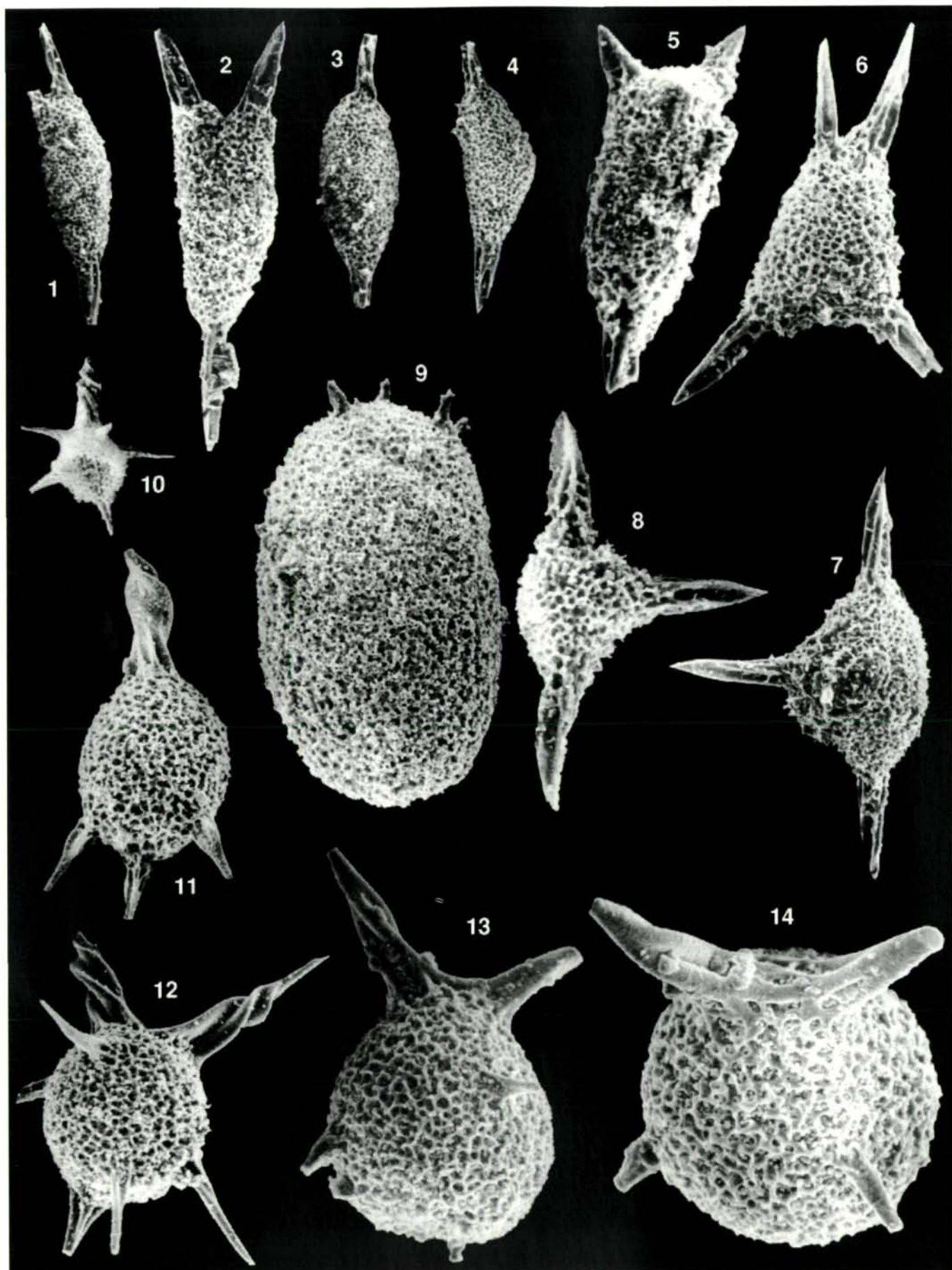




Plate 8

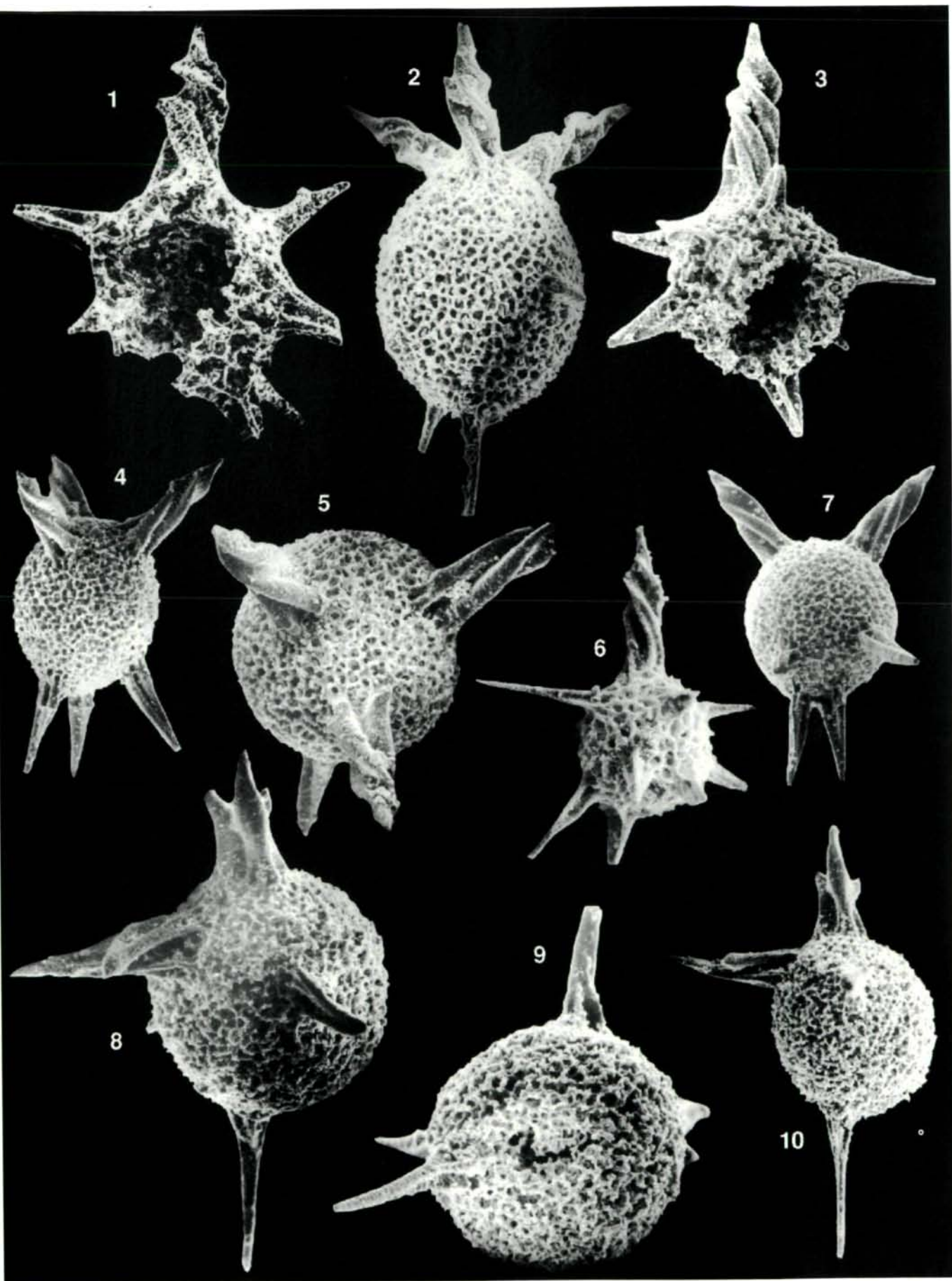


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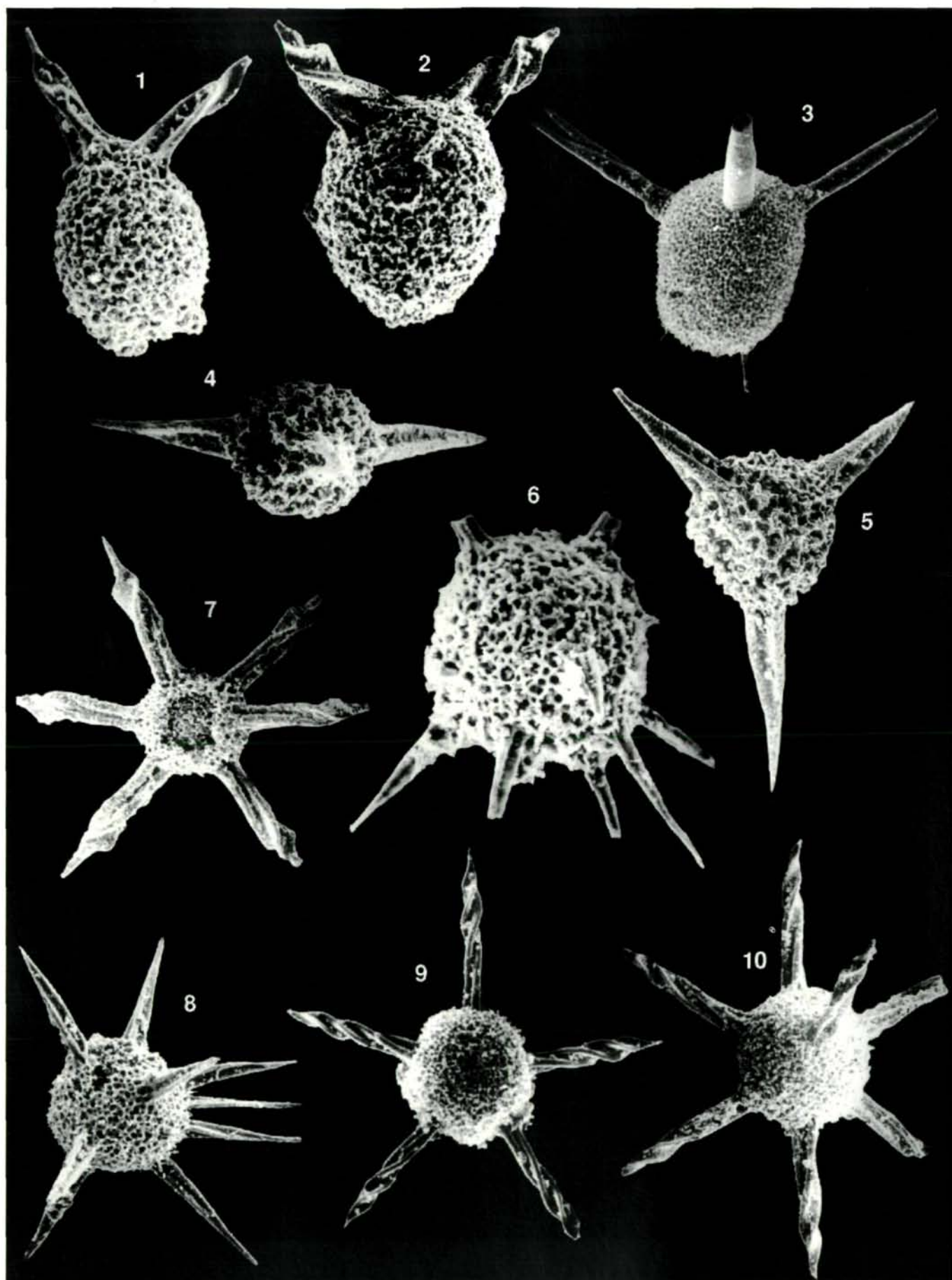




Plate 10

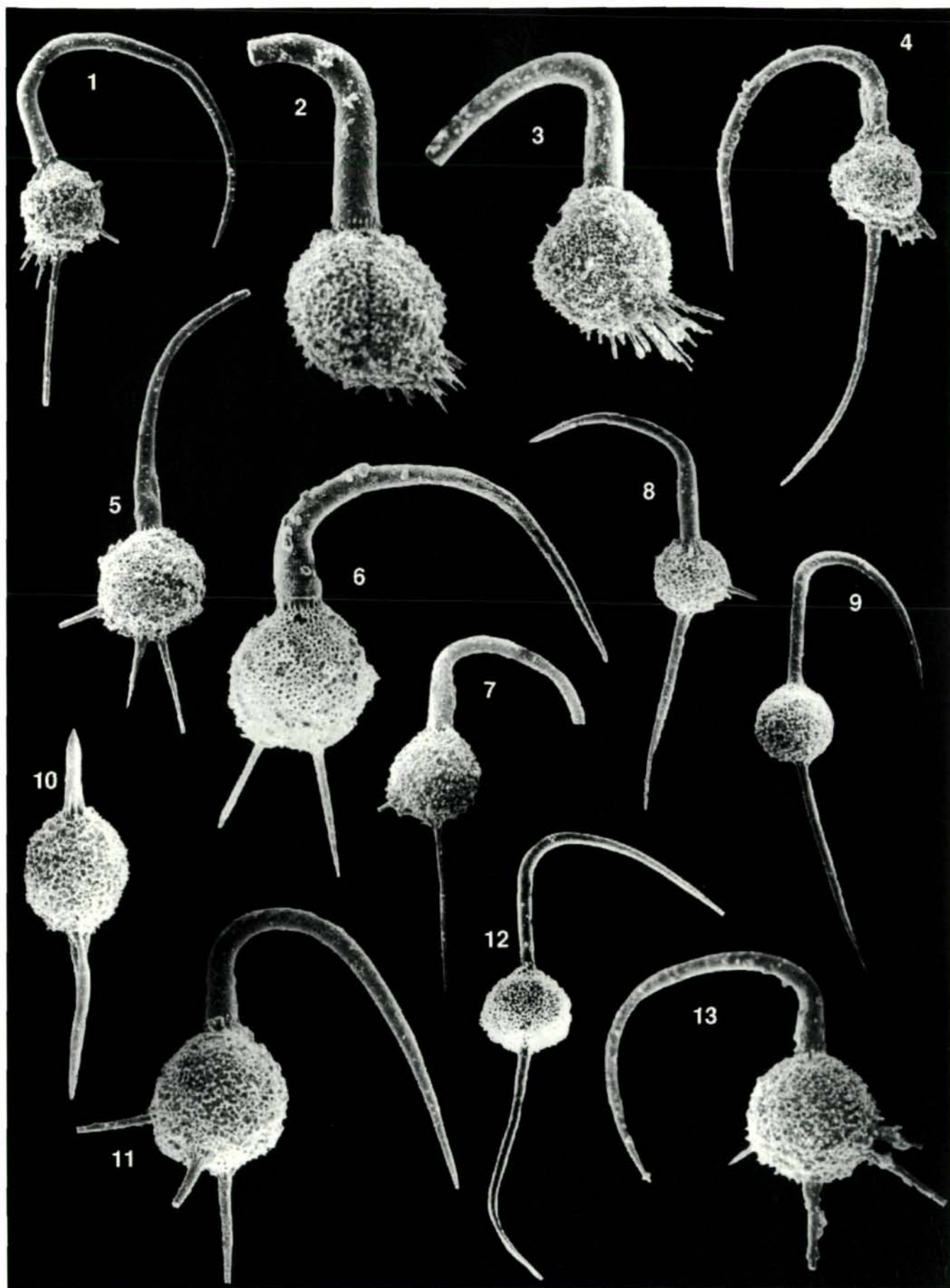


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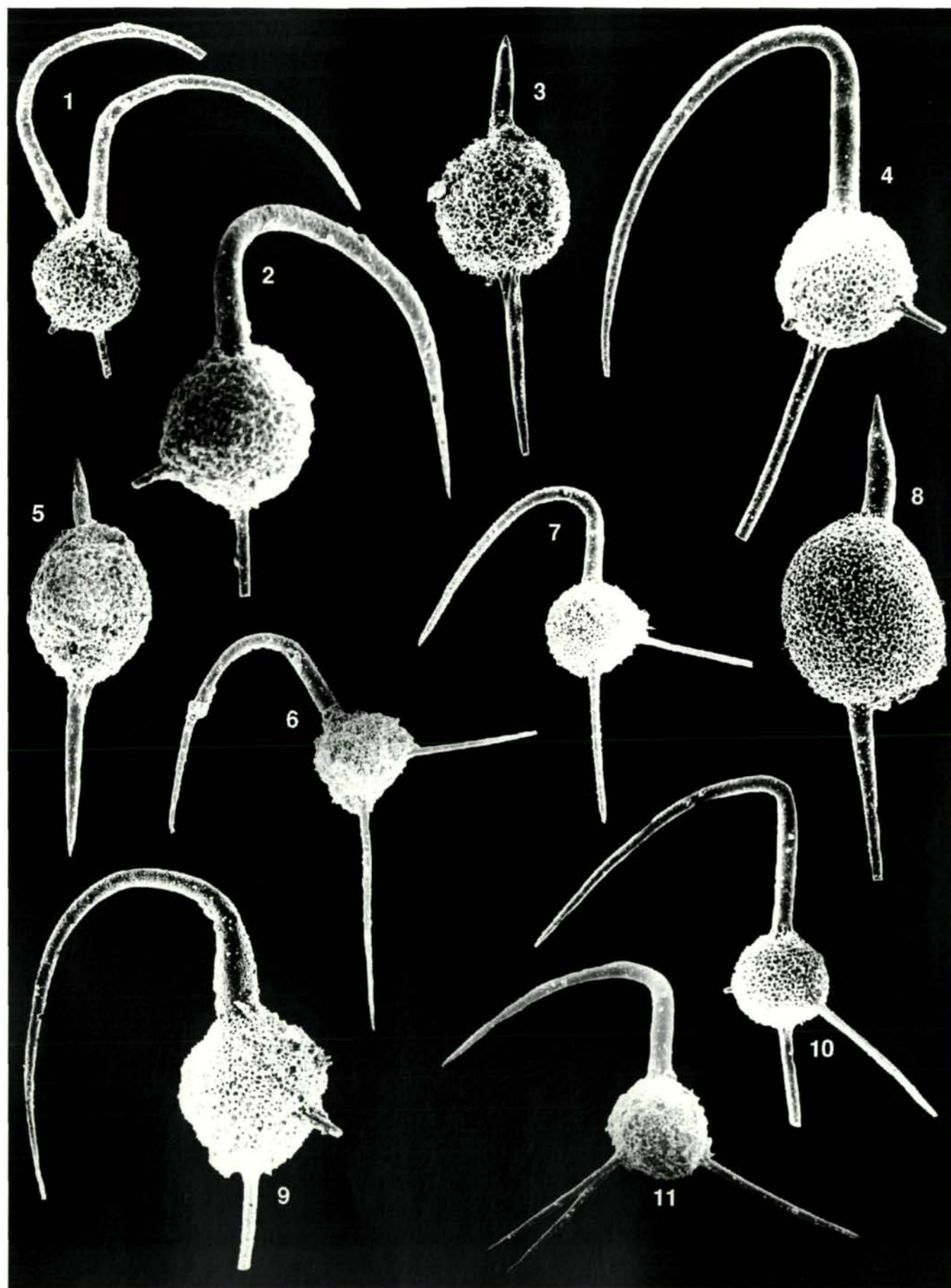




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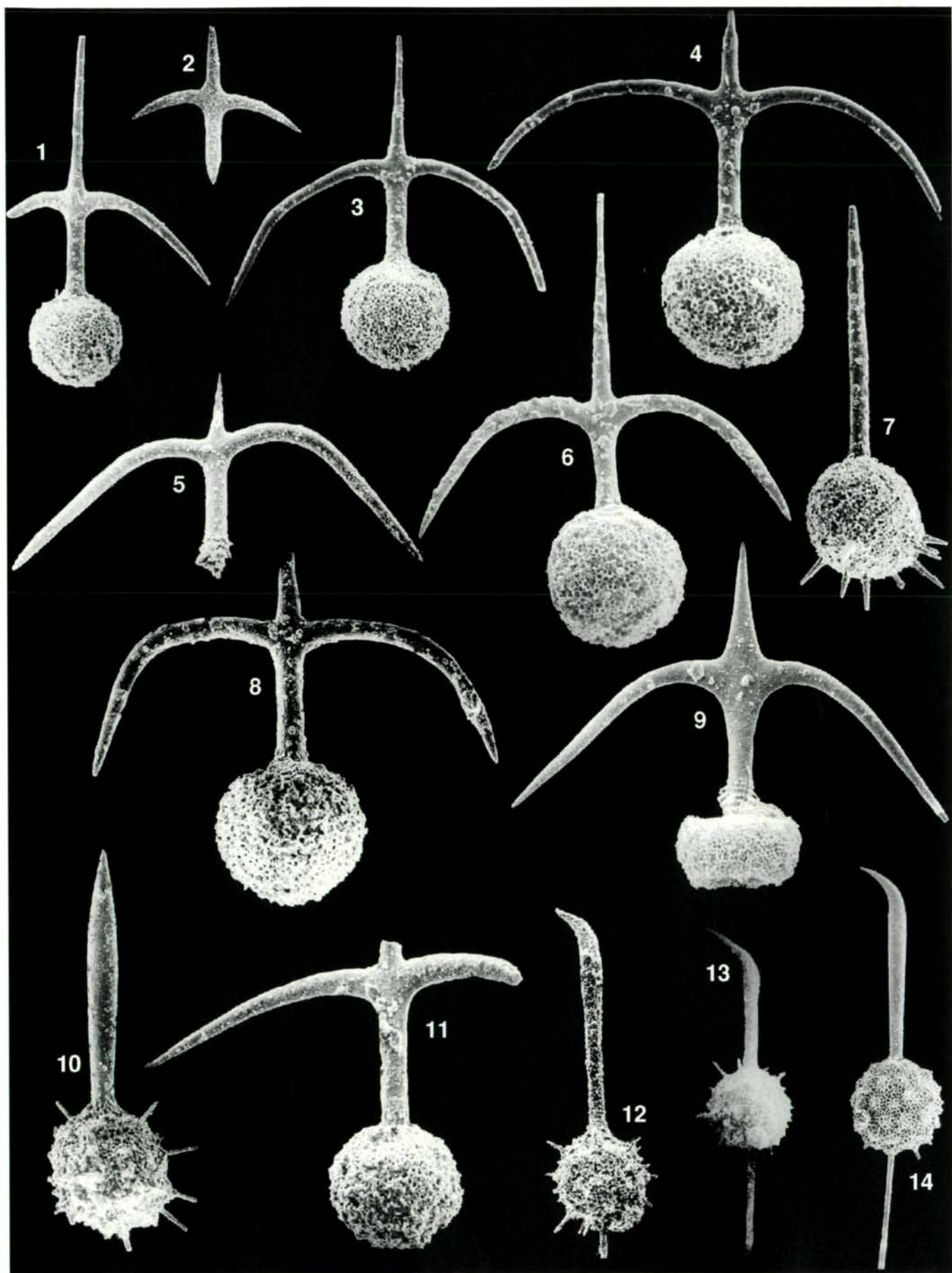


Plate 13

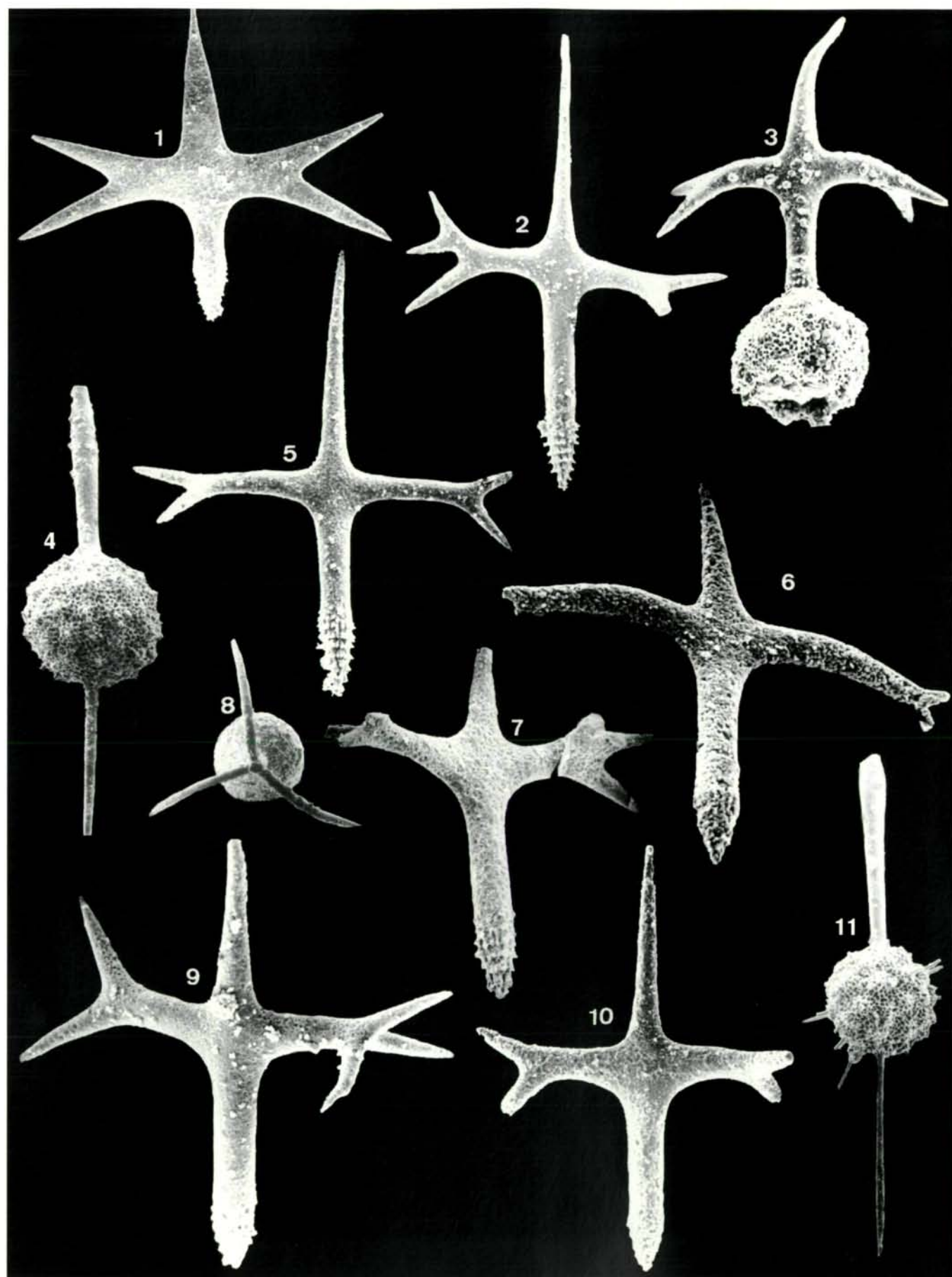


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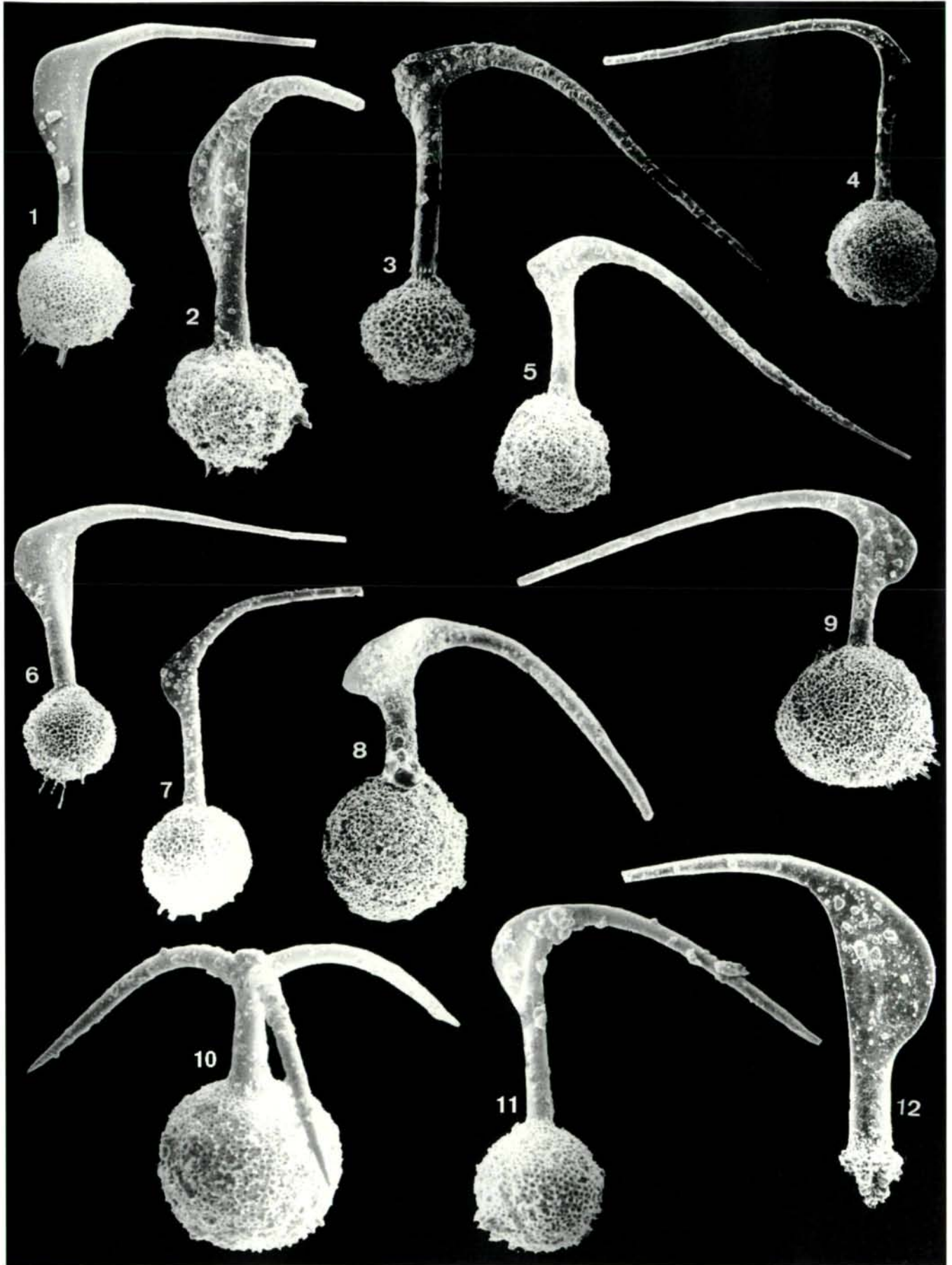




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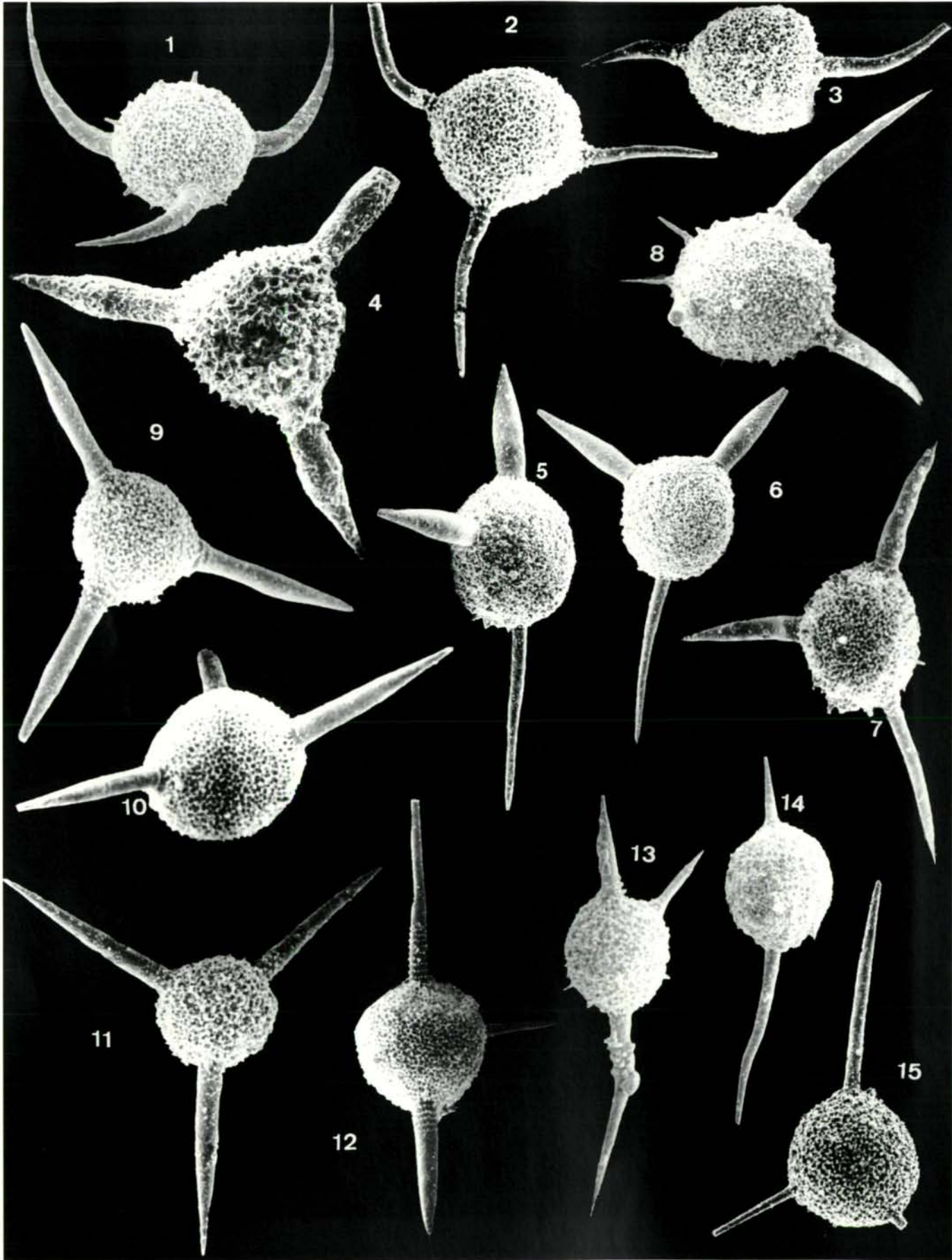


Plate 16

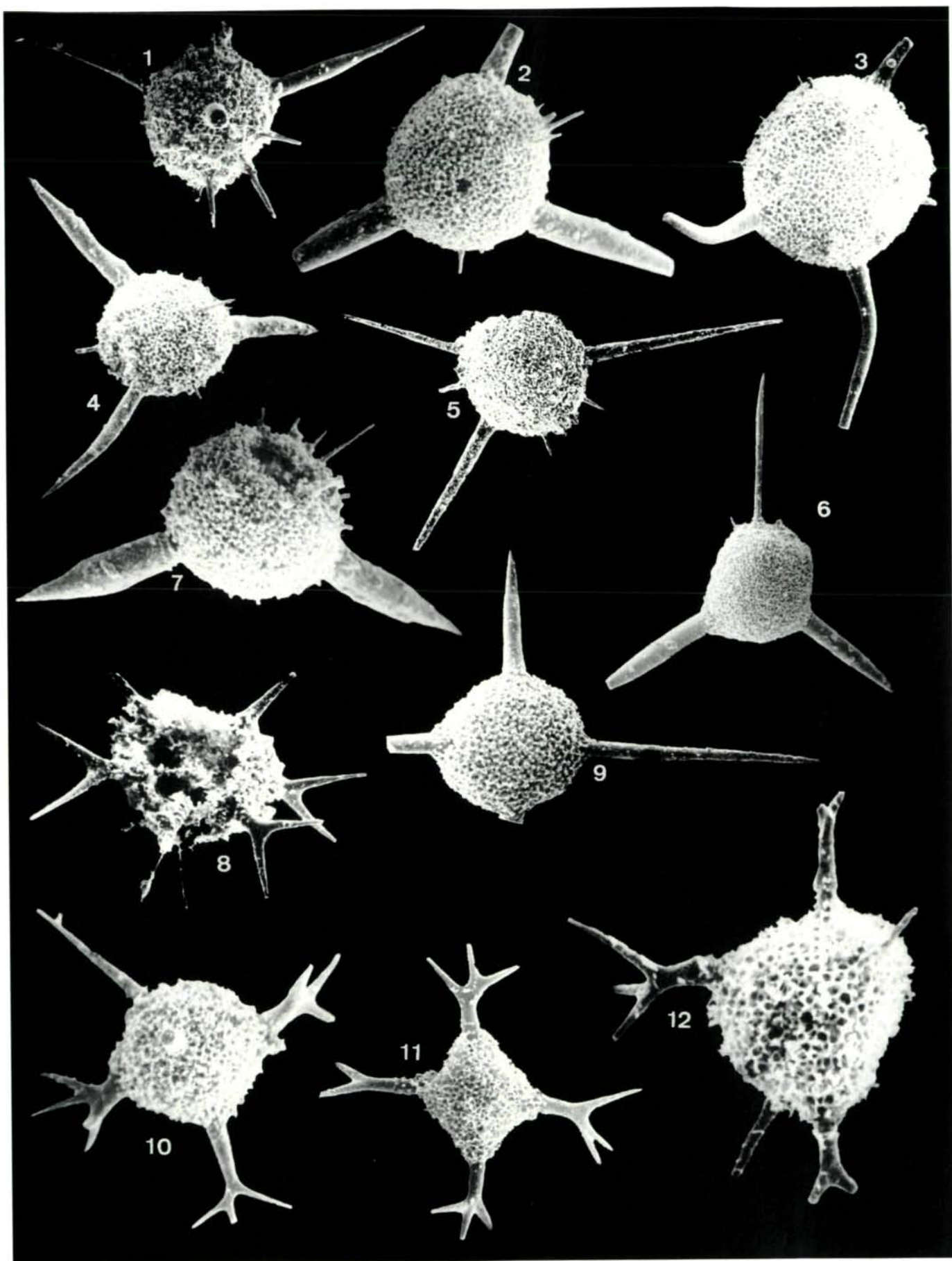
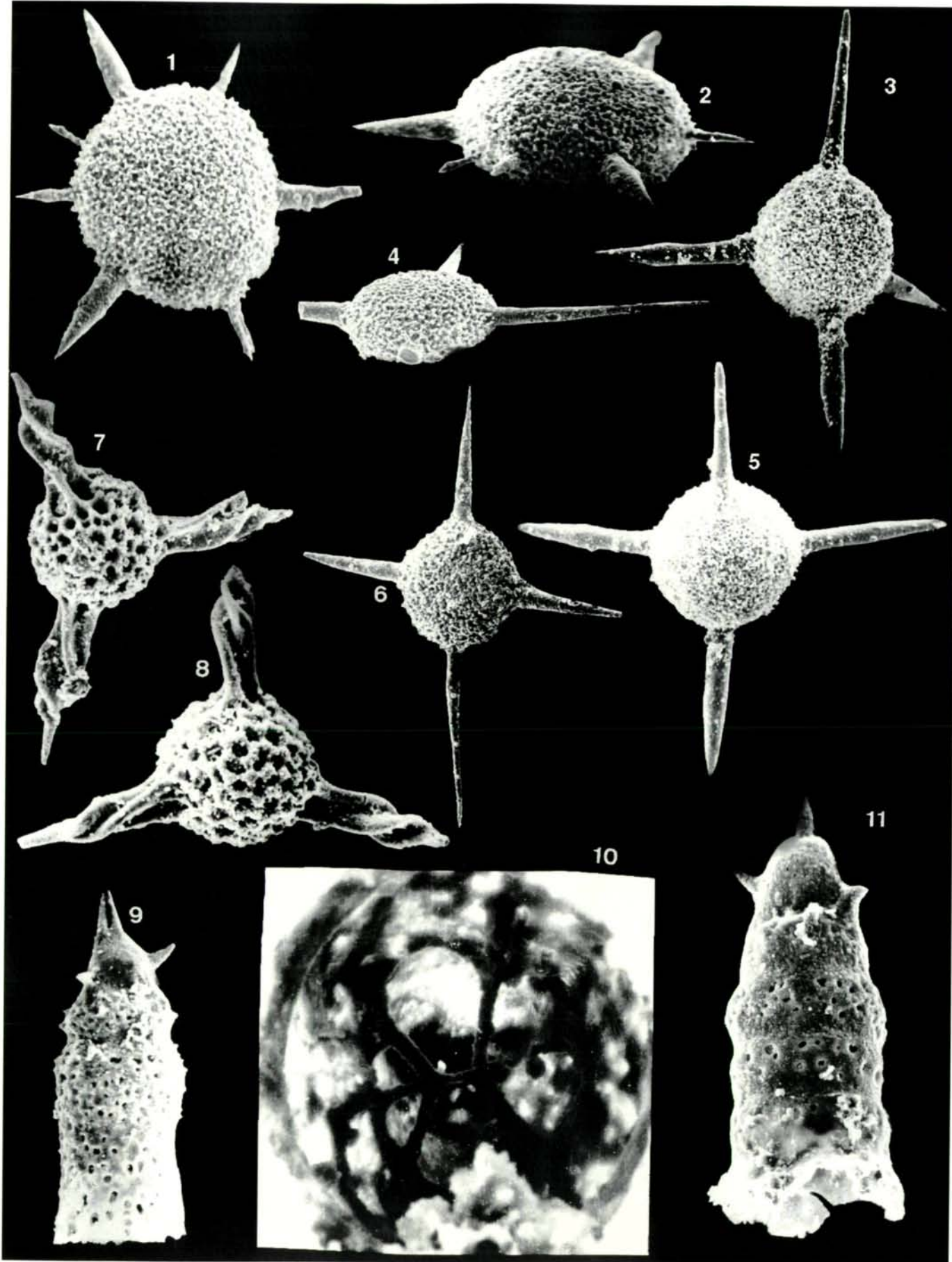




Plate 17



# Plate 18

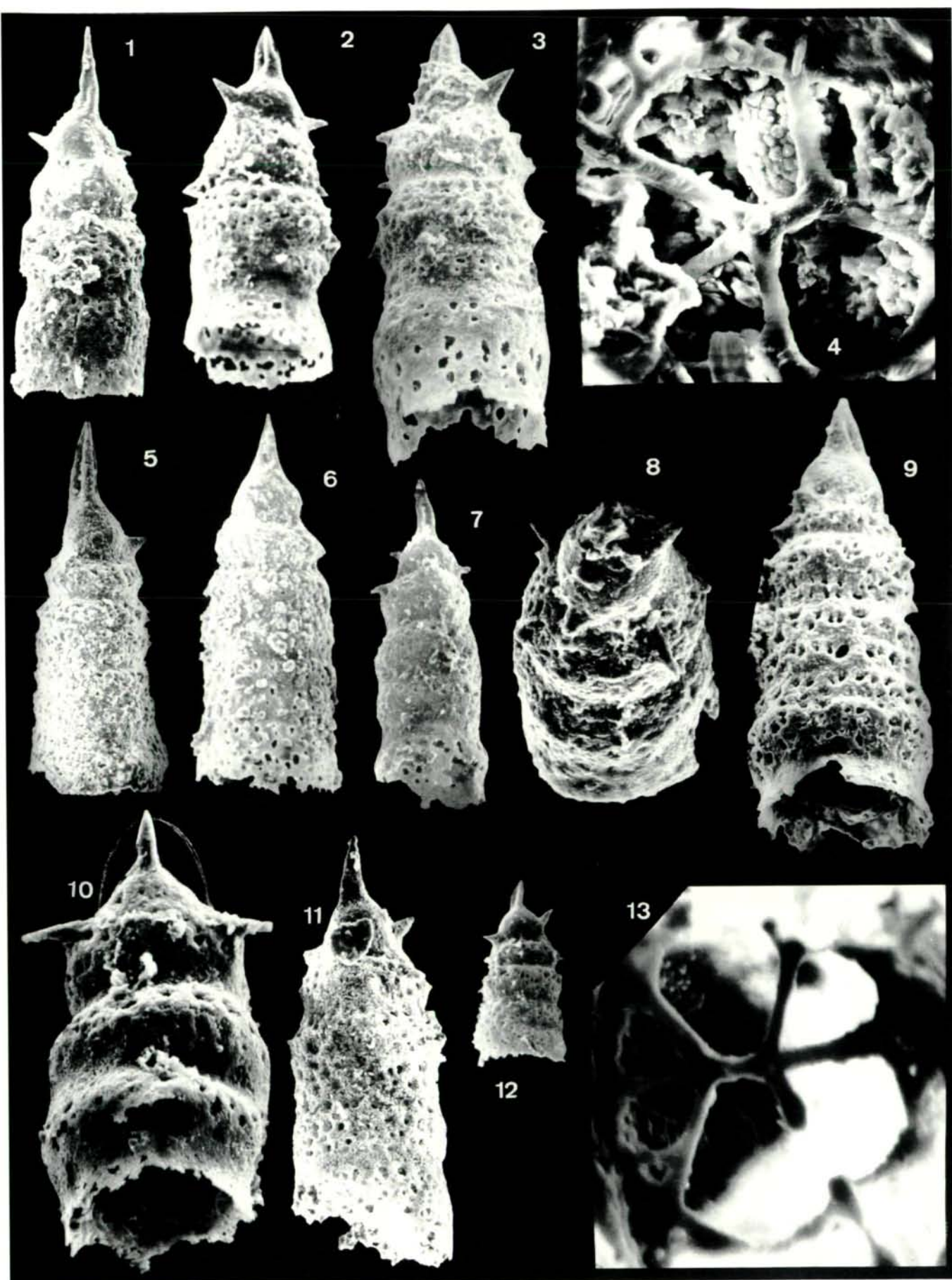




Plate 19

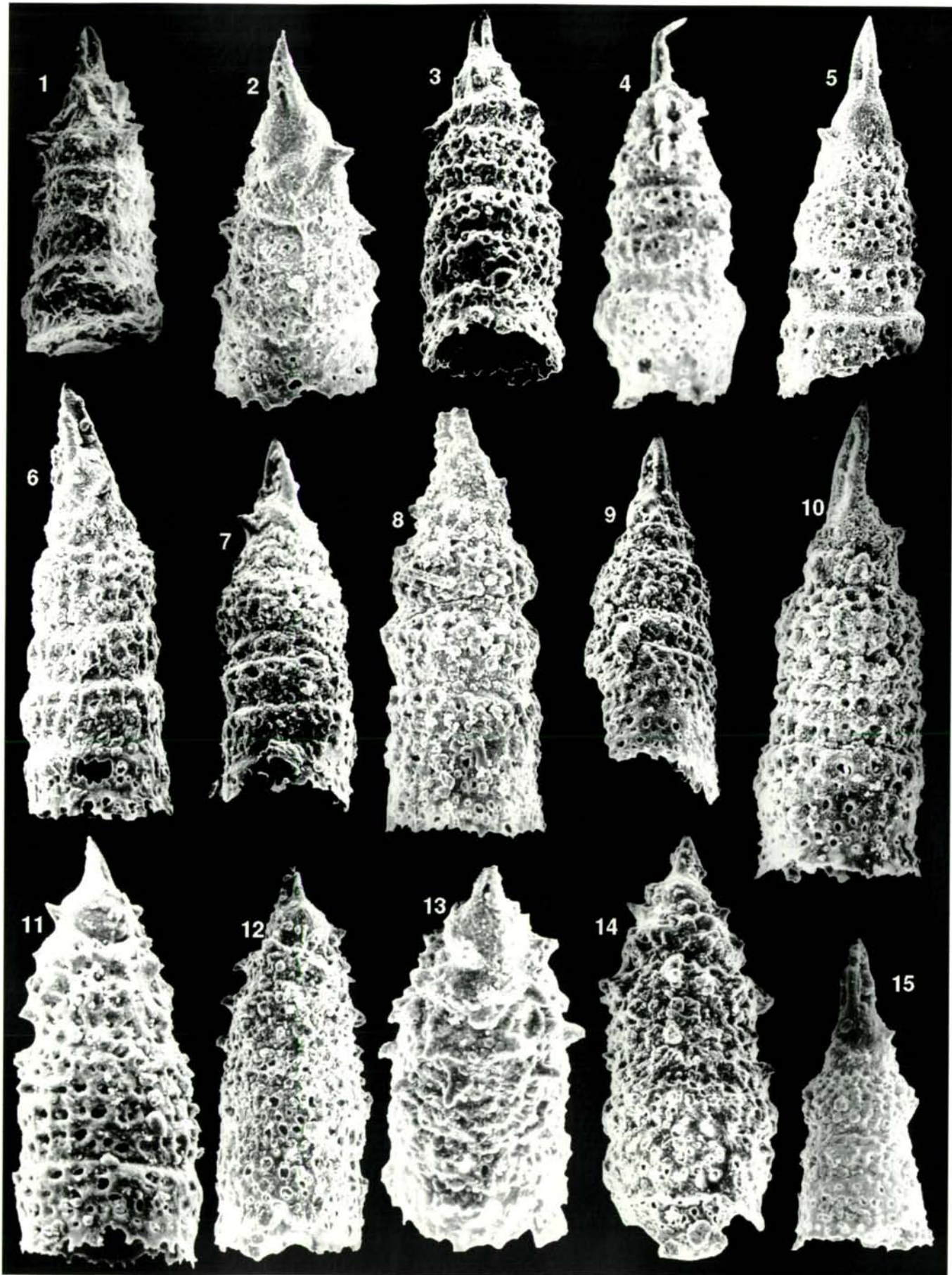
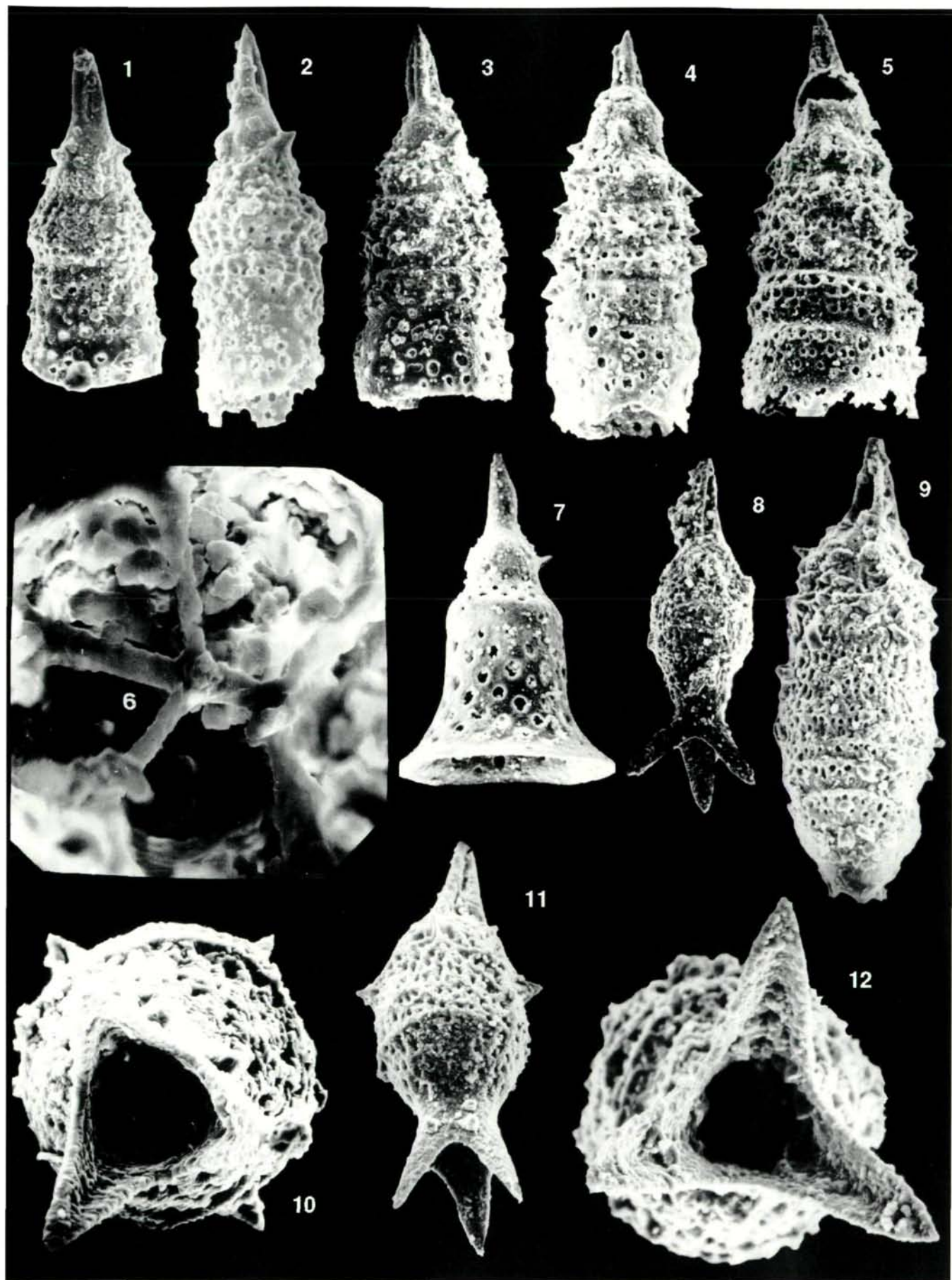




Plate 20



# Plate 21

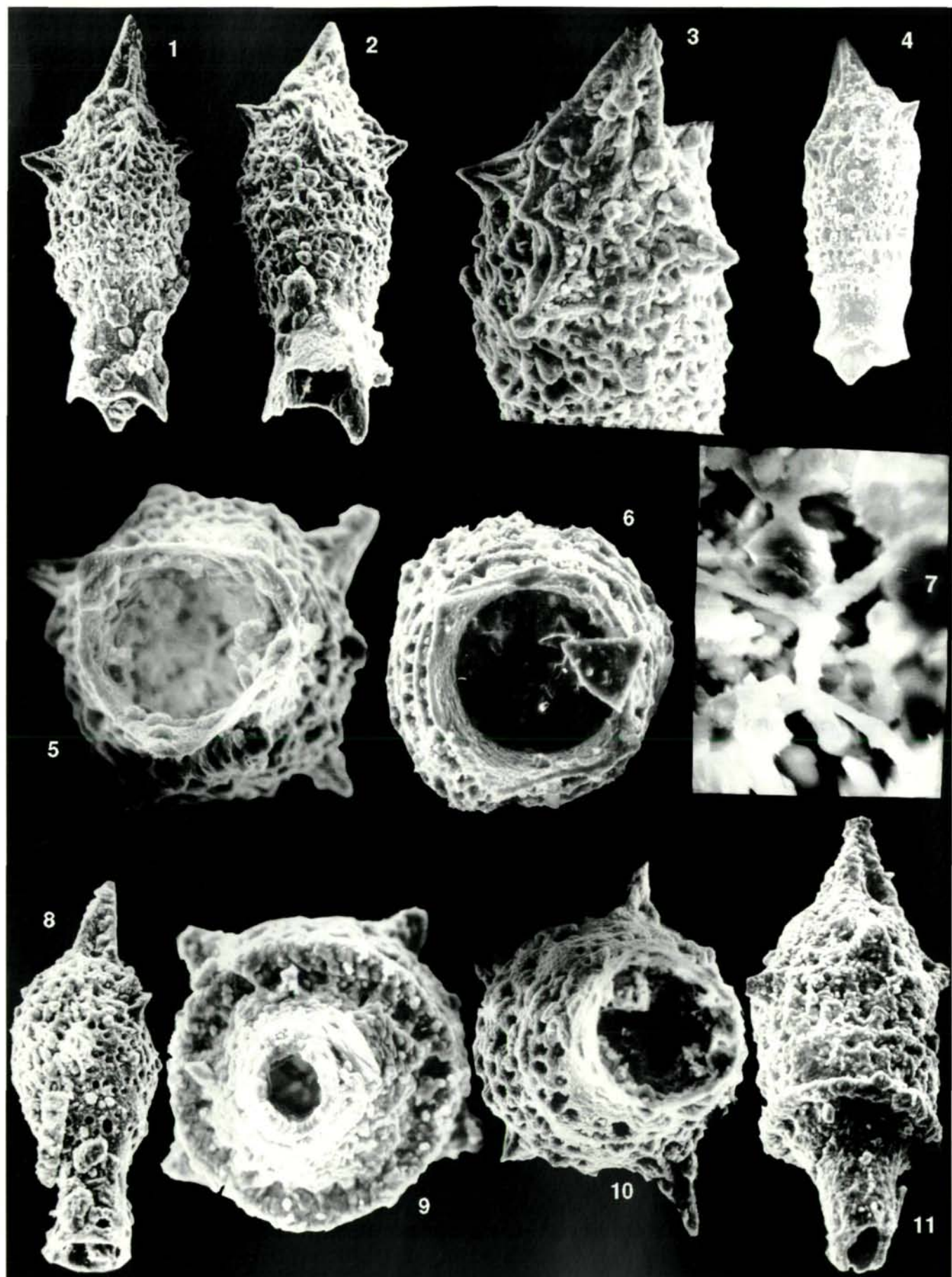




Plate 22

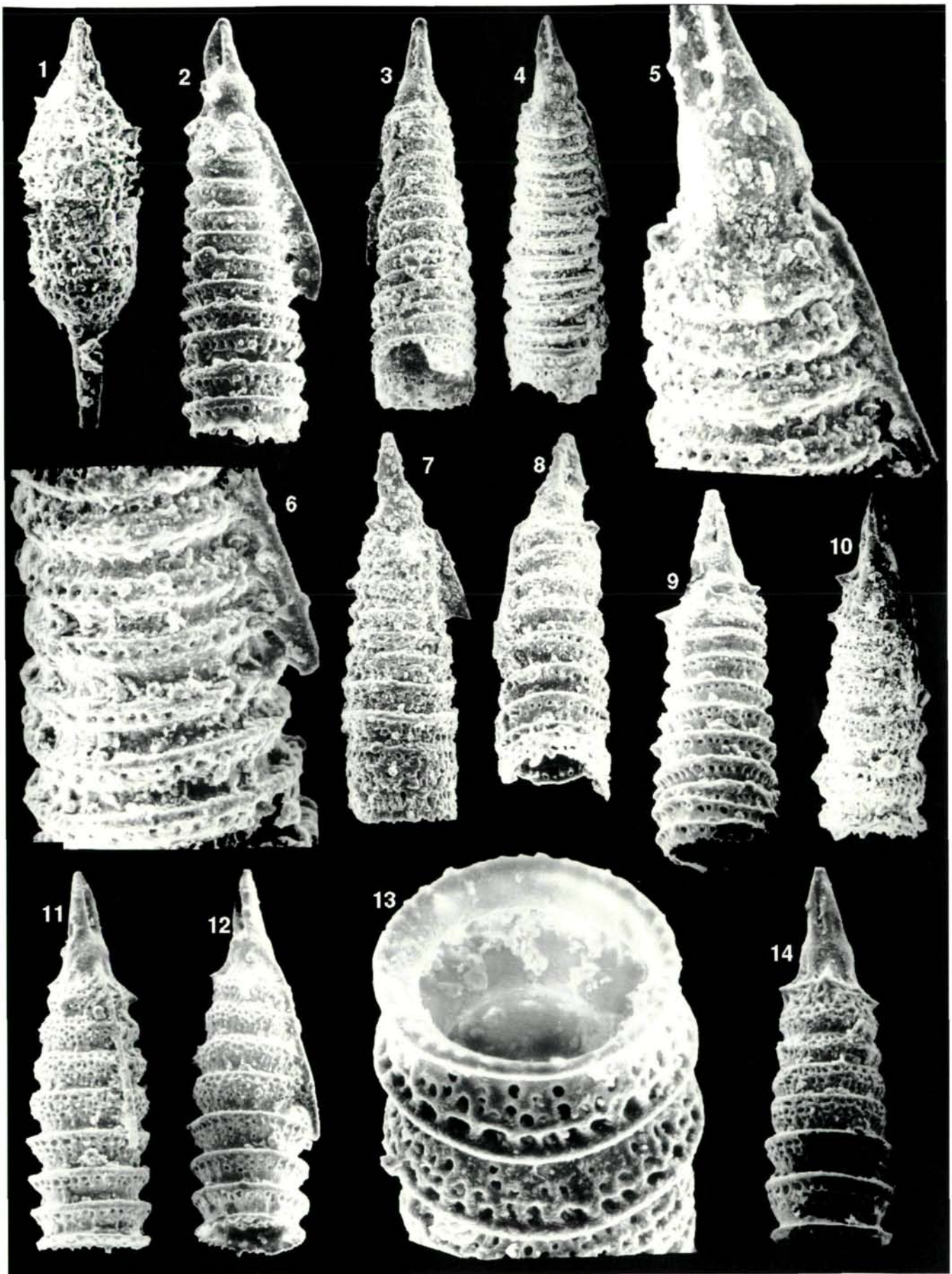




Plate 23

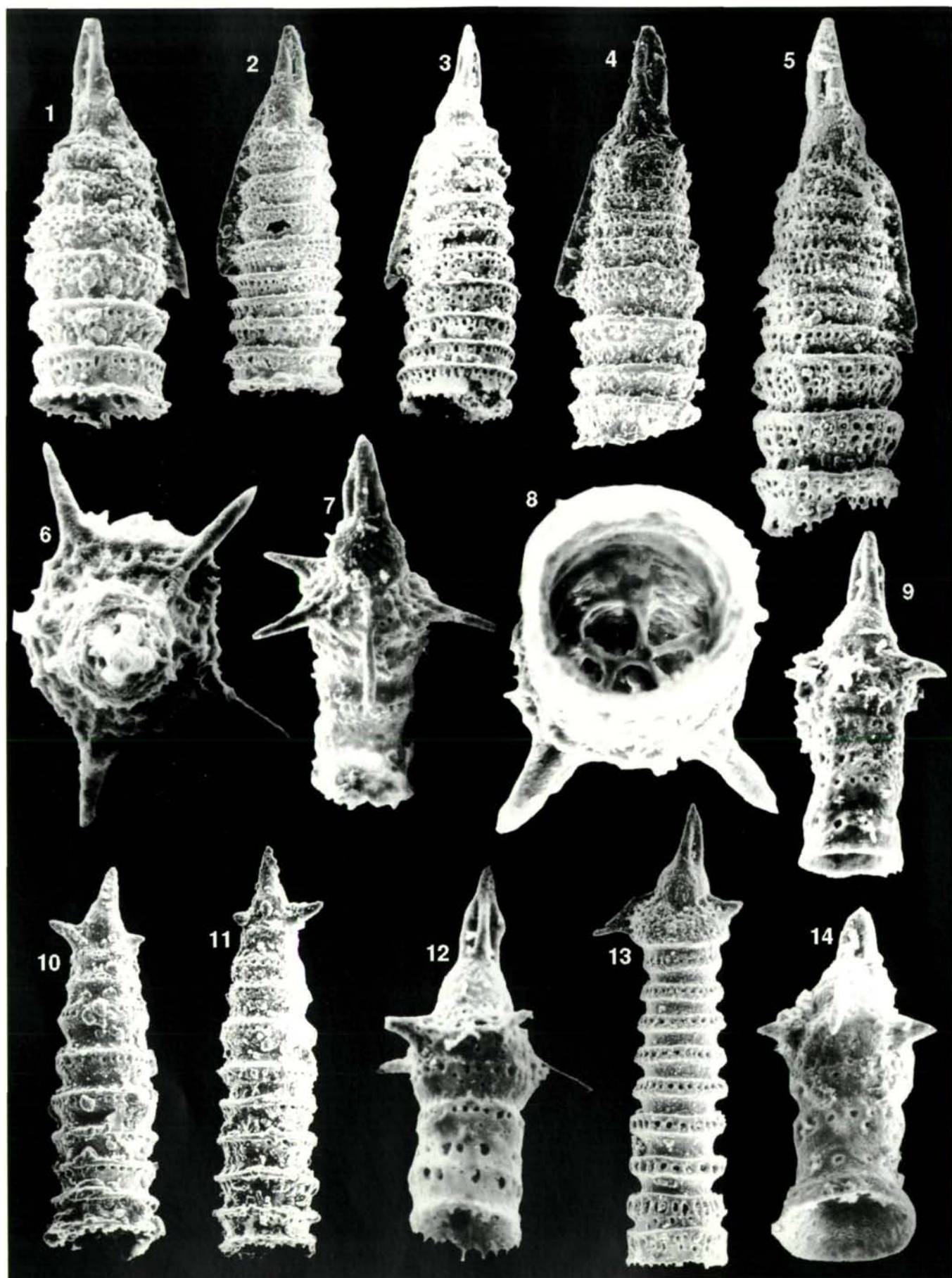


Plate 24

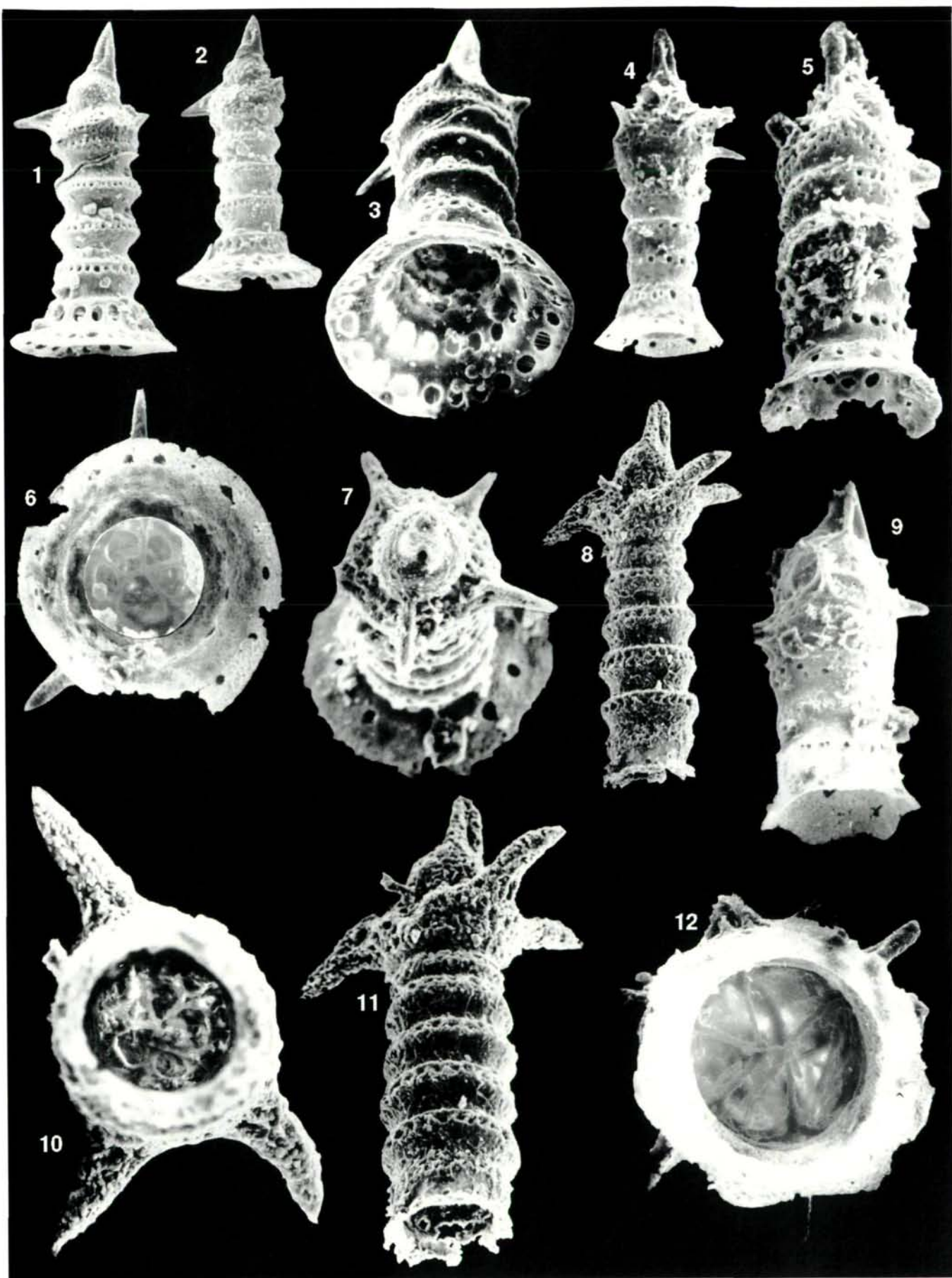
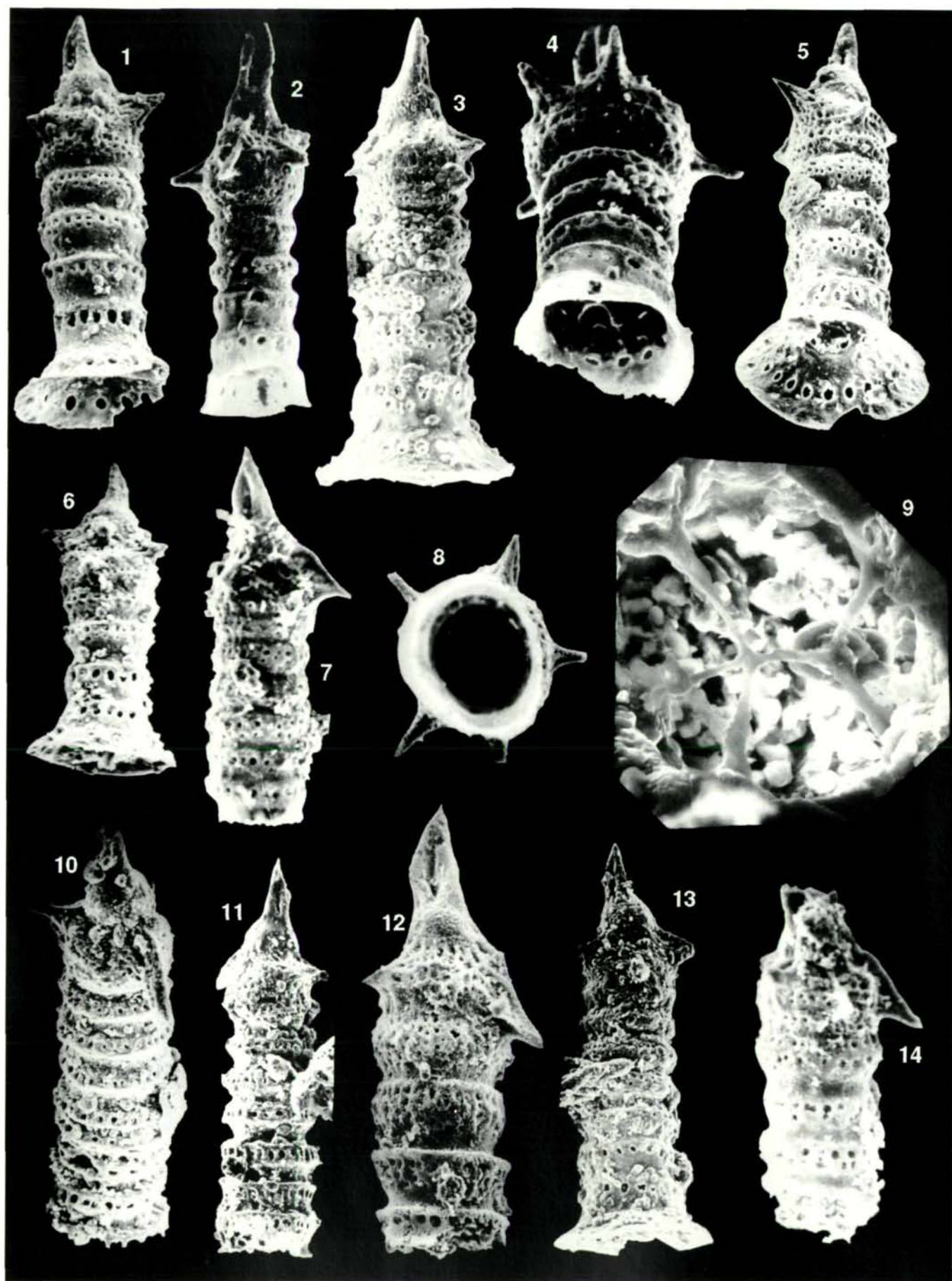
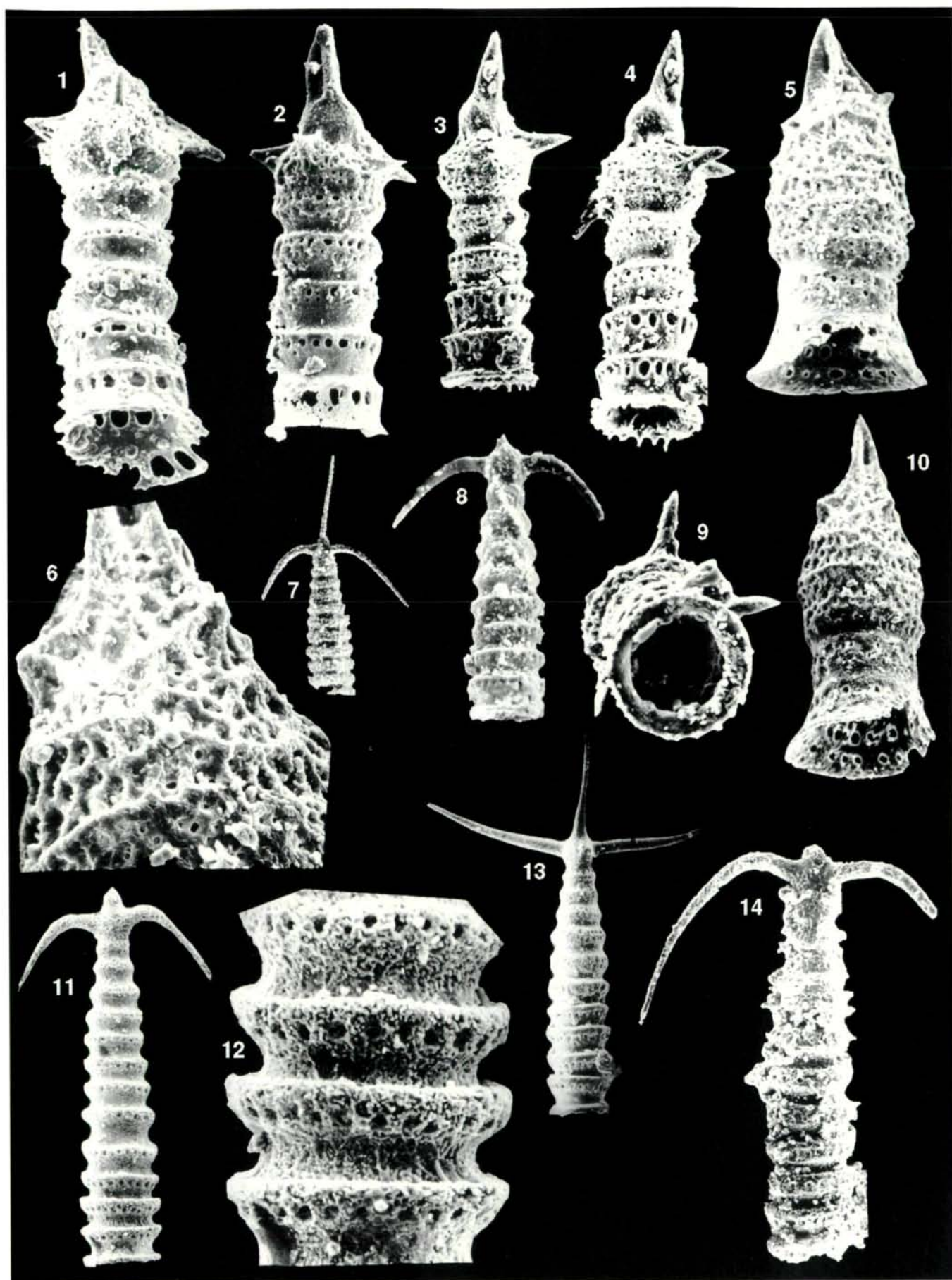




Plate 25







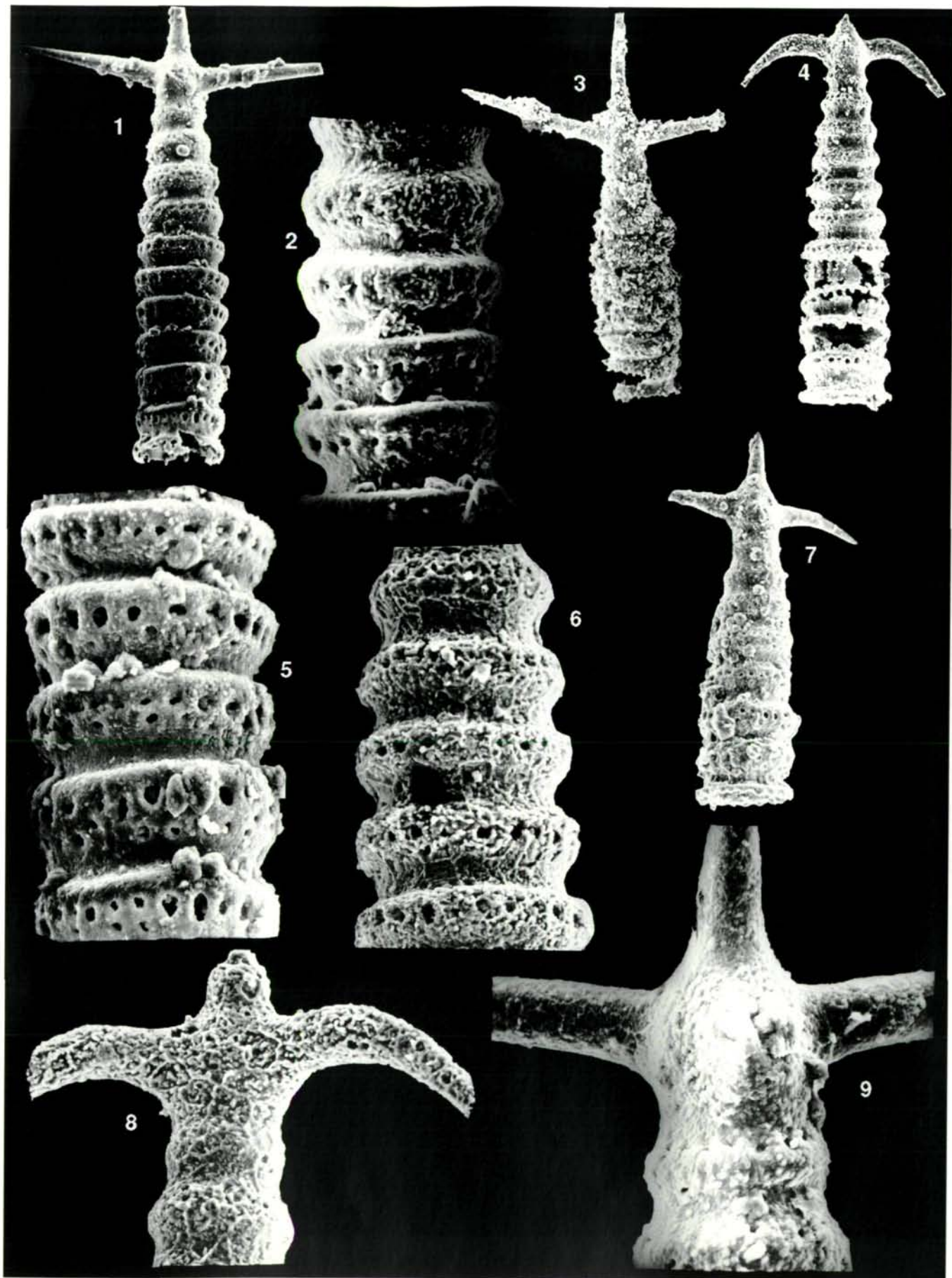




Plate 28

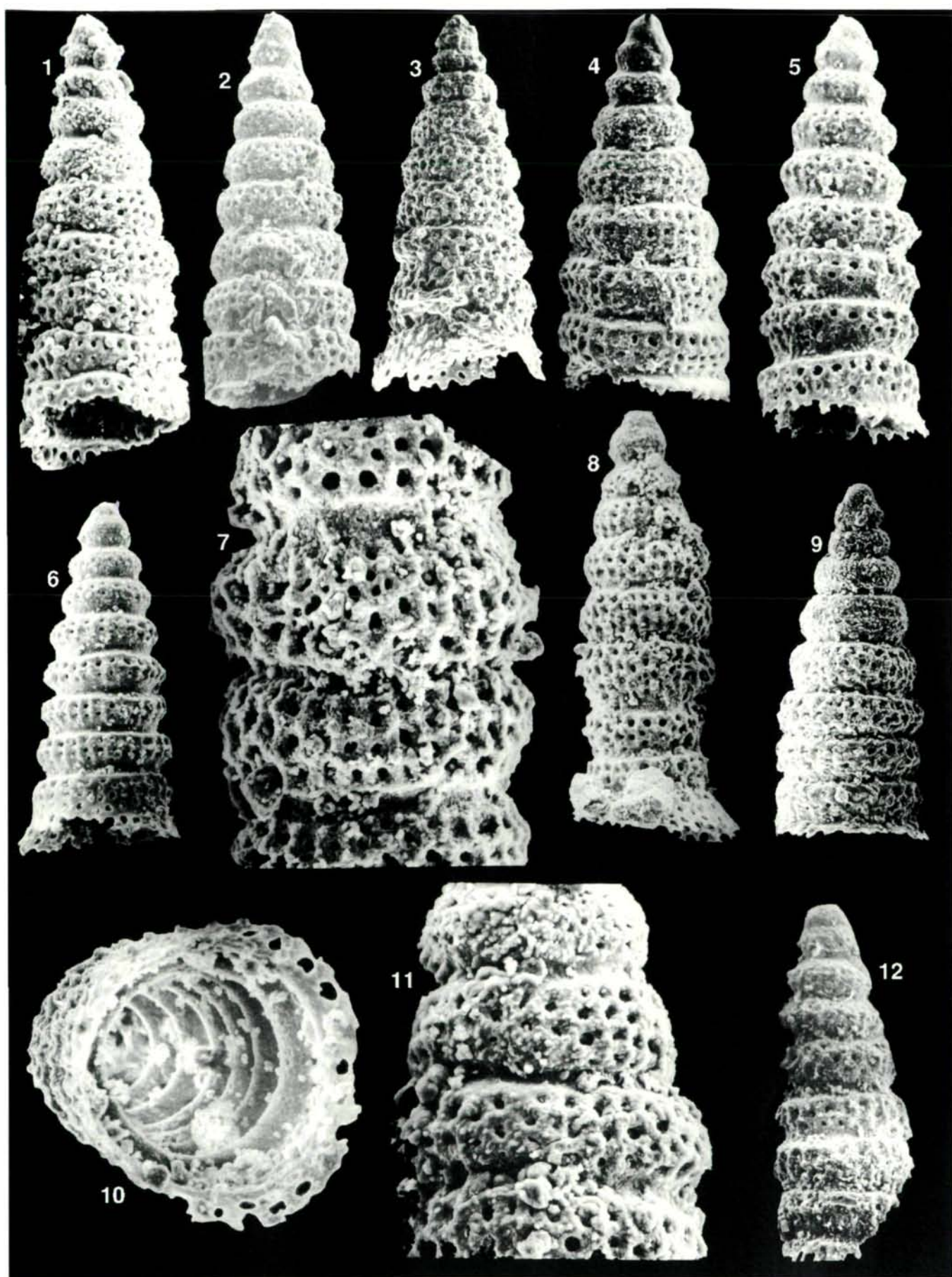




Plate 29

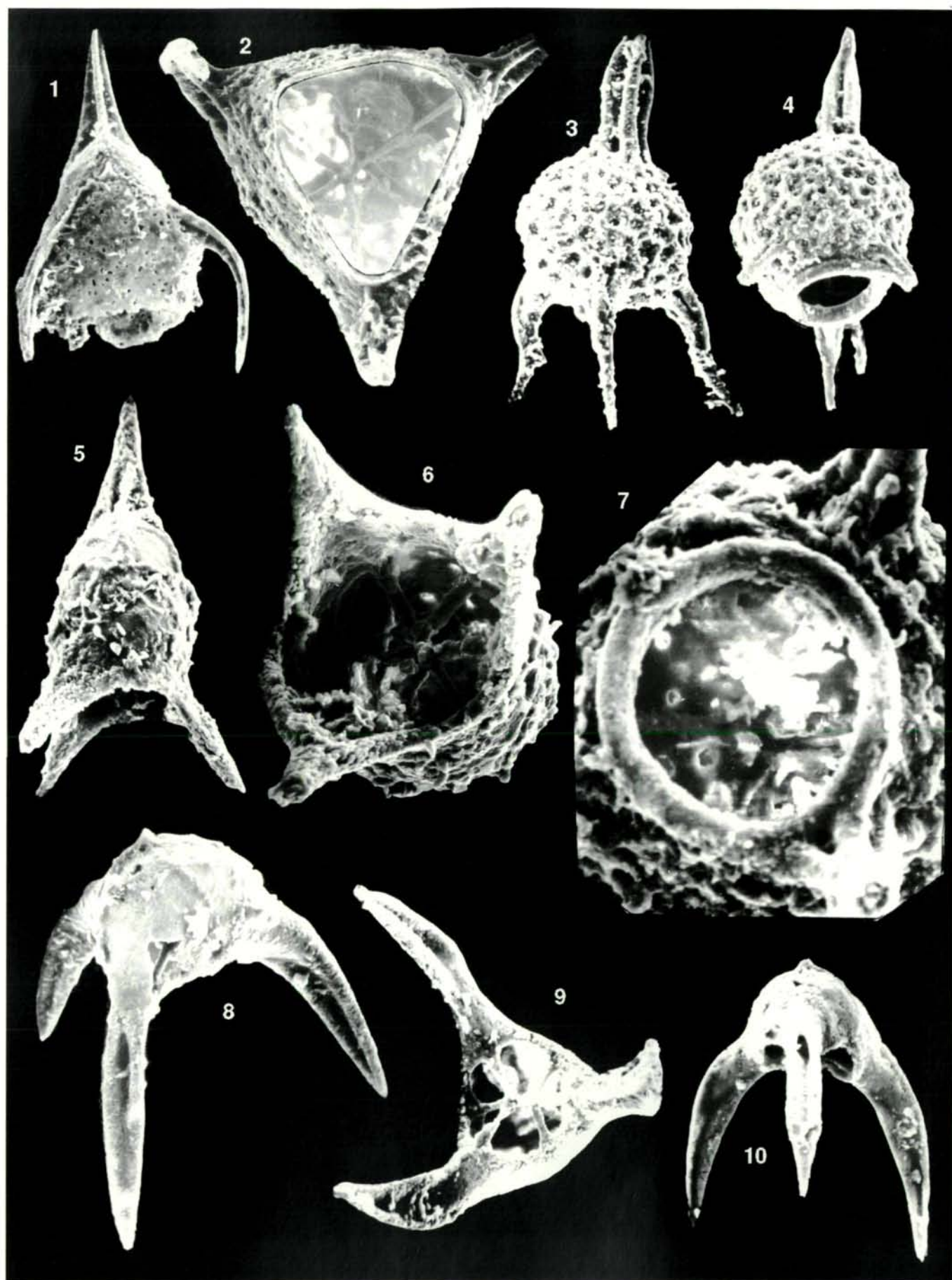


Plate 30

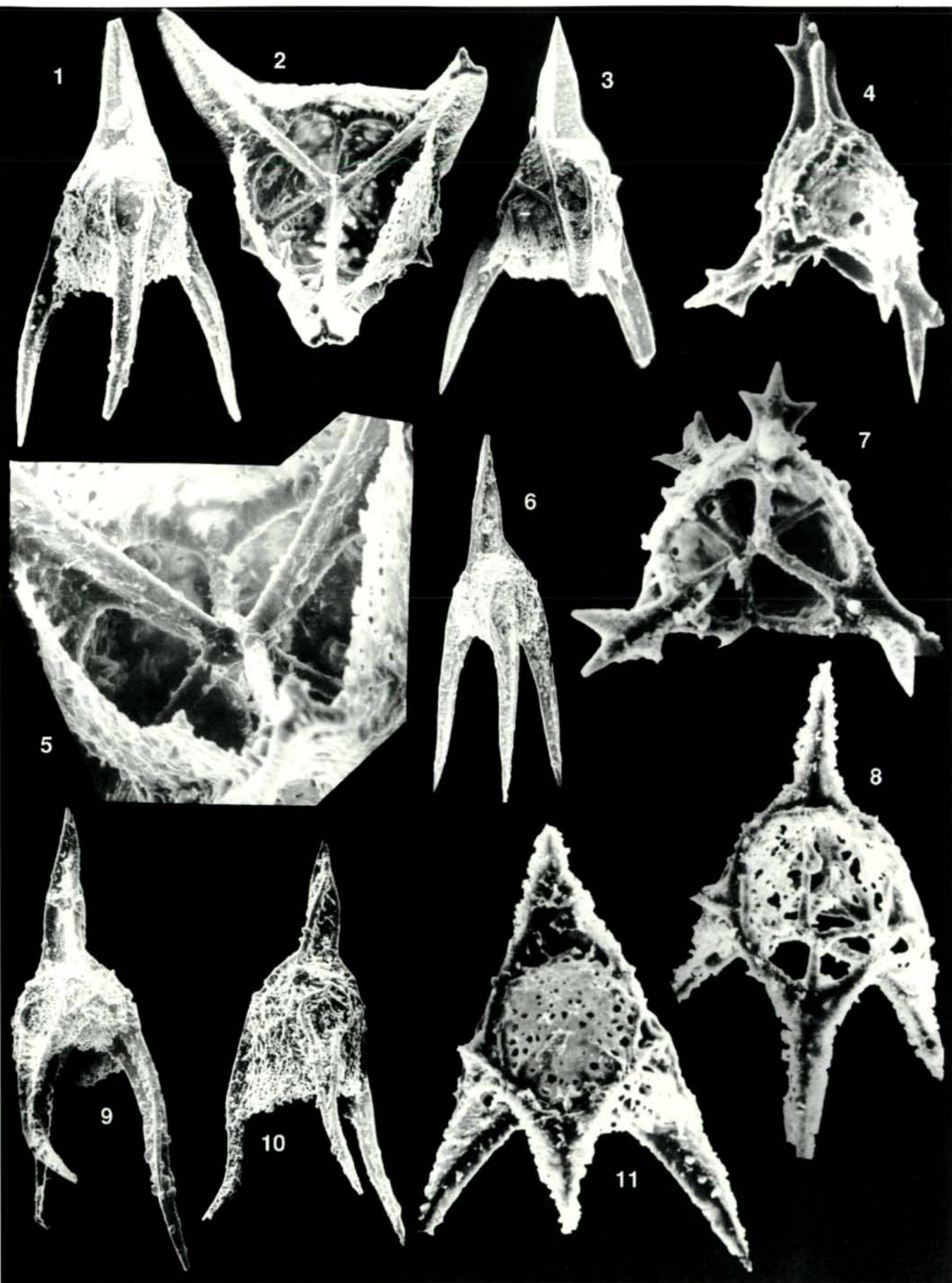




Plate 31

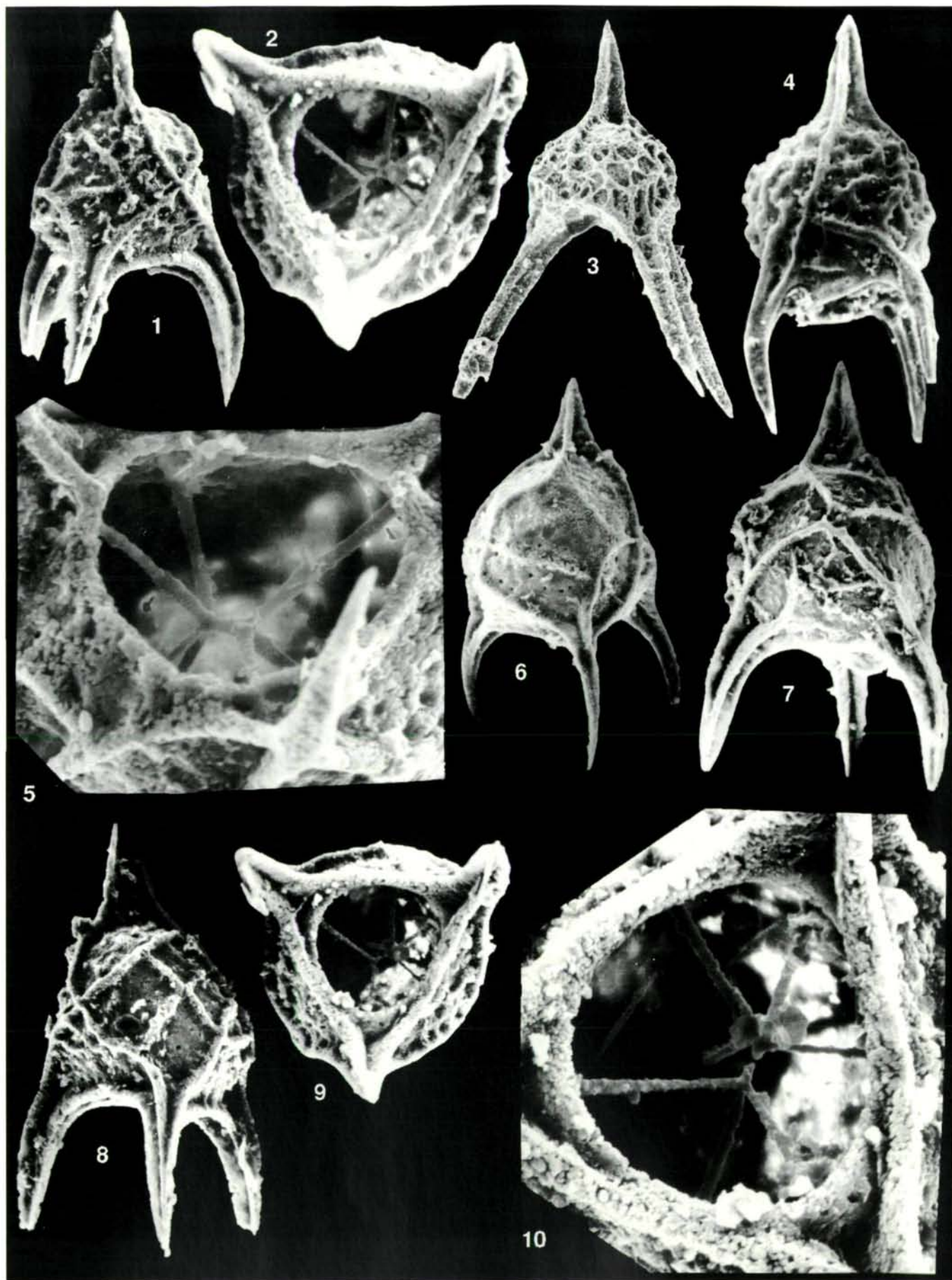
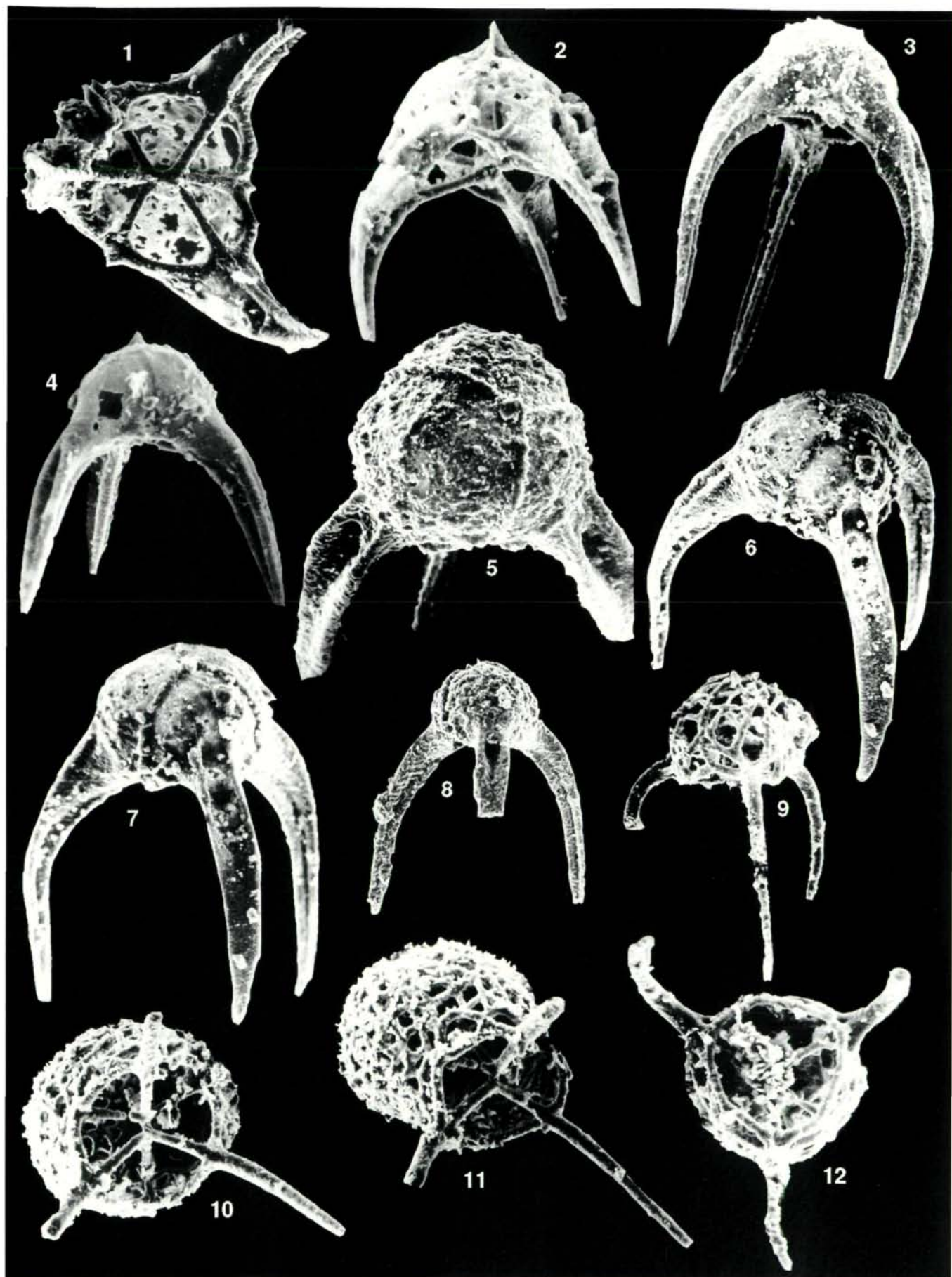


Plate 32





# Plate 33

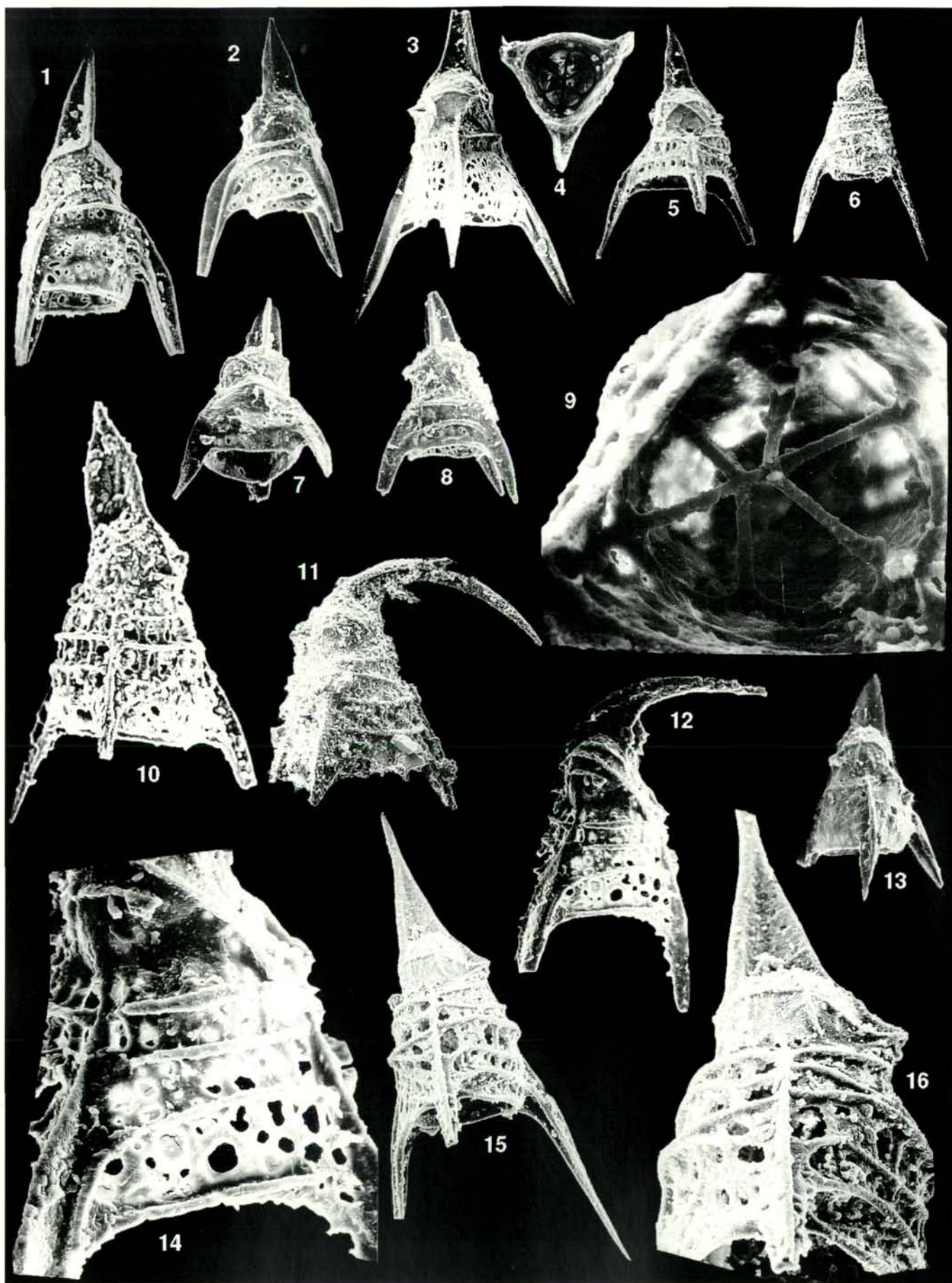


Plate 34

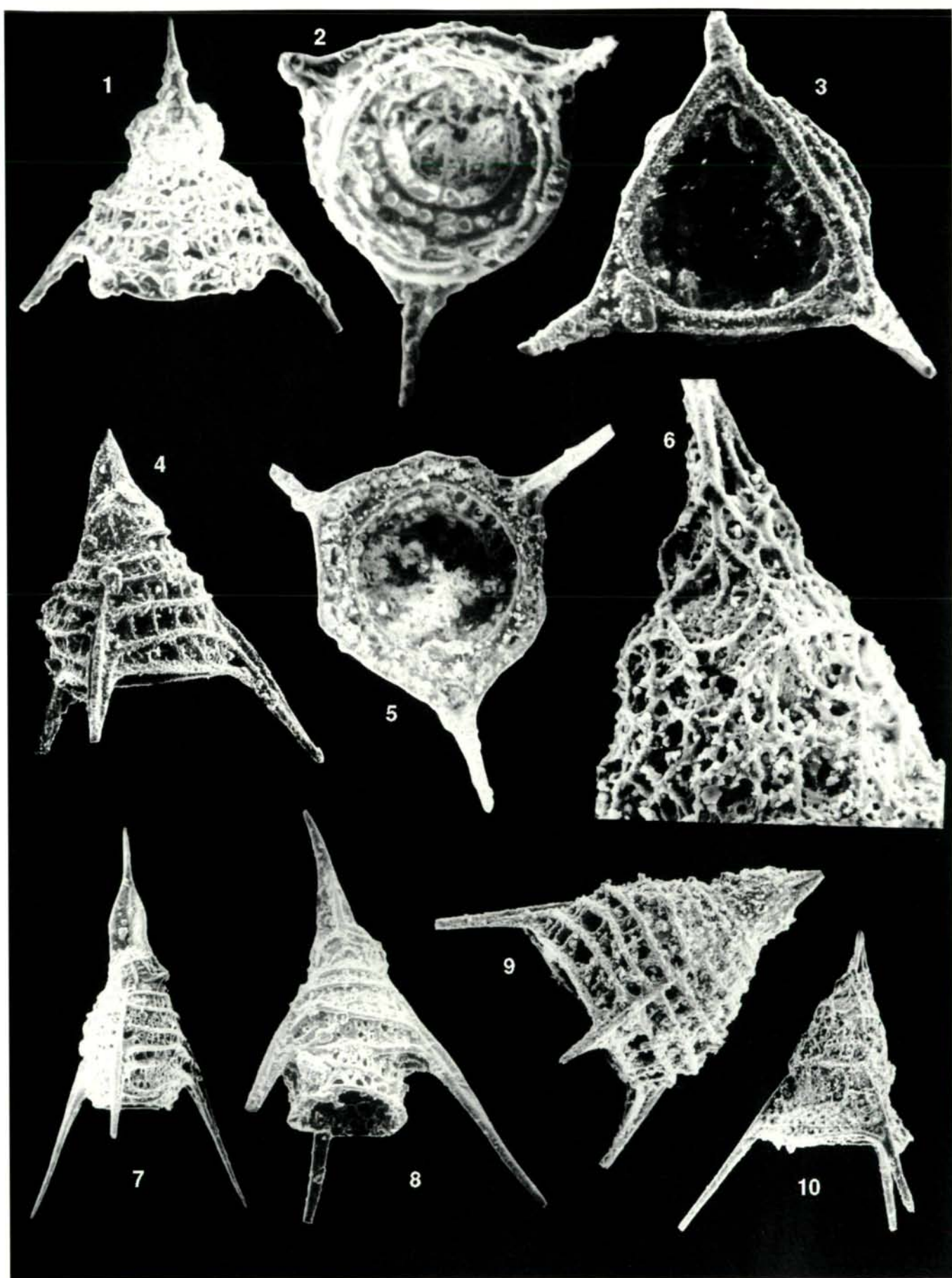




Plate 35

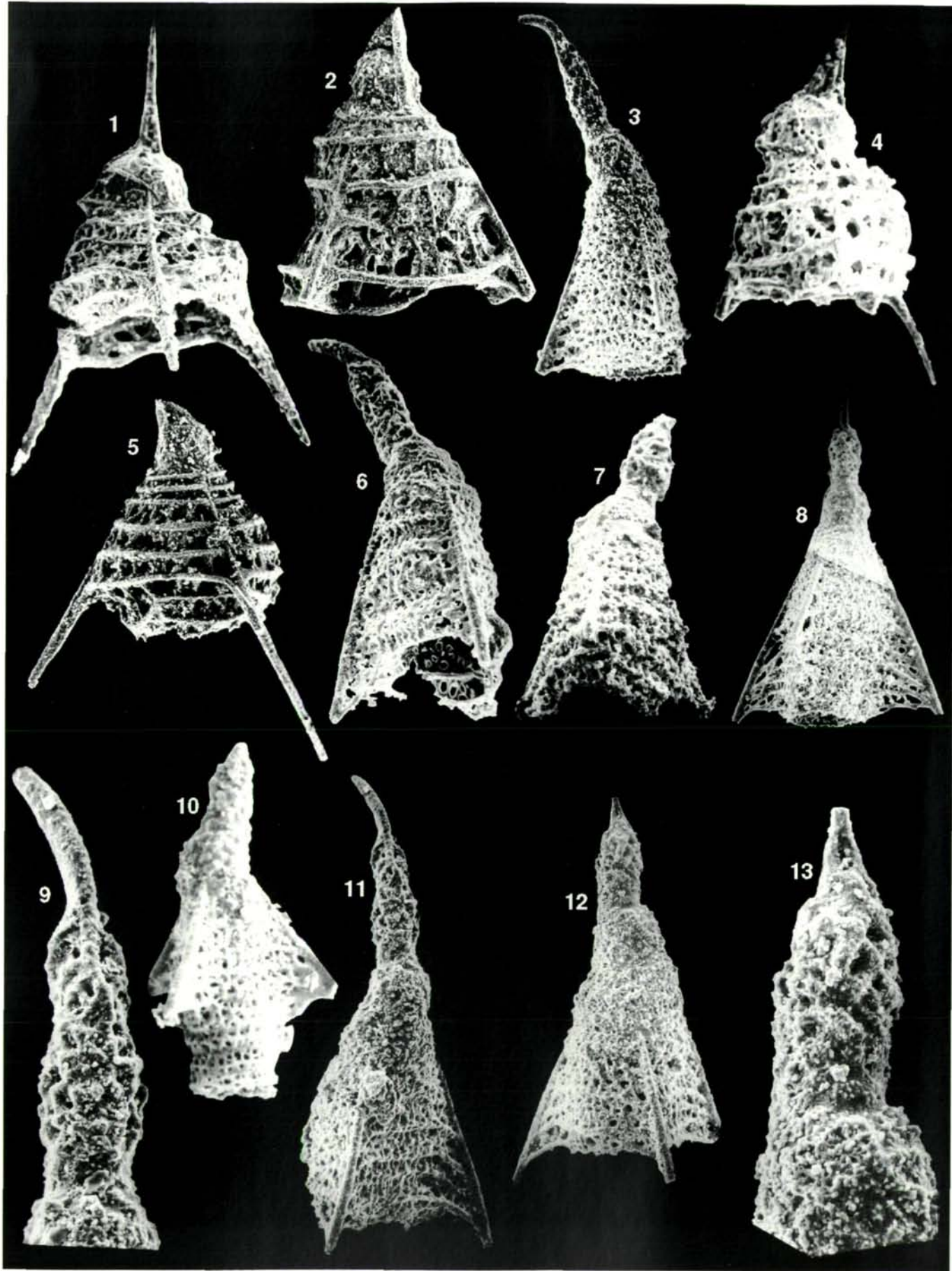


Plate 36

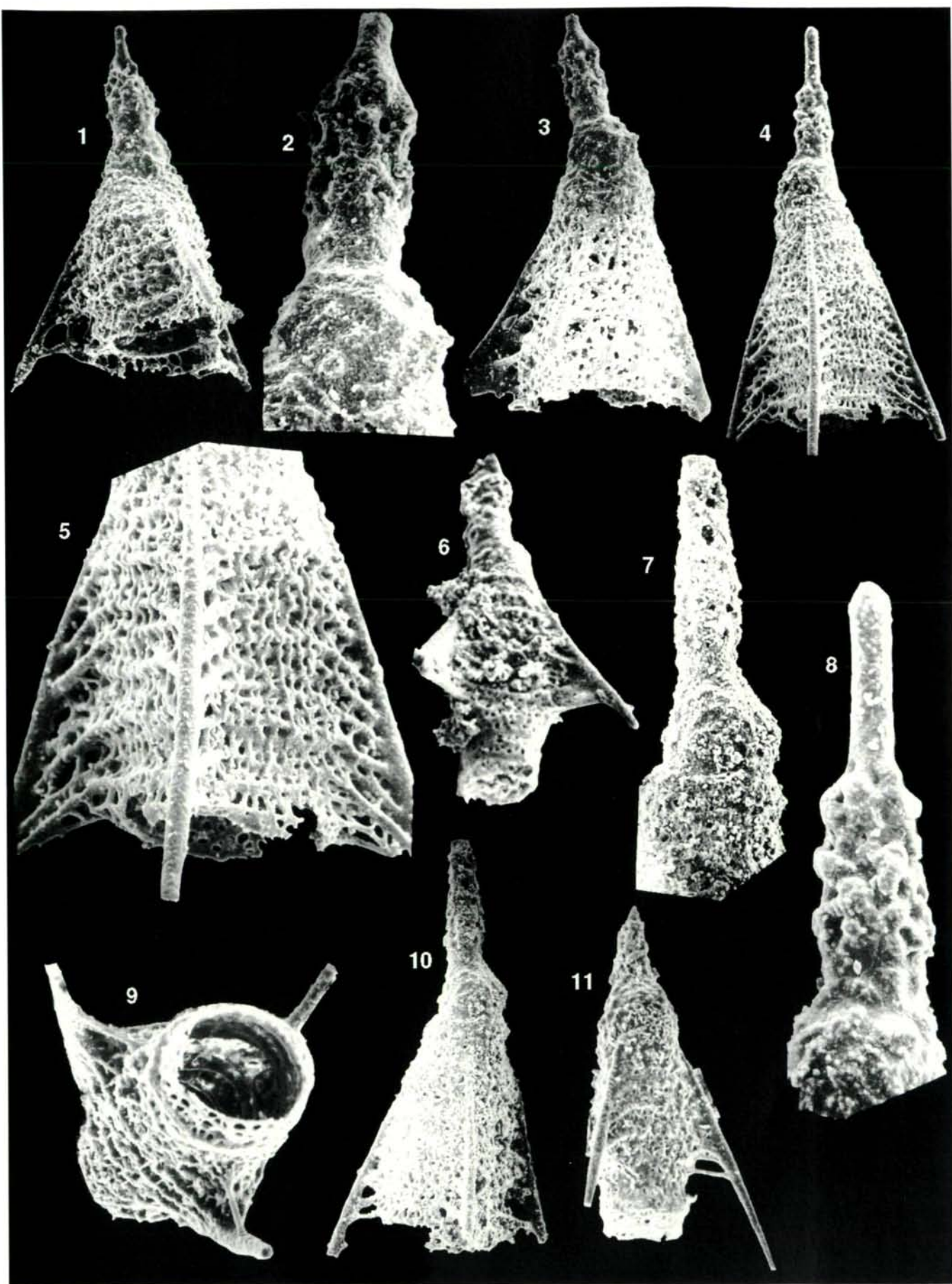




Plate 37

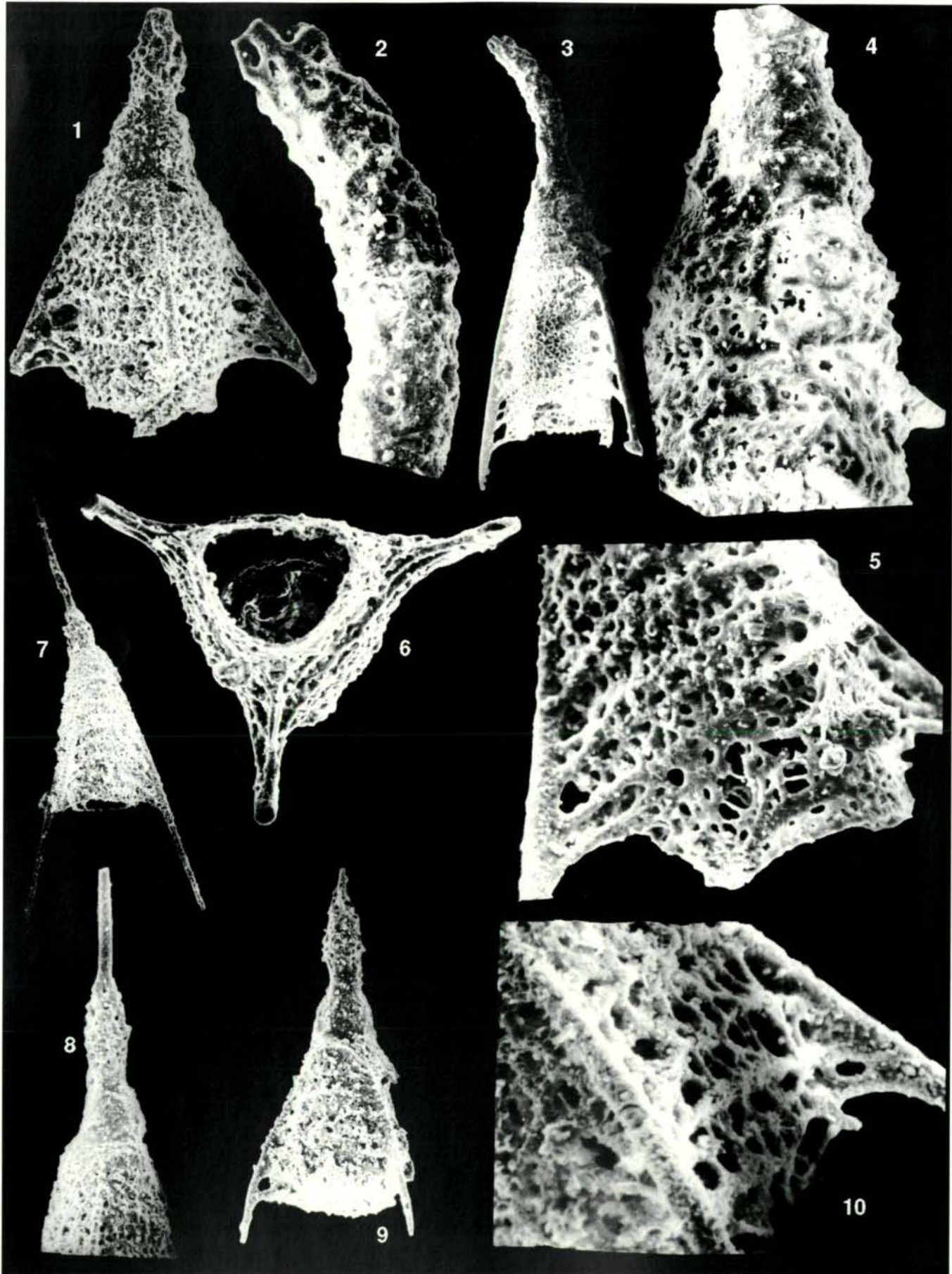




Plate 38

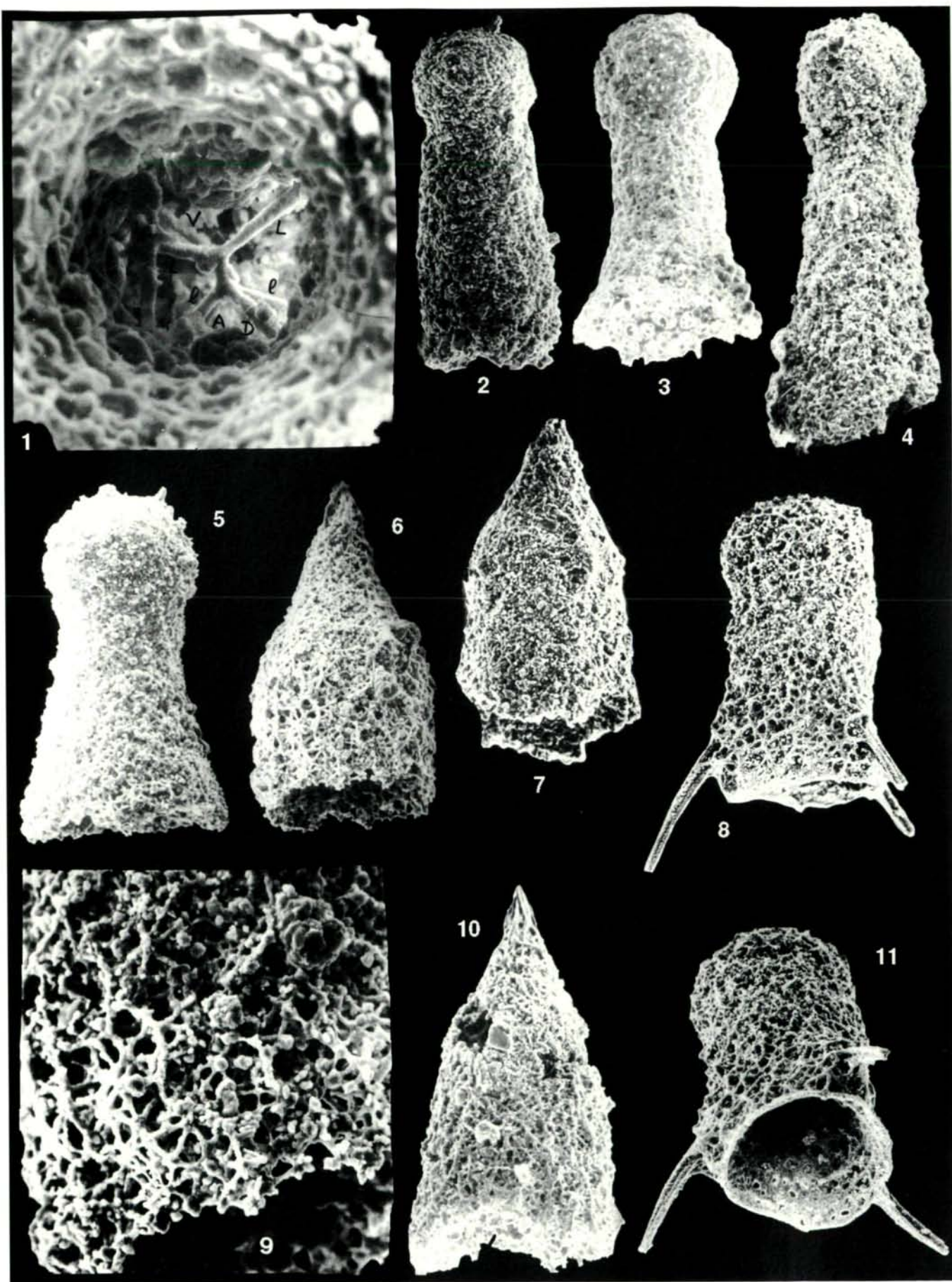




Plate 39

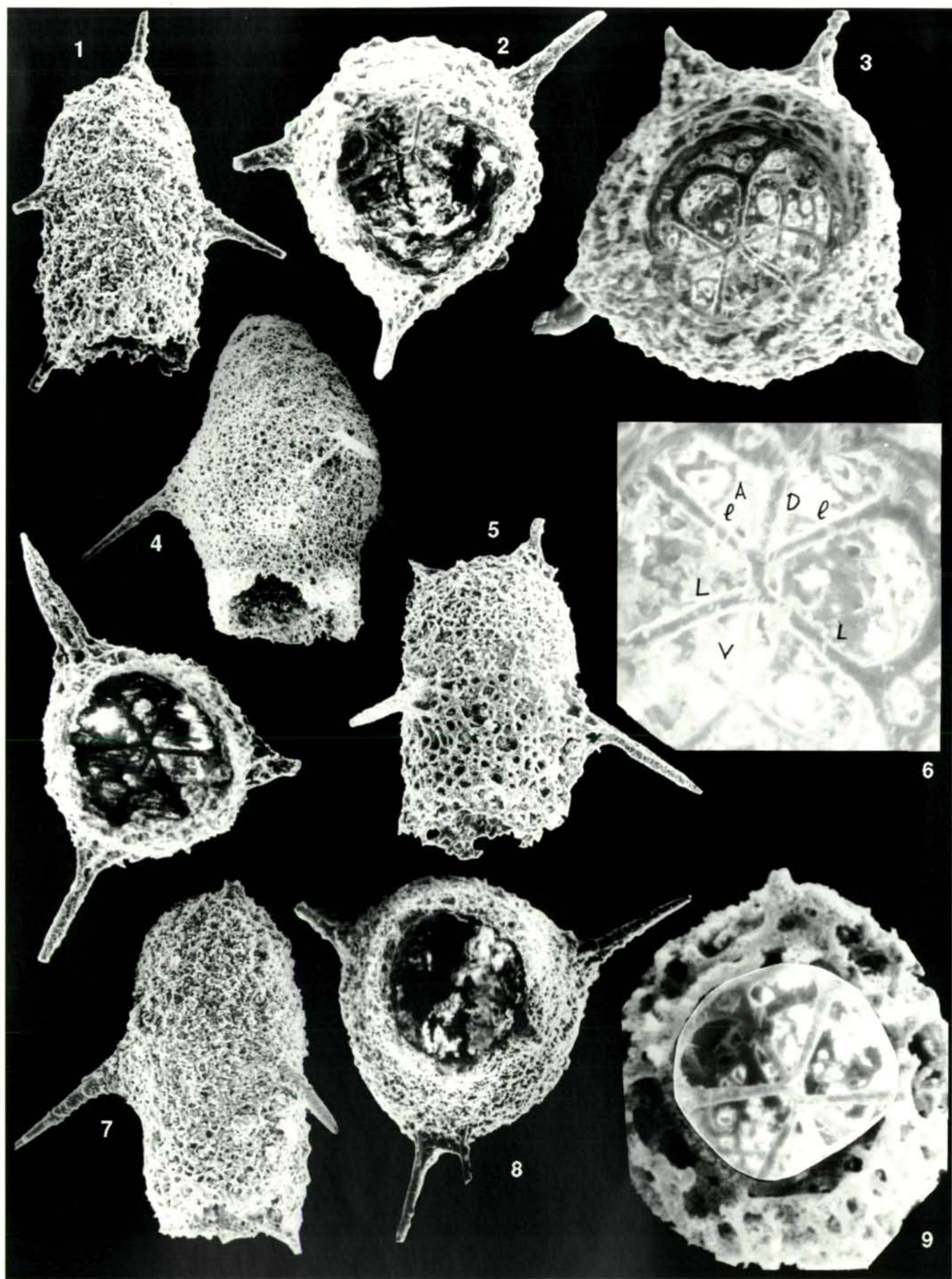


Plate 40

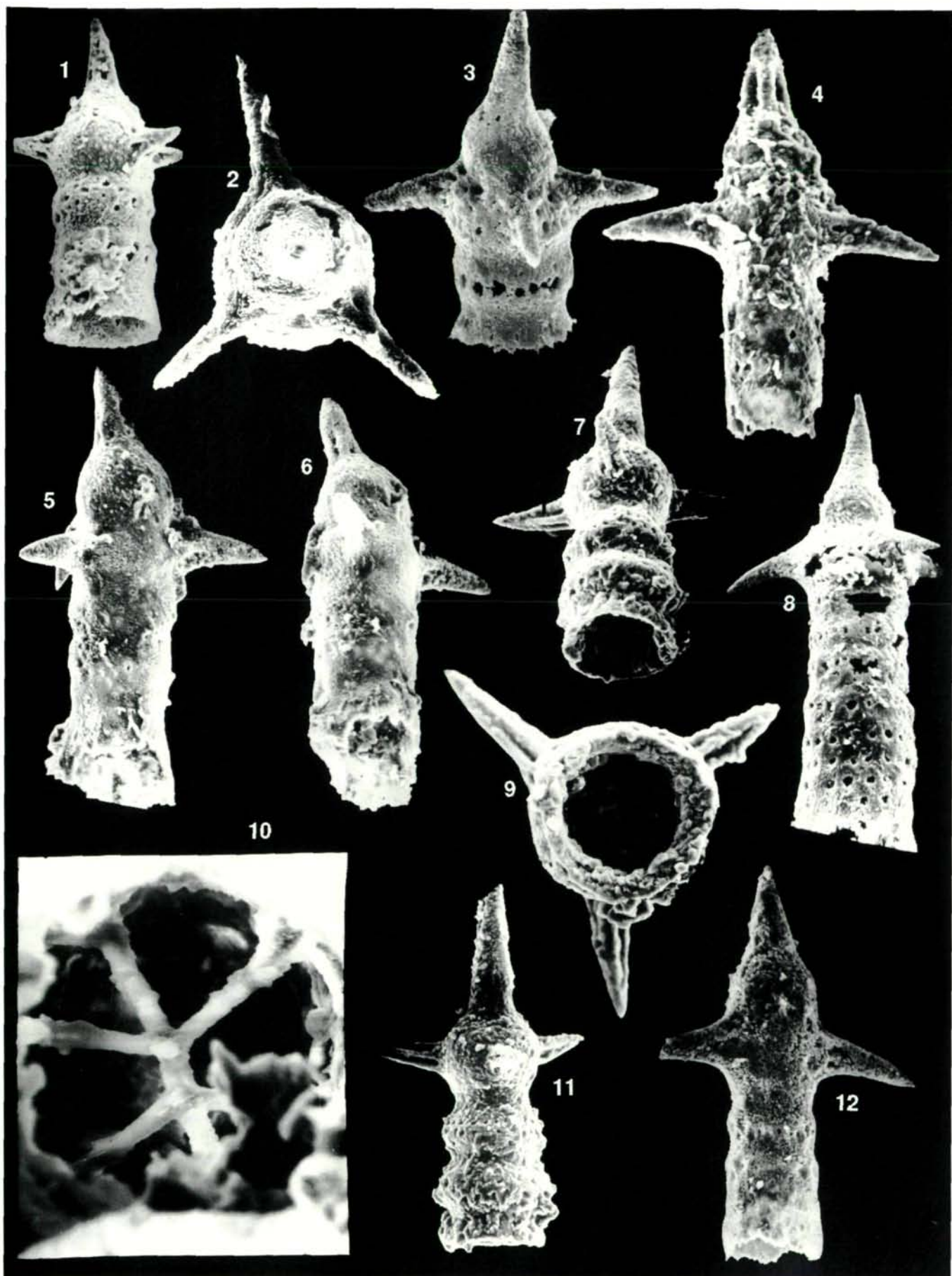




Plate 41

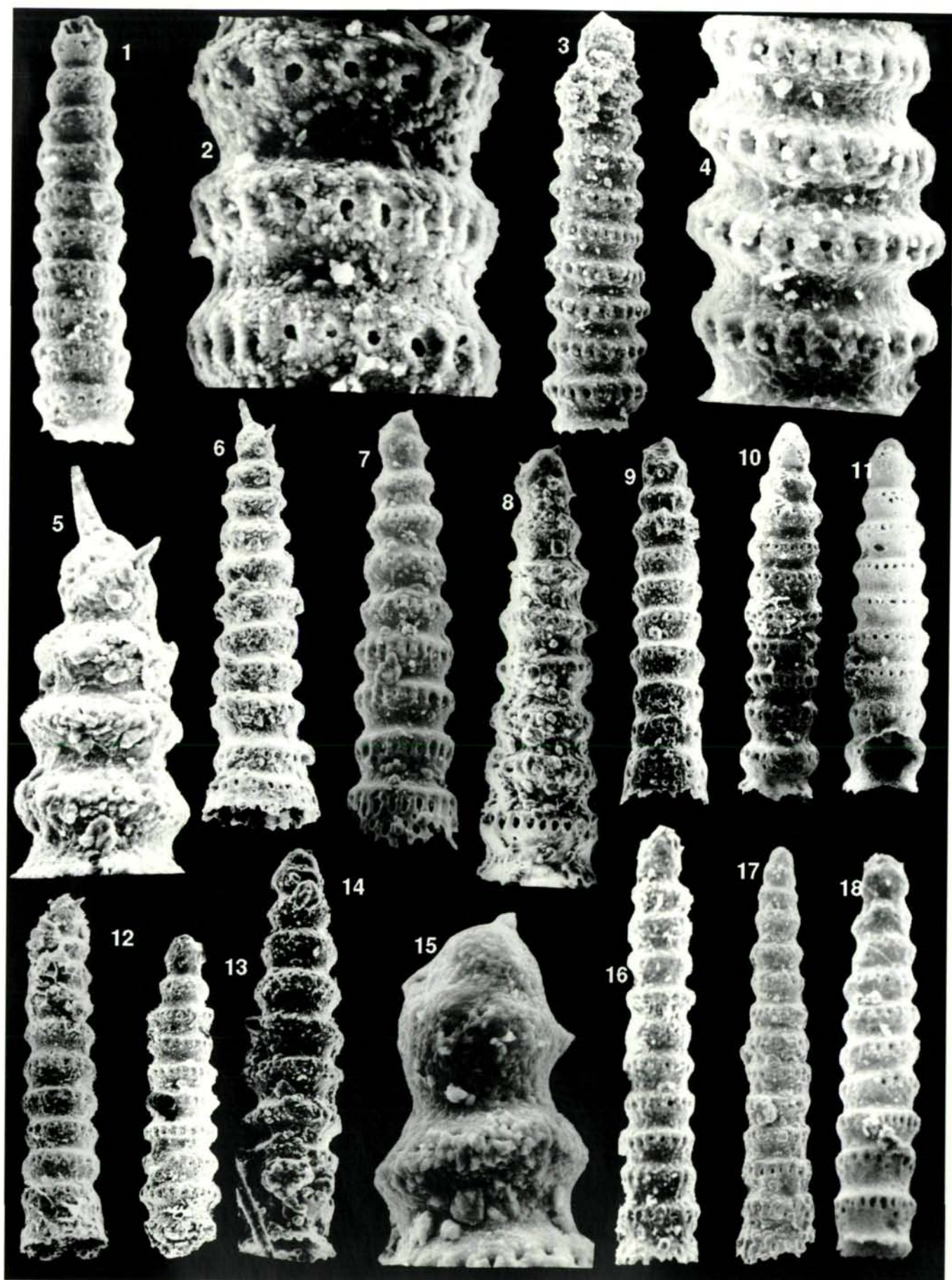




Plate 42

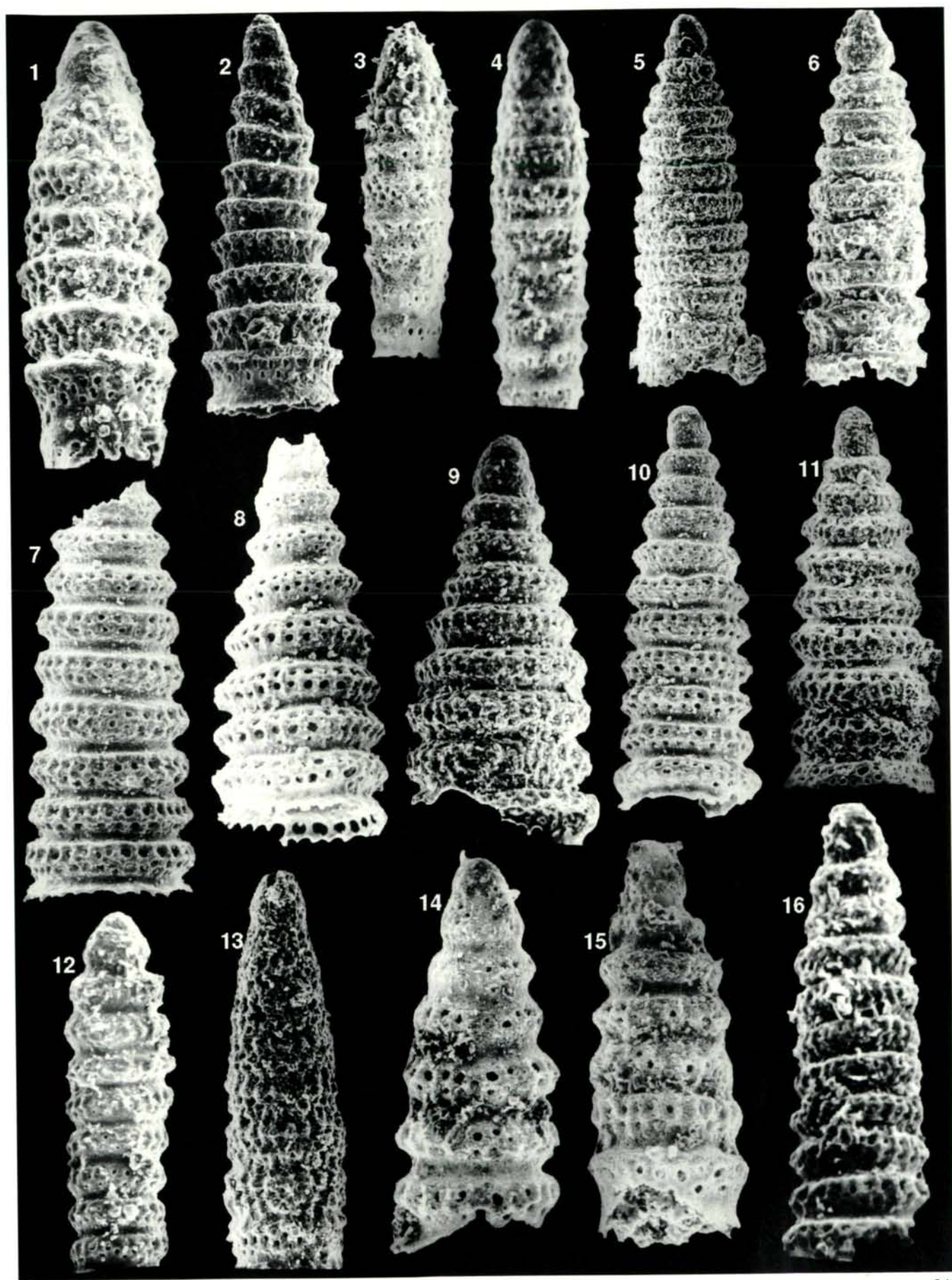




Plate 43

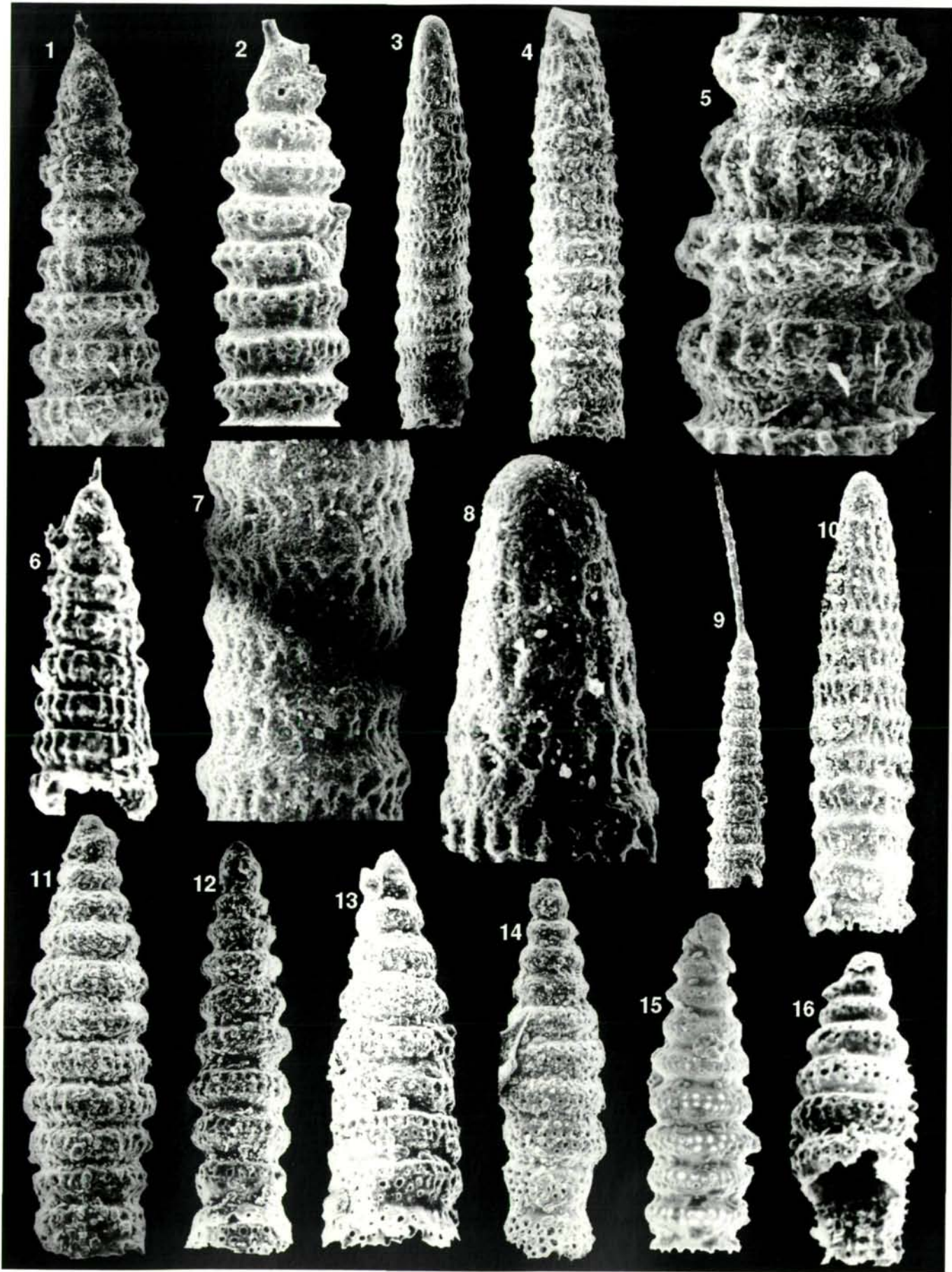




Plate 44

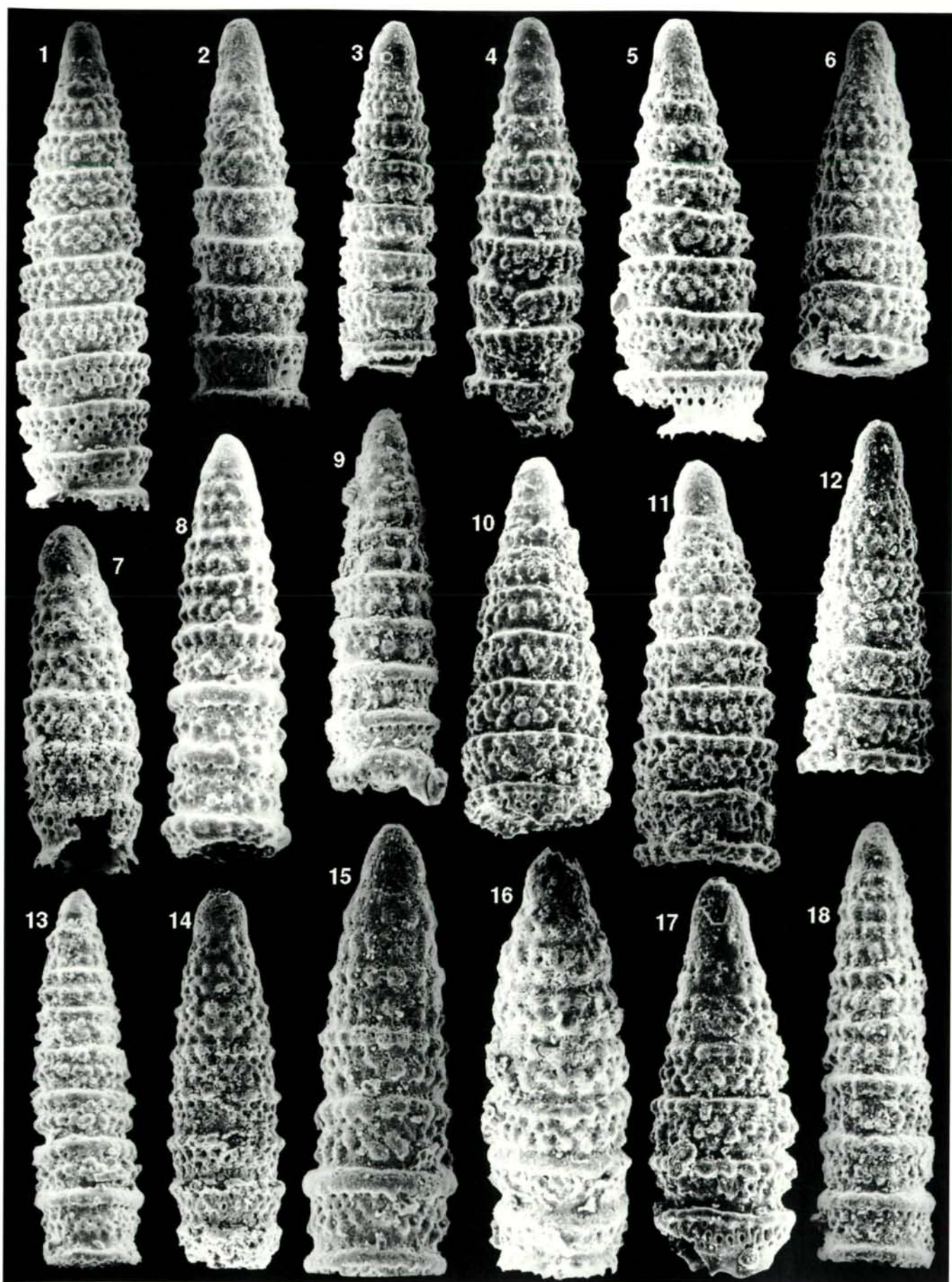




Plate 45

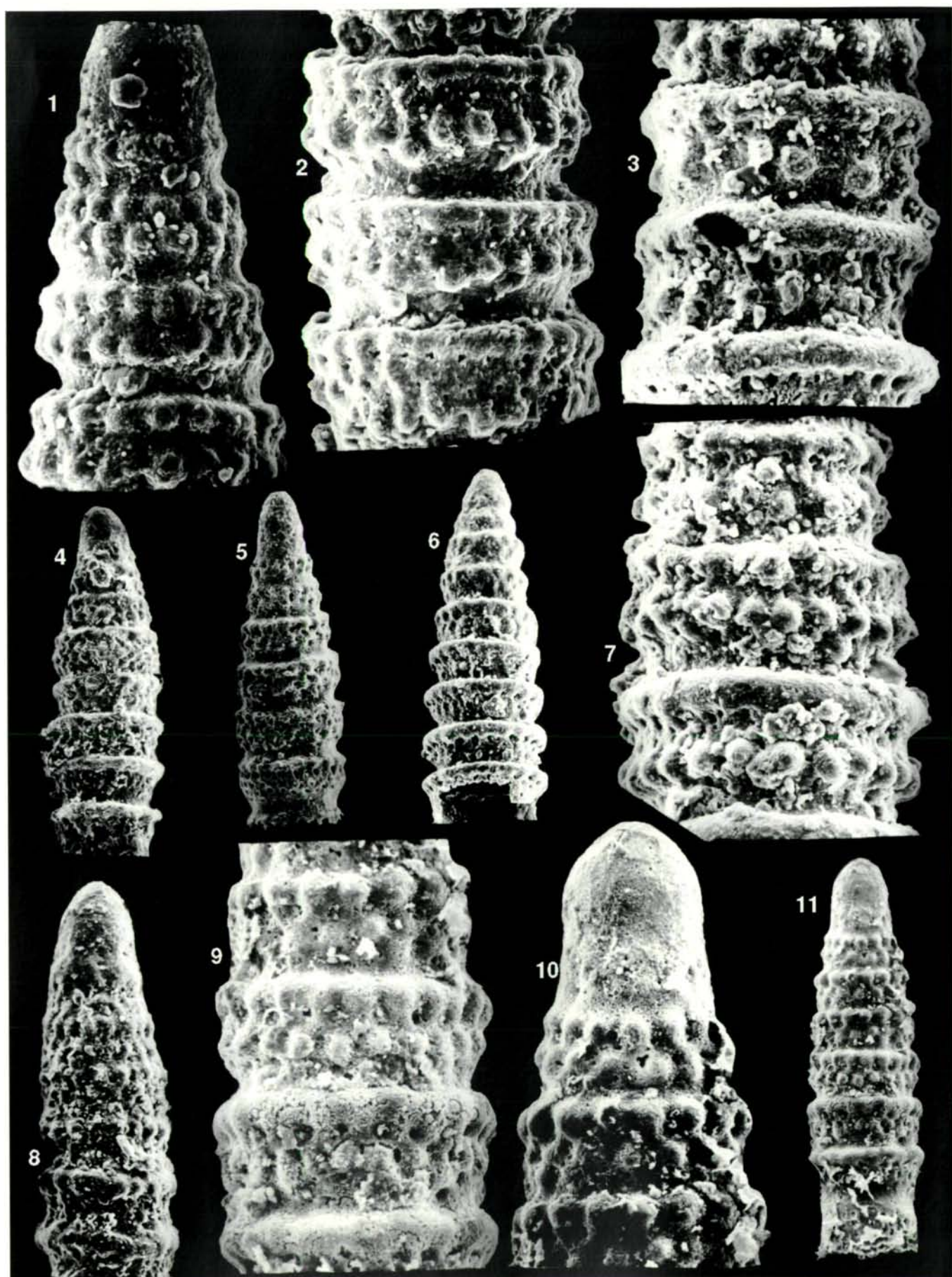




Plate 46

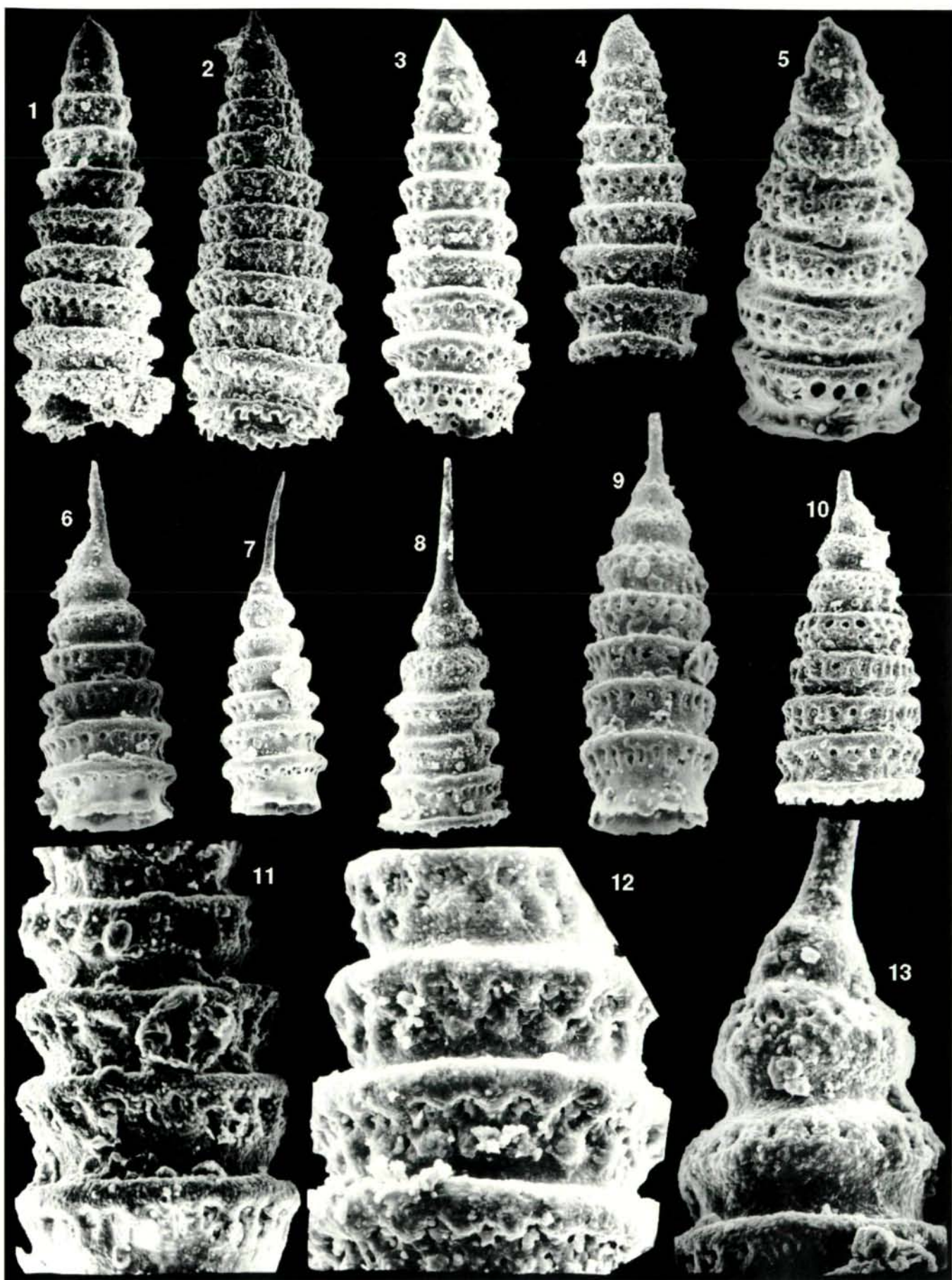
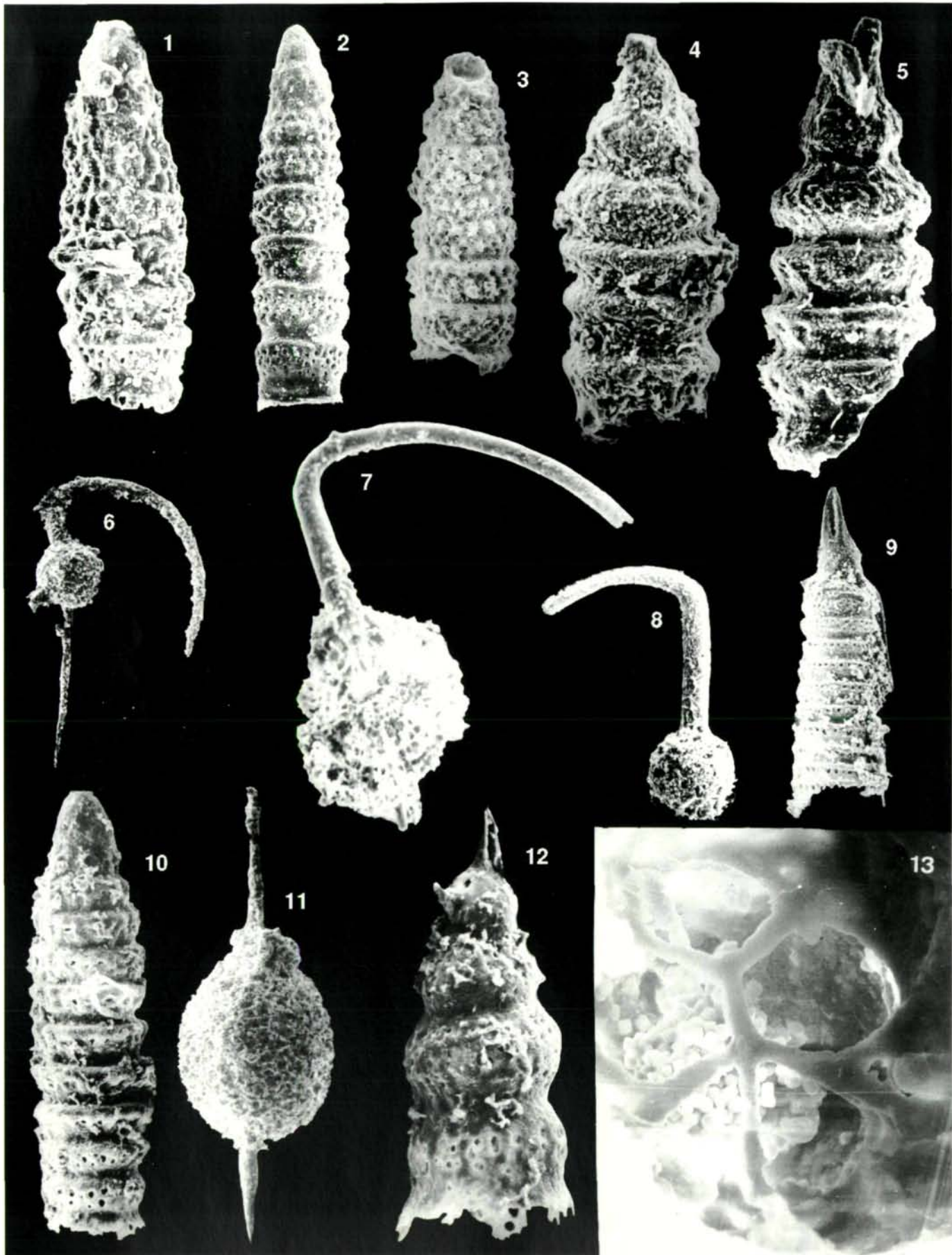




Plate 47



## Appendix

### Radiolarians from the borehole Inke-1

By H. Kozur

In the borehole Inke-1, south of southwestern Balaton Highland 7 cones of pre-Tertiary, very low grade metamorphic rocks of the interval 4551 - 5000 m were investigated. These rocks consists of a melange of serpentinite, acidic metavolcanoclastics, albite-sericite slates (originally intermediate volcanics), microconglomerates, very pure, strongly deformed limestones and black, siliceous slates with microfauna (pyritized radiolarians, very few conodonts - only ramiform elements, pyritized spongy spicules, pyritized bivalves). The sedimentology and fossil content is described by HAAS, KOZUR & LELKES - FELVARI (in press), the radiolarian fauna under the authorship of KOZUR. Because this paper is already 5 years in press, the radiolarians are described in this appendix likewise under authorship of KOZUR to avoid the use of nomina nuda.

Before the findings of fossils by KOZUR, this very low-grade metamorphic sequence have been placed into the Lower Paleozoic. However, it is a tectonic window below unmetamorphic Dinaric marine Upper Paleozoic and Triassic of the Igal Zone. Similar Triassic rocks of the same metamorphic degree, but without serpentinites, have been investigated by KOZUR; KRAINER & MOSTLER (in prep.) from the South Karawanke Koschuta Unit.

The below described radiolarians are all from black, siliceous shell at 4999–5000 m depth. The age is higher Middle Carnian to lower part of Upper Carnian.

#### Description of the radiolarian species

Suborder Entactinaria KOZUR & MOSTLER, 1982

Superfamily Palaeoscenidiacea RIEDEL, 1967

Family Hexapylomellidae

KOZUR & MOSTLER, 1979

Subfamily Hexapylomellinae

KOZUR & MOSTLER, 1979

**Genus:** *Praenanina* n. gen.

**Type species:** *Praenanina veghae* Kozur n. gen., n. sp.

**Derivatio nominis:** According to the supposed relations to *Nanina* Kozur & Mostler, 1982

**Diagnosis:** Outer shell spherical, double-walled. Inner layer with small, oval to round pores. Outer layer consists of a coarse lattice with node-like elevated nodal points. Pentactine spicule enclosed in a latticed medullary shell. At least one further medullary shell is present outside the pentactine. No first order spines are present.

**Included species:** *Praenanina veghae* KOZUR n. gen., n. sp.

**Occurrence:** Upper Triassic of Tethyan realm.

**Remarks:** *Hexapylomella* KOZUR & MOSTLER, 1979 has 6 pylomes, but is otherwise quite similar.

*Nanina* KOZUR & MOSTLER, 1982 has a very thick single-walled outer shell.

*Praenanina* seems to be a transitional genus between *Hexapylomella* and *Nanina*, but it is by far more closely related to *Hexapylomella* than to *Nanina*. The small pylomes in *Hexapylomella* replace 6 primary spines. Needle shaped remnants of these spines are sometimes still present in the centre of these pylomes. The next pylomorphogenetic step is the closing of the small pylomes. This step is realized in *Praenanina*. The development of a very thick single-walled outer shell as in *Nanina* is, in turn, a large phylomorphogenetic step.

The diagnosis of the Hexapylomellinae KOZUR & MOSTLER, 1979 has to be emended to include all double-walled Triassic Palaeoscenidiacea without first order primary spines on the outer shell. The presence of pylomes is then only a generic character, present in taxa transitional to the family Hindeosphaeridae KOZUR & MOSTLER, 1981.

***Praenanina veghae* KOZUR n. gen., n. sp.**

(Pl. 21, fig. 2; pl. 4A, figs. 1, 3)

**Derivatio nominis:** In honour of Prof. Dr. Végh, E. Budapest

**Holotype:** The specimen on pl. 4A, fig. 1

**Diagnosis:** As for the genus

**Measurements:** Diameter of outer shell: 250–256 µm

**Distribution:** Julian(?), Tuvanian of the European Tethys

**Remarks:** As for the genus. Double-walled spherical radiolarians without primary spines and without pylomes are frequent in the Julian and Tuvanian, but their preservation is mostly so bad that a specific and often even a genetic determination is impossible. Most of these radiolarians that are often very dominant components in Lower to Middle Tuvanian radiolarian associations, belong to the genus *Praenanina*. So far as a specific determination is possible,

the Lower to Middle Tuvalian representatives can be assigned to *P. veghae*.

**Suborder Spumellaria EHRENBURG, 1875**  
**Superfamily Actinommacea HAECKEL, 1862**  
**emend. KOZUR & MOSTLER, 1979**  
**Family Capuchnosphaeridae De WEVER, 1979**  
**Genus Capuchnosphaera De WEVER, 1979**

**Type species:** *Capuchnosphaera triassica* De WEVER, 1979

*Capuchnosphaera* n. sp. sensu  
**KOZUR & MOSTLER, 1979**  
(Pl. 3A, figs. 1–3)

**Family Ethmosphaeridae HAECKEL, 1862**  
**Genus Cenosphaera EHRENBURG, 1854**

**Type species:** *Cenosphaera plutonis* EHRENBURG, 1854

*Cenosphaera* spp.  
(Pl. 2A, figs. 5, 6)

**Suborder Nassellaria EHRENBURG, 1875**  
**Superfamily Eucyrtidiacea EHRENBURG, 1847**  
**Family Canoptidae PÉSSAGNO, 1979**  
**Genus Canoptum PÉSSAGNO, 1979**

**Type species:** *Canoptum poissoni* PÉSSAGNO, 1979

*Canoptum* cf. *laxum* BLOME, 1984  
(Pl. 2A, fig. 3)

1984 *Canoptum laxum* new species – BLOME pp. 4748, pl. 11, figs. 9, 14

**Distribution:** Middle Carnian to Middle Norian of European Tethys and western North America.

*Canoptum reiflingense*  
**(KOZUR & MOSTLER, 1981)**  
(Pl. 2A, fig. 4)

1981 *Triassocampe reiflingensis* n. sp. – KOZUR & MOSTLER, p. 99, pl. 26, fig. 1

**Remarks:** KOZUR & MOSTLER (1981) placed this species still in *Triassocampe* DUMITRICĂ; KOZUR & MOSTLER, 1980, but the small, irregularly distributed pores are already secondary pores in the microgranular layer of silica that covers the wall with the primary pores. Sometimes the number of the secondary pores is very small, like in the fragmentary specimen on pl. 1, fig. 6.

**Genus Japonocampe KOZUR, 1984 (January)**

**Type species:** *Triassocampe nova* YAO, 1982  
**Synonym:** *Latium* BLOME, 1984 (April)

*Japonocampe* n. sp. 1 aff. *J. mundum* (Blome, 1984)  
(Pl. 1A, fig. 72)

**Remarks:** In the present incomplete specimen the segments are higher elevated and the pores in the constrictions are smaller than in *Japonocampe mundum* (BLOME, 1984)

*Japonocampe* n. sp. 2 (pl. 1A, fig. 3) has shallower segments like in *J. mundum*, but at least the preserved distal part of the test is cylindrical and narrower than in *J. mundum* and the pores in the constriction are larger than in this species.

**Genus Pachus BLOME, 1984**

**Type species:** *Pachus firmus* BLOME, 1984

*Pachus* sp.  
(Pl. 1A, figs. 5, 6)

**Remarks:** The very fragmentary specimens fit into the diagnosis of *Pachus* Blome, 1984, but the nodes are not yet so strong as in typical representatives of this genus from the Upper Carnian to Middle Norian.

Family Triassocampidae  
KOZUR & MOSTLER, 1981

Genus *Annulotriassocampe* KOZUR n. gen.

**Type species:** *Annulotriassocampe baldii* KOZUR n. gen., n. sp.

**Derivatio nominis:** According to the smooth rings in the distal segments

**Diagnosis:** Test multicyrtyd, long-conical. Cephalothorax dome-shaped, distally often thickened, with round apical end, smooth, poreless or with a few, widely scattered pores. Often pores, sometimes also tiny spines at the junction of V or other bars of the spicular system with the wall are present. Without, or very rarely with a short apical horn. Abdomen a little broader, but shorter than cephalothorax, with 2-3 rings of pores, often partly or entirely covered by a smooth layer of microgranular silica. Stricture between cephalothorax and abdomen mostly without pores, rarely with a ring of pores that may be partially or entirely closed by a layer of microgranular silica. First postabdominal segment mostly hoop-like, in general with one ring of pores, but additional pores may be present in its distal part.

Following postabdominal segments, very rarely also the first postabdominal segment very high, with a central pore ring, in general bordered by an upper and lower smooth ring, in primitive forms without these rings. In typical forms the postabdominal segments are narrow subcylindrical and vertically elevated. Only in primitive forms the postabdominal segments are rather hoop-like. All postthoracic segments are separated by deep, smooth strictures.

**Included species:**

*Annulotriassocampe baldii* KOZUR n. gen., n. sp.

*Triassocampe sulovensis* KOZUR & MOCK, 1981 (in KOZUR & MOSTLER, 1981)

? *Triassocampe immaturum* BLOME, 1984

*Triassocampe proprium* BLOME, 1984

*Annulotriassocampe campanilis campanilis* n. subsp.

*Annulotriassocampe campanilis longiporata* n. subsp.

*Annulotriassocampe eoladinica* n. sp.

*Annulotriassocampe spinosa* n. sp.

**Description** of the last 4 taxa see in the main part of this paper (KOZUR & MOSTLER).

**Occurrence:** Upper Anisian to Julian of the Alps, Western Carpathians and Hungary. Upper Carnian to Middle Noradian of western United States.

**Remarks:** *Triassocampe* DUMITRICĂ; KOZUR & MOSTLER, 1980 from the Middle Triassic has at least 2 rings of pores in every segment.

*Yeharaia* NAKASEKO & NISHIMURA, 1979 has smooth rings in the postabdominal segments, like the new genus, but in every segment only one ring is present. Moreover, a long apical horn is present and the thorax is in general large and subglobular.

*Annulotriassocampe baldii* KOZUR n. gen., n. sp.  
(Pl. 1A, fig. 13)

**Derivatio nominis:** In honour of Prof. Dr. BALDI, T. Budapest

**Holotype:** The specimen on pl. 1A, fig. 1

**Diagnosis:** With the character of the genus. Cephalothorax distally not or only very few thickened, with some pores that mark the end of the spicular bars, at least with one pore at the junction of V with the wall. Abdomen separated from the cephalothorax by a narrow stricture with a ring of small pores that are mostly closed by a layer of microgranular silica. Thorax hoop-like to subtrapezoidal. Pores and indistinct nodes quite covered by a layer of microgranular silica. First postabdominal segment hoop-like, with a smooth or slightly nodose ring and a ring of pores above it.

The 2 following short-cylindrical postabdominal segments consist of 2 smooth to slightly nodose rings that border a slightly depressed ring of round pores. In the fourth (inversely trapezoidal) postabdominal segment the nodose lower ring is strongly reduced. In the fourth postabdominal segment the lower ring is nearly entirely reduced. In the same direction the upper ring becomes stronger and stronger.

**Measurements of the holotype:**

Total length of test: 215 µm

Maximum width of test: 83 µm

	Length	Width
cephalis	35 µm	40 µm
thorax	20 µm	52 µm
abdomen	15 µm	60 µm
postabdominal segments	15–17 µm	70–83 µm

**Occurrence:** Carnian of the borehole Inke-I.

**Remarks:** The new species is similar to *Annulotriassocampe sulovensis* (Kozur & Mock, 1981) from the Lower to Middle Carnian of the Western Carpathians. In this species the thorax has open pores, the first postabdominal segment displays some pores below the proximal pore ring and the lower ring of the segments is not or only slightly reduced in the distal part of the test.

*Annulotriassocampe proprium* (BLOME, 1984) from the Upper Carnian to Middle Norian of western United States is in the distal part of the test identical with *A. baldii* KOZUR n. gen., n. sp., but its proximal part is rather different and a distinct apical horn is present.

*Annulotriassocampe* n. sp. (pl. 1A, fig. 2) is only known from small fragments of the proximal part of the test. The abdomen displays 2 rings of open pores and the first postabdominal segment is already short-cylindrical with a slightly depressed ring of pores between 2 smooth rings.

**Superfamily Theocapsacea HAECKEL, 1882**

**Family Nakasekoellidae KOZUR, 1984**

**Genus *Nakasekoellus* KOZUR, 1984 (January)**

**Type species:** *Stichophormis polita* HINDE, 1908 (= *Dictyomitra pessagnoii* NAKASEKO & NISHIMURA, 1979 = *Xipha striata* BLOME, 1984)

**Synonym:** *Xipha* BLOME, 1984 (April)

***Nakasekoellus inkensis* Kozur n. sp.**

(Pl. 1A, fig. 4)

**Derivatio nominis:** According to the occurrence in the borehole Inke-I

**Holotype:** The specimen on pl. 1A, fig. 4

**Diagnosis:** Tetracyrtid. All segments are separated each other by deep, smooth strictures. Cephalis smooth, poreless. The postcephalic segments increases rapidly in diameter and gradually in their length. Thorax semiglobular, smooth, poreless. Abdomen broadly hoop-like, poreless, with narrow, straight, sharp vertical ribs. These ribs are partly large and a little curved, partly short to moderately long and straight. These latter ribs do not reach the upper margin of the postabdominal segment like the large ones. Aperture large.

**Measurements of the holotype (in µm):**

	whole test	thorax	abdomen	post- abdominal segment
Length	139	20	25	44
Maximum width	97	37	65	97

**Occurrence:** Carnian of the borehole Inke-I.

**Remarks:** Like in all *Nakasekoellus* species the segments have primary pores that are covered by a thick poreless layer. In transmitted light the pores are often visible at least in the thorax and abdomen. For this reason the genus *Canesium* Blome, 1984, is very similar, but in this genus the postabdominal segment has never a cover of microgranular silica.

*Dictyomitra pygmaea* HINDE, 1908, the only hitherto known species of *Canesium* BLOME, 1984, was included by KOZUR, 1984 into *Nakasekoellus* KOZUR, 1984, because in this time both from *Nakasekoellus* and from the nearly related *Canesium* only one species was known. In this time the creation of 2 monospecific genera was not necessary. The evidence of further species both of *Nakasekoellus* and *Canesium* justified now the separation into 2 genera. *Nakasekoellus* KOZUR, 1984 (January) is therefore used here in the more restricted sense of its younger synonym *Xipha* BLOME, 1984 (April).

It is unclear, whether the costal extensions in „*Xipha*“ *striata* BLOME, 1984 are only intraspecific or preservation-controlled features. In „*Dictyomitra*“ *pessagnoii* NAKASEKO & NISHIMURA, 1979 these costal extensions are present in some specimens (NAKASEKO & NISHIMURA, pl. 9, fig. 3) and missing in other ones (NAKASEKO & NISHIMURA, pl. 9, figs. 2, 4). In the holotype of „*Stichophormis*“ *polita* HINDE, 1908 these costal extensions are well developed. If we regard the presence or absence of costal extensions as specific characteristic, than only *Xipha striata* BLOME, 1984 would be an younger synonym of *Nakasekoellus politus* (HINDE, 1908). But in all *Tricolocampe* species (descendants of *Nakasekoellus*) of Jurassic age, there are likewise species with and without costal extensions (or even velum). This depends on the stage of preservation or partly also on intraspecific variation. The same is assumed for the Triassic *Nakasekoellus* species. For this reason both „*Dictyomitra*“ *pessagnoii* NAKASEKO & NISHIMURA, 1979 and *Xipha striata* BLOME, 1984 are here regarded as junior synonyms of *Nakasekoellus politus* (HINDE, 1908).

*Nakasekoellus inkensis* KOZUR n. sp. is clearly distinguished from *N. politus* (HINDE, 1908) = *Dictyomitra pessagnoii* NAKASEKO & NISHIMURA, 1979 = *Xipha striata* BLOME, 1984 by the smooth thorax and by the considerably higher number of narrower and more irregular ribs on the postabdominal segment.



## Explanation of plates

All figures specimens from the plates of the appendix have been solved by HF from black siliceous shales and lydites from the borehole Inke-1 at 4999 m - 5000 m, sample 16/II. Rep.-no. Ko 1994 I-1

### Plate 1 A

- Fig. 1: *Annulotriassocampe baldii* KOZUR n. gen. n. sp., holotype, a) x 300, b) detail, x 720.  
Fig. 2: *Annulotriassocampe* n. sp., x 320.  
Fig. 3: *Japonocampe* n. sp. 2, x 360  
Fig. 4: *Nakasekoellus inkensis* KOZUR, n. sp., holotype, x 480.  
Figs. 5, 6: *Pachus* sp., fig. 5: x 400, fig. 6: x 540.  
Fig. 7: *Japonocampe* n. sp. 1 aff. *J. mundum* (BLOME, 1984), x 400.  
Fig. 8: Fragment of a ramiform conodont, x 300.

### Plate 2 A

- Fig. 1: Pyritized juvenile bivalve, x 300.  
Fig. 2: *Praenanina veghae* KOZUR, n. gen. n. sp., x 260.  
Fig. 3: *Canoptum* cf. *laxum* BLOME, 1984, x 540.  
Fig. 4: *Canoptum reiflingense* (KOZUR & MOSTLER, 1981), x 440.  
Fig. 5: *Cenosphaera* sp. 2, a) x 260, b) detail, x 600.  
Fig. 6: *Cenosphaera* sp. 1, x 260.

### Plate 3 A

- Figs. 1—3: *Capuchnosphaera* n. sp., fig. 1 a: x 400, fig. 1 b: detail of the same specimen, x 860; fig. 2a: x 320, fig. 2 b: detail of the same specimen, x 600; fig. 3: x 460.  
Fig. 4: Framboidal pyrite, x 360.  
Fig. 5: *Capuchnosphaera*, spec. indet.

### Plate 4 A

- Fig. 1, 3: *Praenanina veghae* KOZUR, n. gen. n. sp., fig. 1: holotype, a x 220, b) detail, x 480; fig. 3 a: x 260, fig. 3 b: detail of the same specimen, x 600.  
Fig. 2: Sponge spicule, x 300.

Plate 1A

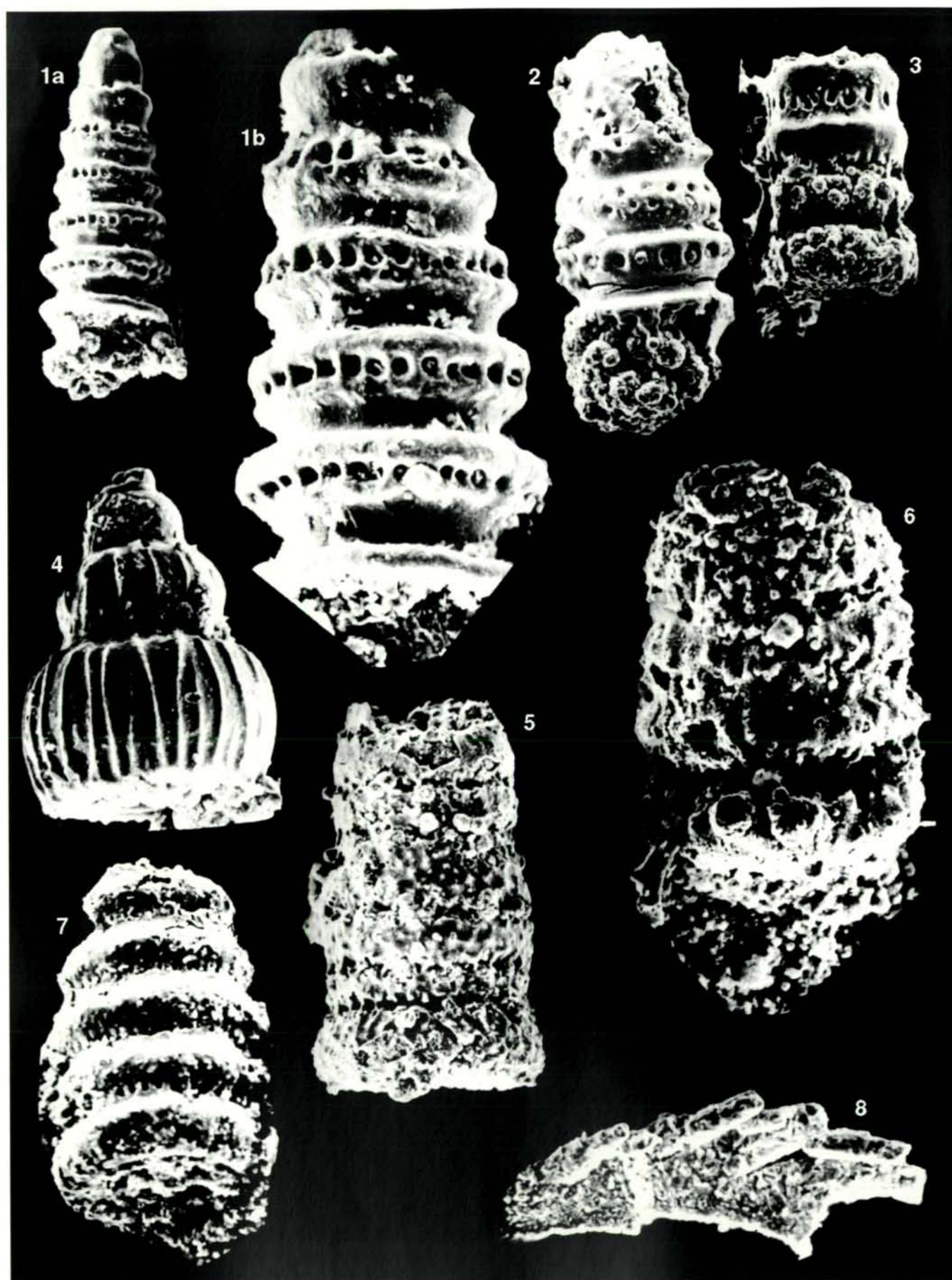




Plate 2A

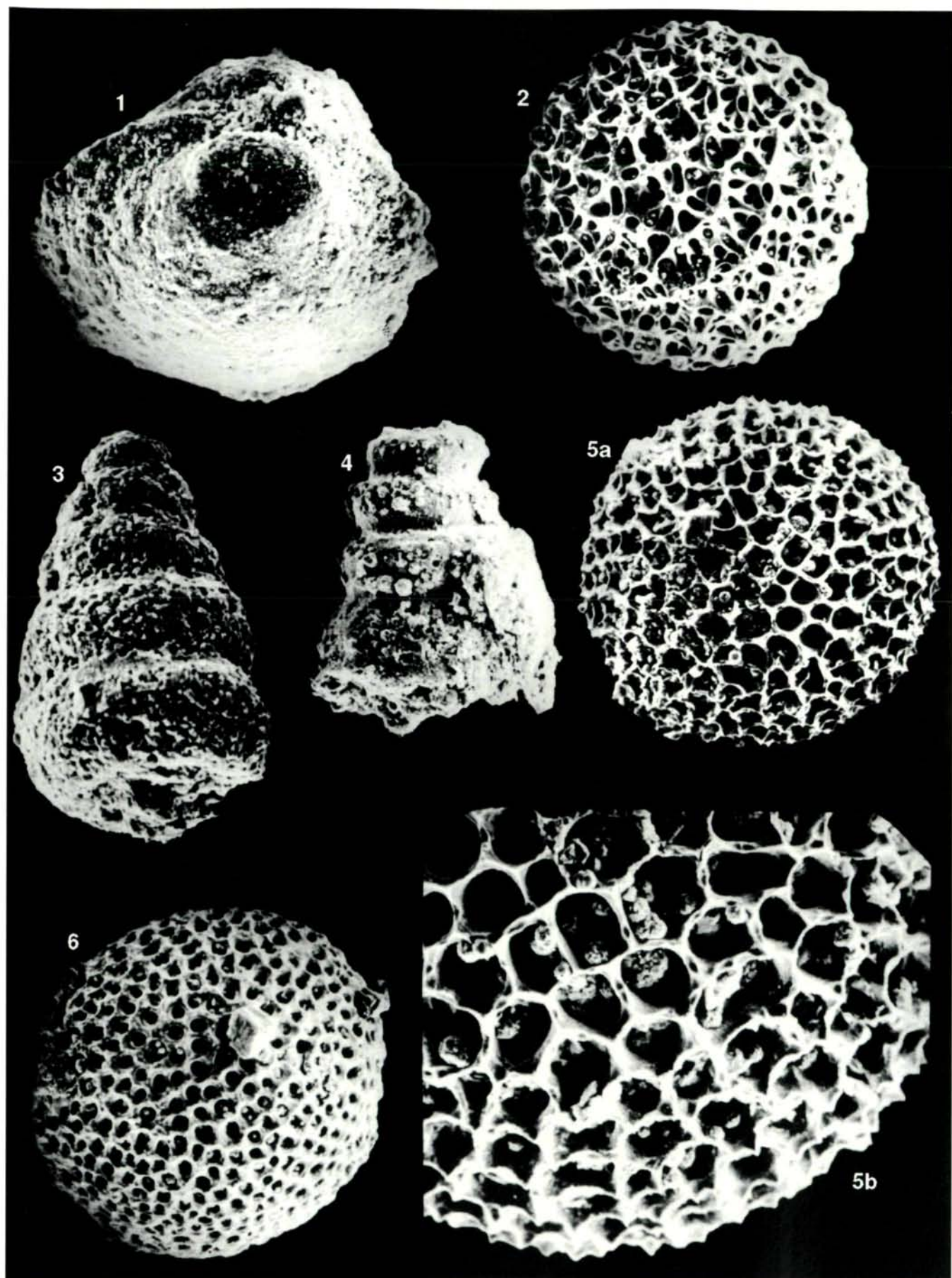




Plate 3A

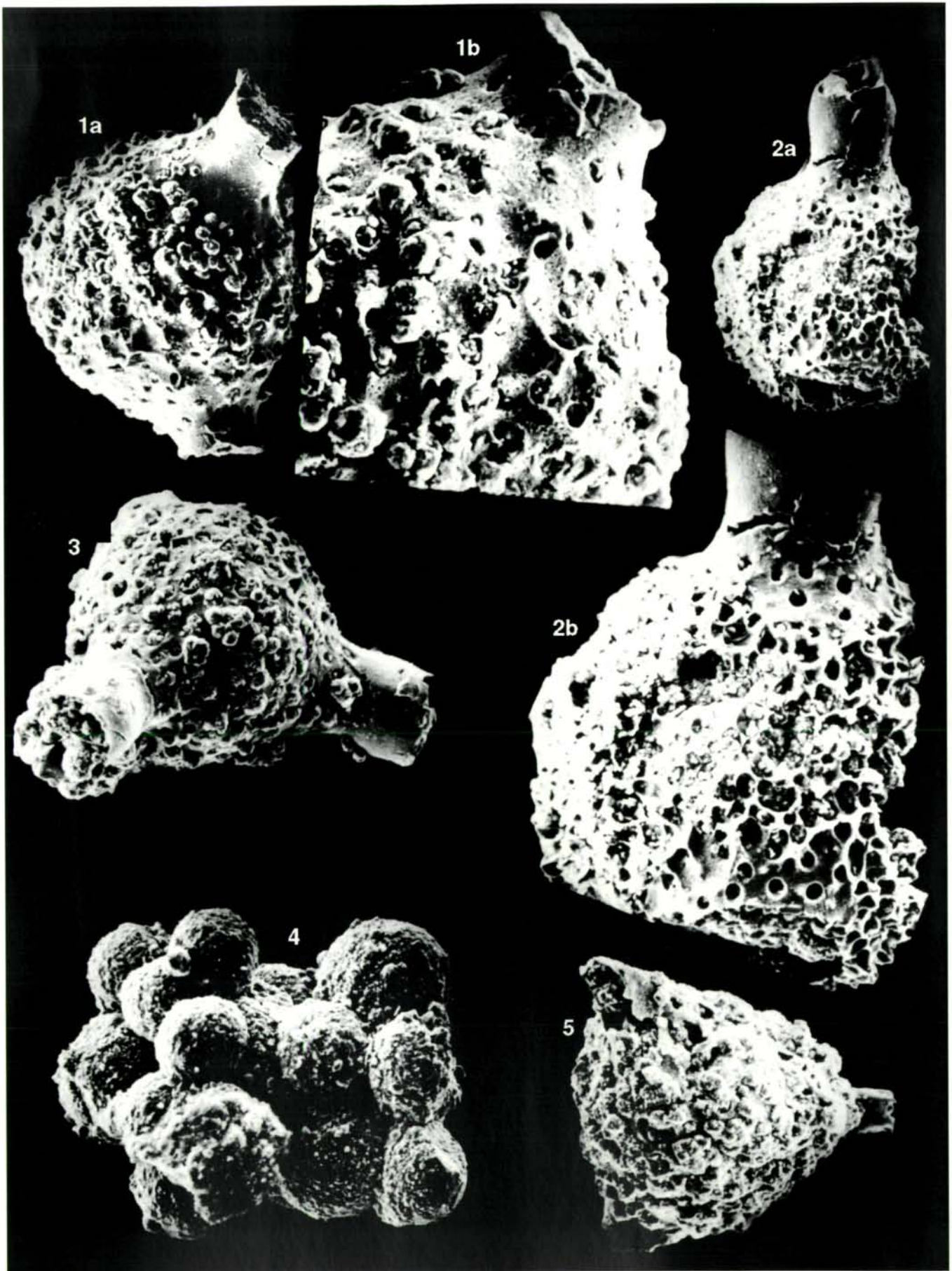
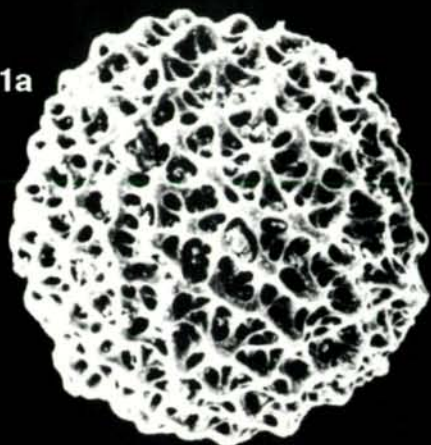


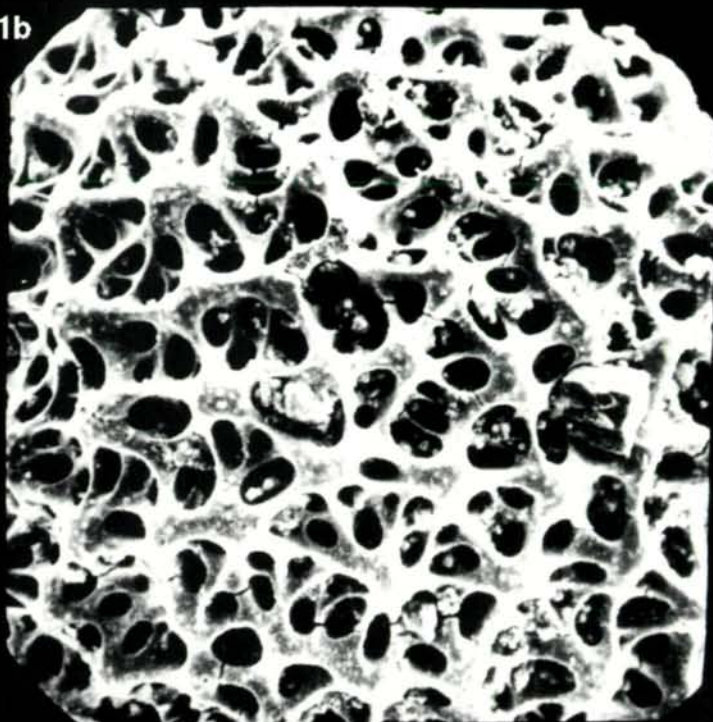


Plate 4A

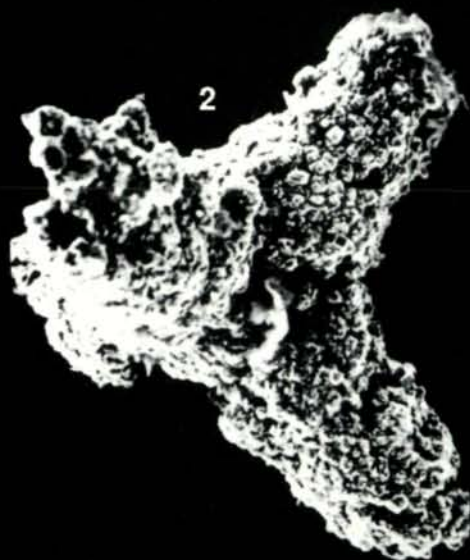
1a



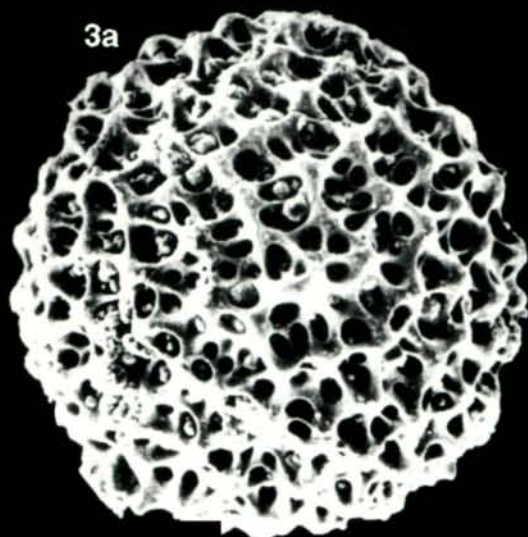
1b



2



3a



3b

