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JURASSIC RADIOLARITES FROM THE EASTERN PART OF THE PIENINY KLIPPEN BELT (WESTERN CARPATHIANS)

LADISLAVA OŽVOLDOVÁ and LENKA FRANTOVÁ

Department of Geology and Paleontology, Faculty of Sciences, Comenius University, Mlynská dolina, 842 15 Bratislava, Slovak Republic

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Abstract: The radiolarites of the Šariš and Pieniny part of the Pieniny Klippen Belt belong to the Pieniny Succesion s.l. (Nemčok et al. 1990). A horizon of radiolarites from the locality Milpoš and Podsadek near Stará Ľubovňa contains a considerable calcareous admixture. At the localities of Šarišské Jastrabie and Lúčka the radiolarites are almost without calcite and contain Mn coatings. The radiolarian associations represent UAZone 8 - UAZone 10 ranging from middle Callovian to early Kimmeridgian (sensu Baumgartner et al. 1995). Radiolarites with Mn coatings reach to middle Oxfordian at the locality Šarišské Jastrabie. A new genus *Fultacapsa* nov. gen. is described in this paper.

Key words: Jurassic, Western Carpathians, Pieniny Klippen Belt, Pieniny Succession, radiolarians, radiolarites.

Introduction

Up to now the occurrence of radiolarites in the eastern part of the Pieniny Klippen Belt has not been proved by evidence of radiolarian microfauna. In this first contribution we deal with the evaluation of radiolarian microfauna at the localities of Milpoš, Lúčky, Kyjov, Šarišské Jastrabie (the Šariš part of the Klippen Belt) and Podsadek near Stará Ľubovňa (the Pieniny part of the Klippen Belt) (Fig. 1).

On the Polish territory Birkenmajer (1977) determined the lithostratigraphical units for the Pieniny Klippen Belt.

For radiolarites they are as follows:

1 — Sokolica Radiolarite Formation — grey-green, dark-grey or black radiolarites with the typical coatings of Mn minerals. The age — ?Upper Bajocian-Callovian - ?Lower Oxfordian.

2 — Czajakowa Radiolarite Formation with three members:
lower red radiolarites — Kamionka Radiolarite Member
green radiolarites — Podmajerz Radiolarite Member
upper red radiolarites — Buwald Radiolarite Member
Age — ?Upper Callovian-Upper Oxfordian-?Kimmeridgian.

The latest comprehensive geological research in the investigated area was carried out by Nemčok (1982, 1986) and Nemčok et al. (1990).

In accordance with this information radiolarites belong to the Pieniny Succession s.l. They overlie the crinoidal or spotty limestones. In the underlying strata, nodular limestones or the pelagic facies occur.

Within the research of Nemčok et al. (1986) the investigation of radiolarian microfauna was also performed for the localities of Podsadek and Šarišské Jastrabie by Ondrejíčková (1985). The age for radiolarian associations from radiolarites was determined as the Upper Jurassic.

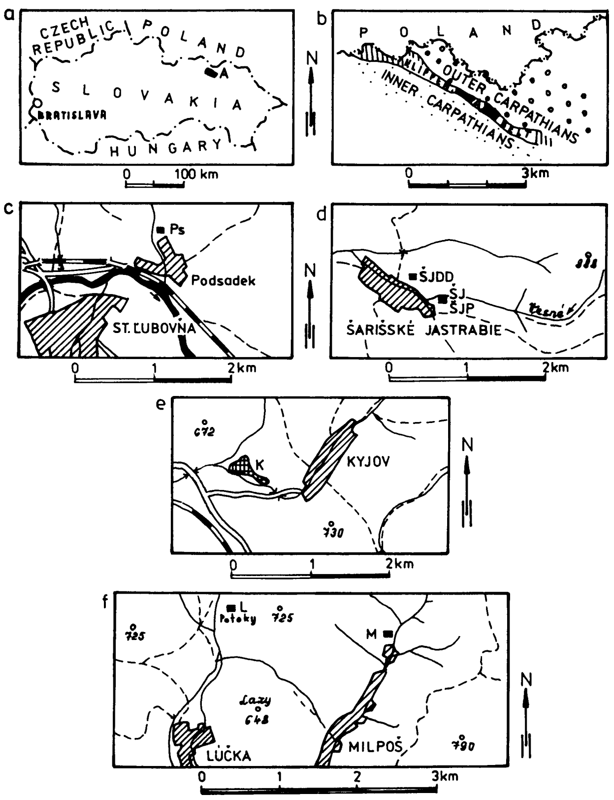


Fig. 1. Location of the investigated area and sampling localities. **a** — Situation of investigated area (A). **b** — Close view of the investigated area (A). **c** — Podsadek section — Ps. **d** — Šarišské Jastrabie sections — ŠJP, ŠJ, ŠJDD. **e** — Kyjov area — K. **f** — Lúčka section — L, Milpoš section — M.

Stratigraphy of investigated localities

Milpoš (Fig. 1f)

Radiolarites overlie the red crinoidal limestones sometimes with a layer or lense of cherts (Krupianka Limestone Formation sensu Birkenmajer 1977). Except for crinoidal plates they contain fragments of forams, ostracods and phantoms of radiolarians. There is a debris section between the crinoidal limestones and the overlying radiolarites. The section continues with the rusty-red radiolarites of the Czajakowa Radiolarite Formation (Buwald Radiolarite Member), sometimes with the occurrence of the green parts.

The radiolarian microfauna from radiolarites was very poor. Only one sample (M-5) has been analyzed, in which the species *Fultacapsa sphaerica* (Ožvoldová) nov. comb. occurred. Its presence shows that the association is not older than UAZone 9 ranging from middle to late Oxfordian (sensu Baumgartner et al. 1995, as well as the results of our investigations).

In the upper part of the radiolarite horizon a great number of intercalations of pinkgrey limestones appear. They become dominant into the overlying strata and they include numerous irregular intercalations of siliceous nodules. The limestones only contain phantoms of radiolarians, filled up with chalcedony or calcite. The phantoms of radiolarians are less numerous in the siliceous intercalations. The presumptive age of this part of the bed is Kimmeridgian. The Tithonian pelagic limestones (Pieniny Limestone Formation sensu Birkenmajer 1977) with rich microfauna overlie these limestones.

Lúčka (Fig. 1f)

In the lower part of the outcrop of radiolarites, green-grey to dark-grey radiolarite layers with Mn coatings occur (Sokolica Radiolarite Formation). Grey-green and rusty-red radiolarites overlie them (Podmajerz Radiolarite Member and Buwald Radiolarite Member of Czajakowa Radiolarite Formation).

The poor radiolarite association from the rusty-red radiolarite (sample L-5) represented a middle Oxfordian - early Kimmerdgian age (the species *Fultacapsa sphaerica* (Ožvoldová) nov. comb. and *Zhamoidellum ovum* Dumitrica appear in UAZone 9 ranging from middle to late Oxfordian and the species *Emiluvia premyogii* Baumgartner finishes in UAZone 10 — Oxfordian–early Kimmeridgian according to Baumgartner et al. 1995).

Kyjov (Fig. 1e)

The grey-green and rusty-red radiolarites occur in the scree material only.

The grey-green radiolarite, sample K-2, contained a relatively poor association. The presence of the species *Podobursa spinosa* (Ožvoldová) proves that the assemblage is not older than UAZone 8 ranging from middle Callovian to early Oxfordian (l.c.).

In the rusty-red radiolarite the radiolarian association, presented in sample K-1 corresponds to UAZone 8–10 — middle Callovian–early Kimmeridgian (l.c.). The species *Podobursa spinosa* (Ožvoldová) and *Emiluvia orea orea* Baumgartner, which appear in UAZone 8 and *Paronaella mulleri* Pesagno and *Angulobracchia digitata* Baumgartner, which finish in UAZone 10 occur in this association.

Concerning the stratigraphical range of *Emiluvia orea orea* Baumgartner, this species does not occur with such species as *Guexella nudata* (Kocher) and *Stylocapsa oblongula* Kocher (UAZone 8) according to our investigations. It appears later.

Šarišské Jastrabie (Fig. 1d, Fig. 2)

This locality is situated in the eastern part of the village in the brook Vesné. Three sections have been ivestigated in this area: ŠJ, ŠJP and ŠJDD.

The section ŠJ consists of outcrops of radiolarites of grey-green to dark-grey colour, partly of reddish colour with shale intercalations of similar colour. The radiolarite levels sometimes show coatings of Mn minerals (Sokolica Radiolarite Formation). The radiolarian microfauna was very poor, mostly indeterminable.

The section ŠJP presents brown-grey and green-grey radiolarites in its lower part, sometimes with rusty-red parts and with irregular pigmentation of Mn minerals (Sokolica Radiolarite Formation). The radiolarite levels are separated by thin shale intercalations.

The sample ŠJP-1, in the lowermost part of the section yielded a badly preserved association with only one determinable species *Eucyrtidiellum ptyctum* Riedel & Sanfilippo. According to Baumgartner et al. (1995) this species appears in UAZone 5, ranging from latest Bajocian to early Bathonian. We agree with the opinions presented by Baumgartner (1984) and Goričan (1994) that this species appears during the Callovian.

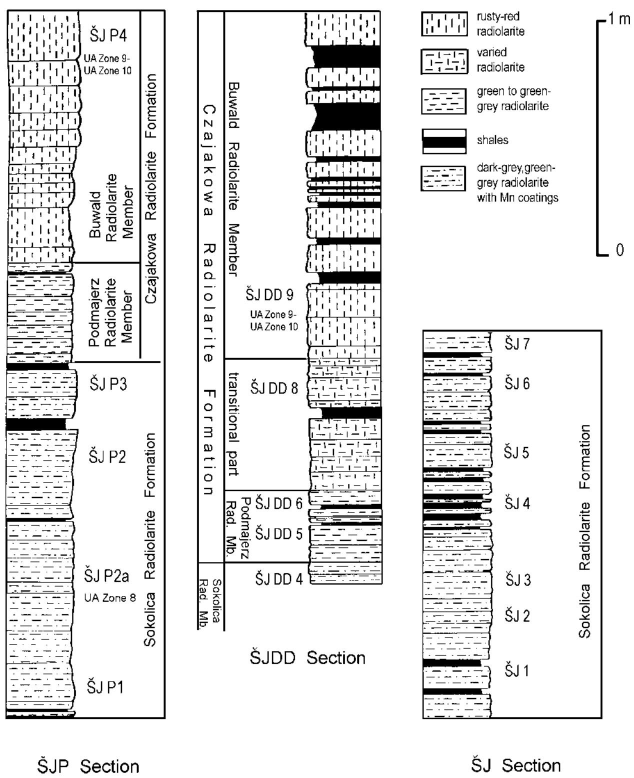


Fig. 2. Lithological columns of the sections ŠJP, ŠJDD and ŠJ (locality Šarišské Jastrabie).

Approximately 0.5 m upwards a richer association occurs in sample ŠJP-2a, which contains the species *Emiluvia pessagnoi multipora* Steiger. This species appears in UAZone 8, ranging from middle Callovian to early Oxfordian (Baumgartner et al. 1995) and co-occurs with the species *Williriedellum* sp. A sensu Matsuoka 1983, which makes its last occurrence in this zone. These data indicate that the association represents a middle Callovian–early Oxfordian age.

In the upper part of the outcrop the Mn coatings disappear. Green-grey or grey-green radiolarites with reddish parts occur there (Podmajerz Radiolarite Member of Czajakowa Radiolarite Formation).

The uppermost part of the outcrop is formed by rusty-red radiolarites (Buwald Radiolarite Member of the Czajakowa Radiolarite Formation). The rich association found in sample ŠJP-4 contained two types of radiolarian tests: **a)** well preserved, often pellucid (fluoritization) and **b)** worse preserved with Fe pigmentation, often with features of pressure deformation. The second type seems originate in argillaceous laminae, which are probably formed by bottom currents (the signs of the shape sorting). The radiolarian tests in the argillaceous parts are more sensitive to deformation during the compaction of sediment.

In the sample ŠJP-4 the following species occur: *Podocapsa amphitreptera* Foreman, *Fultacapsa sphaerica* (Ožvoldová), nov. comb., ranging from middle to late Oxfordian (UAZone 9 of Baumgartner et al. 1995) and the species *Tritrabs casmaliaensis* (Pessagno), which has its last occurrence in UAZone 10, ranging from late Oxfordian to early Kimmeridgian (l.c.). The above mentioned data indicate that the association represents a middle Oxfordian–early Kimmeridgian age.

In this section chemical analyses (Fig. 3) were performed on the grey radiolarites (ŠJP-l), the grey-green radiolarites with Mn coatings (ŠJP-2), the green superposed radiolarites (ŠJP-3) and the rusty-red radiolarites at the top of the section (ŠJP-4).

The composition of CaO increases towards the top of the section but if we compare with the radiolarites of the western part of the Klippen Belt, these values are very low (max. 0.36 %). The concentration of Al_2O_3 and Fe_2O_3 increases upwards. In the radiolarites with Mn coatings (ŠJP-2) the concentration of Mn (3.16 %) highly exceeds the values obtained from the underlying and overlying beds (ŠJP-1 — 138 ppm, ŠJP-3 — 281 ppm, ŠJP-4 — 326 ppm).

According to the research of Ilavský (1955) the enriched radiolarites with Mn contained as much as 18 % Mn.

On the right side of the outcrop a tectonic contact between the Sokolica Radiolarite Formation and the Eocene Globigerinian marls occurs. These marls are of dark-grey to black colour with rich pigmentation of Mn minerals. Their presumptive age was Middle Jurassic (Ilavský 1955), but later investigations proved that they are of Eocene age (Gašparíková 1986).

In the other places of this locality the radiolarites are overlain by red nodular limestones of Kimmeridgian-Early Tithonian age (Doležalová 1993). This fact demonstrates the correspondence of this section to the Kysuca Succession.

In the section ŠJDD, overturned beds of radiolarites with thin intercalations of shales occur. In the middle part of the outcrop, a tectonic contact between radiolarites and dark-grey and black shales containing rich impregnations of Mn pigment and intraclasts of light soft clayey material with high concentration of P_2O_5 (8.29 %) occurs. Paleontological evidence for their stratigraphical assignment does not exist.

	ŠJP 1	ŠJP 2	ŠJP 3	ŠJP 4
H_2O^+ (%)	0.09	0.08	0.08	0.09
H_2O^- (%)	1.97	5.78	4.81	3.59
SiO_2 (%)	94.49	84.95	80.97	81.96
TiO_2 (%)	0.10	0.09	0.11	0.11
Al_2O_3 (%)	1.41	2.21	6.80	6.59
Fe_2O_3 (%)	0.94	1.73	3.86	4.35
CaO (%)	0.19	0.28	0.26	0.36
MgO (%)	0.18	0.30	1.49	1.22
K_2O (%)	0.25	0.28	1.26	1.38
Na_2O (mg/kg)	943.60	935.70	1204.90	1203.10
Mn (mg/kg)	138.83	31600.00	281.25	326.22
Cr (mg/kg)	11.07	11.05	37.97	32.92
Ni (mg/kg)	10.06	16.07	36.47	30.92
Cu (mg/kg)	40.24	49.22	116.89	43.89

Fig. 3. Chemical analyses of the samples from the section ŠJP (locality Šarišské Jastrabie).

In the top part of the outcrop the radiolarian fauna from dark-grey to green-grey radiolarites with Mn coatings (Sokolica Radiolarite Formation) was very poor. The presence of the species *Podocapsa amphitreptera* Foreman (sample ŠJDD-4) demonstrates that the association is not older than UAZone 9, ranging from middle to late Oxfordian (Baumgartner et al. 1995).

The underlying grey-green to green radiolarites, sample ŠJDD-5, (Podmajerz Radiolarite Member of Czajakowa Radiolarite Formation) contained the species *Fultacapsa sphaerica* (Ožvoldová) nov. comb., which appears in UAZone 9, ranging from middle to late Oxfordian (l.c.). In the lower part, in rusty-red levels, the species *Emiluvia orea* Baumgartner in sample ŠJDD-8 occurred. In the bottom of the outcrop the rusty-red radiolarites contained an association (sample ŠJDD-9) which represents UAZone 9–UAZone 10, ranging from middle Oxfordian to early Kimmeridgian (l.c.) according to the co-occurrence of the species *Fultacapsa sphaerica* (Ožvoldová) nov. comb., (first occurrence in UAZone 9) and *Tritrabs casmaliaensis* (Pessagno) (late occurrence in UAZone l0).

The above mentioned data resulted in the conclusion that the radiolarites in this outcrop represent a middle Oxfordian-early Kimmeridgian age.

Podsadek near Stará Ľubovňa (Fig. 1c)

The section is situated in the brown-grey siliceous limestones with grey cherts in the lower part and the rusty-red or green siliceous limestones to calcareous radiolarites in the upper part of the outcrop. The Middle-Upper Tithonian Rogoznik limestones overlie these strata (Nemčok et al. 1982).

In the brown-grey limestones the chert contained an assemblage (sample Ps-3) representing middle Oxfordian–early

Kimmeridgian (UAZone 9–10) (Baumgartner et al. 1995) on the basis of the co-occurrence of *Emiluvia premyogii* Baumgartner and *Orbiculiforma (?) catenaria* Ožvoldová with *Emiluvia ordinaria* Ožvoldová.

In the upper part the radiolarian assemblage from the rusty-red calcareous radiolarite (sample Ps-14) contained the species *Paronaella pristidentata* Baumgartner, which has its first occurrence in UAZone 10 (late Oxfordian to early Kimmeridgian) and the species *Paronaella mulleri* Pessagno, which finishes in this zone (l.c.). The association represents a late Oxfordian–early Kimmeridgian age (UAZone 10 of Baumgartner et al. 1995).

The horizon of radiolarites in this locality has a great quantity of calcareous component. According to this research the most siliceous part of the section represents the middle Oxfordian–early Kimmeridgian interval.

Summary of the results obtained

Radiolarites from the studied localities belong to the Pieniny Succession s.l. (Nemčok et al. 1990). In the localities of Milpoš and Podsadek near Stará Ľubovňa the horizon of radiolarites includes a large quantity of limestone layers and the radiolarites have mostly fair calcareous admixture. The strata with regard to the underlying crinoidal limestones belong to the Czertezik Succession.

In the locality of Šarišské Jastrabie the nodular limestones overlie radiolarites (Doležalová 1993). This fact demonstrates correspondence to the Kysuca Succession.

The underlying and overlying rocks to the radiolarite horizon are not uncovered in the locality of Lúčka. However, the radiolarites are similar to those in the locality of Šarišské Jastrabie.

The radiolarites in the locality of Kyjov only occur in the scree.

The important feature of the Sokolica Radiolarite Formation in the localities of Šarišské Jastrabie and Lúčka is the presence of Mn coatings. Ilavský (1955) gives information concerning the concentrations of Mn minerals in radiolarites in the Vesné brook of the Šarišské Jastrabie (section ŠJP). This author found that the course and the amount of these concentrations was irregular. The richest zone is located near the contact with the shales, which are also covered by manganeseferous coating and are Middle Jurassic in age, according to Ilavský (1955). He assumed the migration of Mn minerals towards the contact with the impermeable horizon of shales.

Recent research proved that the contact with these shales is tectonic and the shales belong to the Paleogene series (Proč beds) of the Klippen Belt (Nemčok et al. 1990).

The presence of Mn in radiolarites through the migration from the original source can be supported by the preliminary chemical analyses presented in this paper and carried out in the section ŠJP in Šarišské Jastrabie. While the concentration of Mn in the dark-grey radioarite with Mn coatings in the lower part of the section (sample ŠJP-2) was 3.16 %, in the underlying grey beds (sample ŠJP-1) and overlying green and rusty-red radiolarites (samples ŠJP-3 and ŠJP-4) the concentration of Mn was low (138 ppm, 281 ppm, 326 ppm).

It can be supposed that the accumulation of Mn minerals was realized in the course of the migration from the original source into the radiolarite beds originally having plenty of joints. Under the microscope the original siliceous matter is sometimes broken into angular parts separated by chlorite-siliceous fissures with Mn pigment.

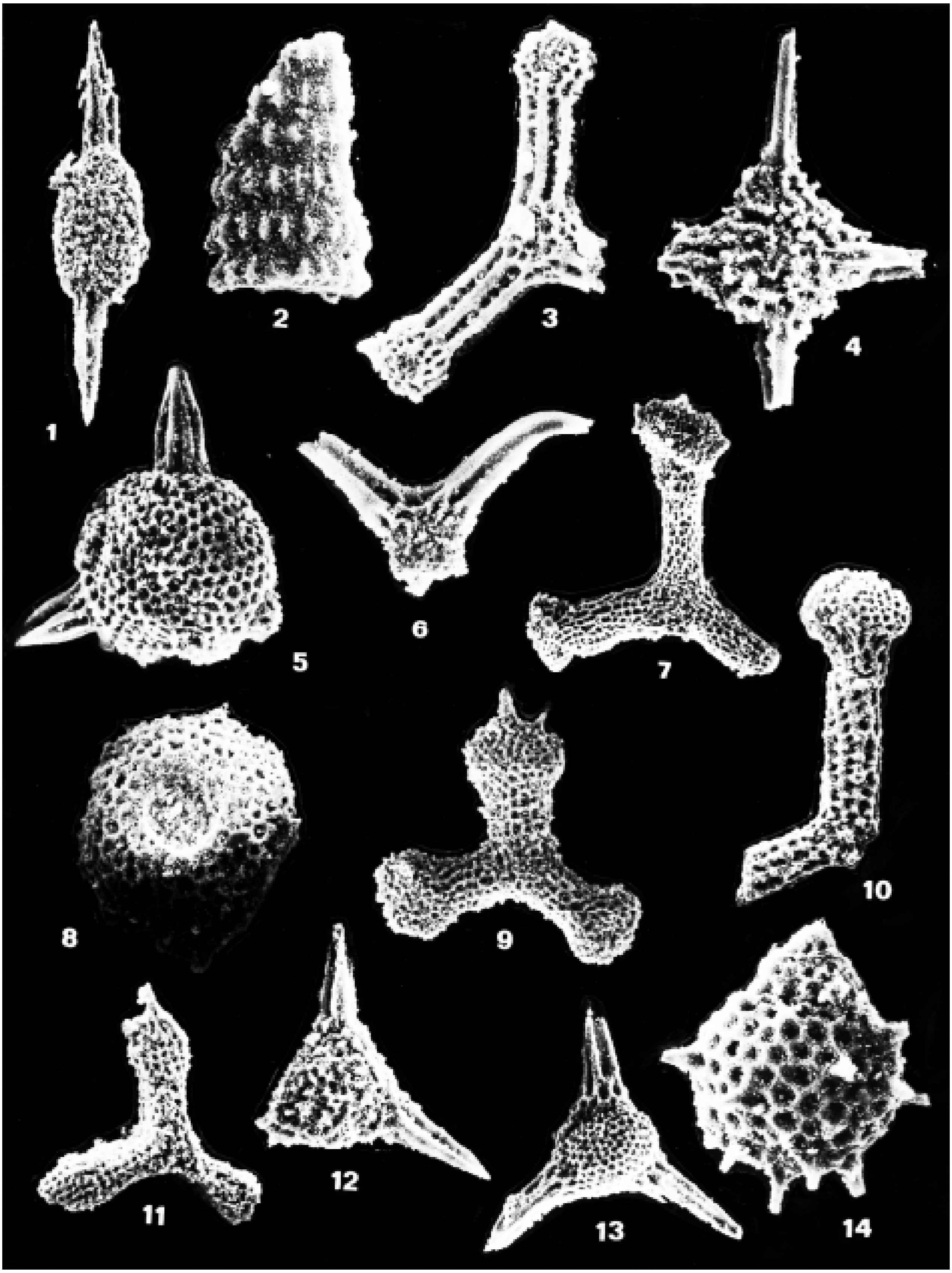
Microscopic analysis of the black shales from the section ŠJDD show that the rock is thickly impregnated with small globular particles of Mn minerals covering thickly the original rock.

The analyses of microfauna show well preserved radiolarians in Šarišské Jastrabie. In the lower part of the radiolarite horizon the radiolarian assemblages represent the middle Callovian–early Oxfordian interval (UAZone 8 sensu Baumgartner et al. 1995). The upper part of the radiolarite horizon is correlatable to the UAZone 9–UAZone 10 (middle Oxfordian–early Kimmeridgian) (l.c.).

Plate I: Fig. 1. *Archaeospongoprunum imlayi* Pessagno — ŠJP-2a, 8151, 150×. **Fig. 2.** *Transhsuum brevicostatum* (Ožvoldová) — ŠJP-2a, 1860, 240×. **Fig. 3.** *Tritrabs rhododactylus* Baumgartner — ŠJP-2a, 1906, 170×. **Fig. 4.** *Emiluvia pessagnoi multipora* Steiger — ŠJP-2a, 8129, 165×. **Fig. 5.** *Triactoma blakei* (Pessagno) — ŠJP-2a, 1921, 160×. **Fig. 6.** *Bernoullius dicera* (Baumgartner) — ŠJP-2a, 1867, 180×. **Fig. 7.** *Paronaella kotura* Baumgartner — ŠJP-2a, 8147, 130×. **Fig. 8.** *Orbiculiforma* (?) cf. *catenaria* Ožvoldová — ŠJP-2a, 8120, 160×. **Fig. 9.** *Paronaella broennimanni* Pessagno — ŠJP-2a, 2383, 140×. **Fig. 10.** *Homoeoparonaella argolidensis* Baumgartner — ŠJP-2a, 8133, 150×. **Fig. 11.** *Paronaella mulleri* Pessagno — ŠJP-2a, 8137, 175×. **Fig. 12.** *Triactoma* sp. — ŠJP-2a, 8106, 240×. **Fig. 13.** *Triactoma jonesi* (Pessagno) — ŠJP-2a, 8156, 160×. **Fig. 14.** *Sethocapsa* sp. — ŠJP-2a, 1882, 290×.

Plate II: Fig. 1. ?*Dictyomitrella* sp. — ŠJP-2a, 8145, 360×. **Fig. 2.** *Parvicingula dhimenaensis* Baumgartner — ŠJP-2a, 2387, 250×. **Fig. 3**. *Archaeodictyomitra directiporata* (Rüst) — ŠJP-2a, 1917, 280×. **Fig. 4.** *Cinguloturris carpatica* Dumitrica — ŠJP-2a, 1883, 260×. **Fig. 5.** *Williriedellum* sp. A sensu Matsuoka,1983 — ŠJP-2a, 1875, 360×. **Fig. 6.** *Eucyrtidiellum ptyctum* (Riedel & Sanfilippo) — ŠJP-2a, 8108 490×. **Fig. 7.** *Archaeodictyomitra prisca* Kozur & Mostler — ŠJP-2a, 8107, 280×. **Fig. 8.** *Pseudodictyomitrella hexagonata* (Heitzer) — ŠJP-2a, 8095, 450×. **Fig. 9.** *Transhsuum maxwelli* (Pessagno) — ŠJP-2a, 1897, 230×. **Fig. 10.** *Mirifusus* cf. *fragilis* Baumgartner — ŠJP-2a, 8151, 150×. **Fig. 11.** *Tricolocapsa yaoi* Matsuoka — ŠJP-2a, 8102, 400×. **Fig. 12.** *Tricolocapsa undulata* (Heitzer) — ŠJP-2a, 1894, 410×.

Plate III: Fig. 1. *Acanthocircus suboblongus* (Yao) — ŠJP-4, 8330, 210×. **Fig. 2.** *Orbiculiforma* (?) *catenaria* Ožvoldová — ŠJP-4, 8306, 160×. **Fig. 3.** *Archaeospongoprunum imlayi* Pessagno — ŠJ DD-9, 4515, 220×. **Fig. 4.** *Archaeospongoprunum* sp. — K-1, 4570, 165× **Fig. 5.** *Emiluvia orea* Baumgartner, the side view of Fig. 6 — Ps-3, 7010, 170×. **Fig. 6.** *Emiluvia orea* Baumgartner — Ps-3, 7009, 145×. **Fig. 7.** *Paronaella pygmaea* Baumgartner — ŠJ DD-9, 4514, 145×. **Fig. 8.** *Emiluvia ordinaria* Ožvoldová — Ps-3, 5831, 150×. **Fig. 9.** *Hexastylus* sp. — Ps-3, 7001, 130×. **Fig. 10.** *Triactoma blakei* (Pessagno) — Ps-3, 5836, 140×. **Fig. 11.** *Paronaella broennimanni* Pessagno — K-1, 4576, 190×. **Fig. 12.** *Fultacapsa* cf. *sphaerica* (Ožvoldová) nov. comb. — PS-14, 2341, 180×. **Fig. 13.** *Archaeospongoprunum imlayi* Pessagno — Ps-14, 4265, 225×. **Fig. 14.** *Emiluvia premyogii* Baumgartner — Ps-3, 5838, 175×. **Fig. 15.** *Paronaella mulleri* Pessagno — K-1, 4581, 135×. **Fig. 16.** *Triactoma jonesi* (Pessagno) — ŠJP-4, 8331, 190×. **Fig. 17.** *Halesium* sp. — K-1, 4568, 120×. **Fig. 18.** *Angulobracchia* cf. *rugosa* Jud — Ps-14, 3060, 145×. **Fig. 19.** *Emiluvia sedecimporata* (Rüst) — Ps-14, 3048, 145×.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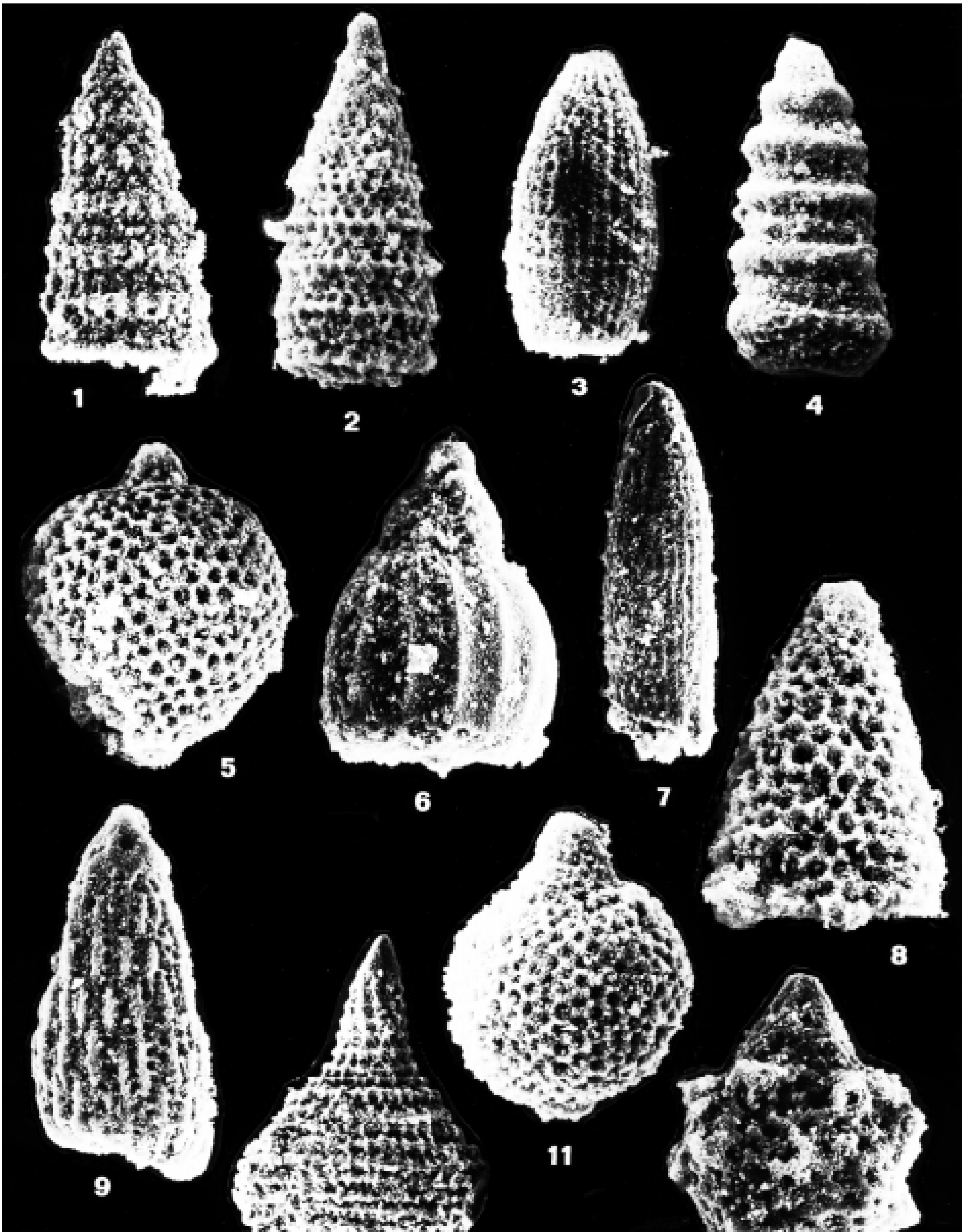
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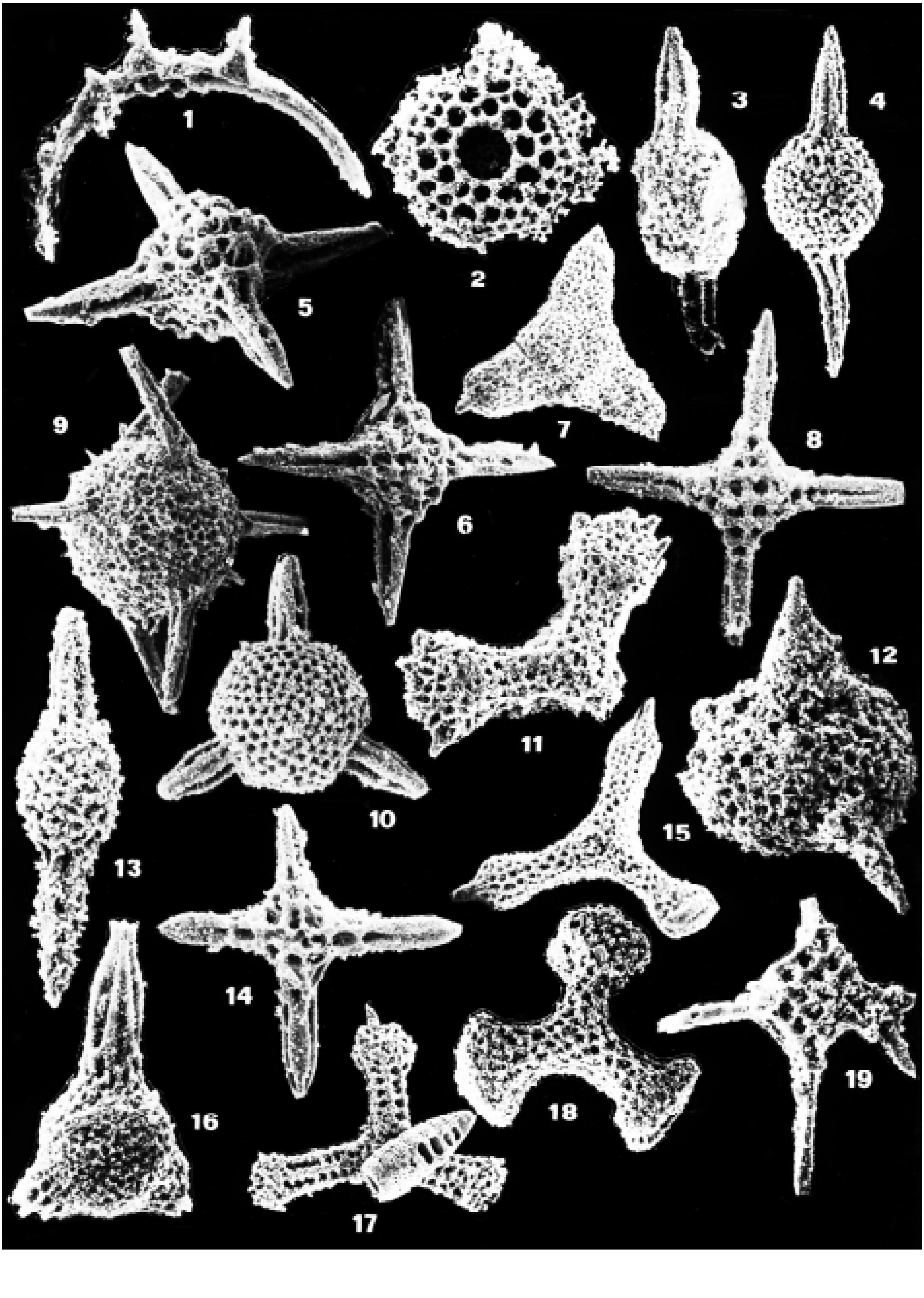
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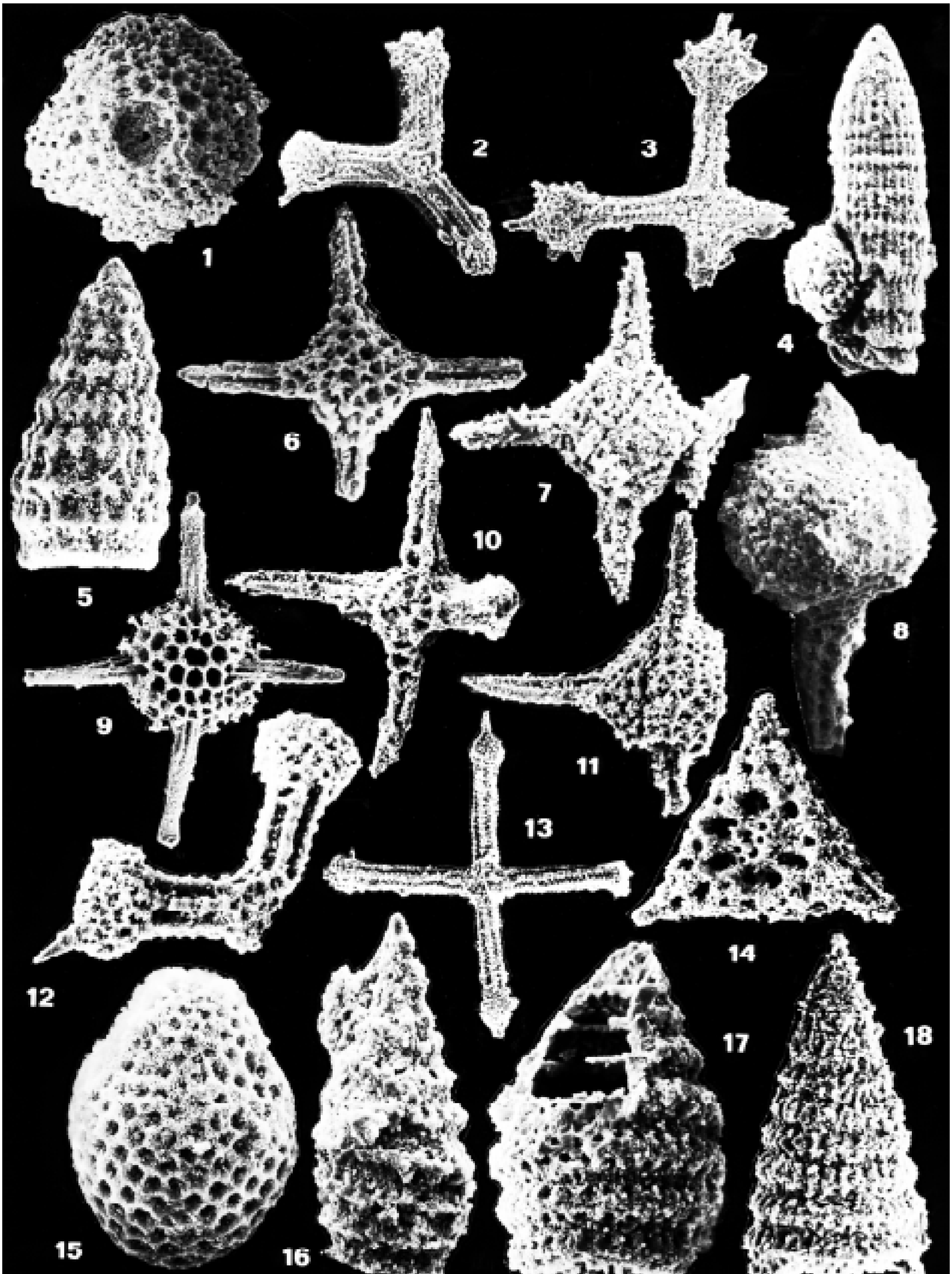
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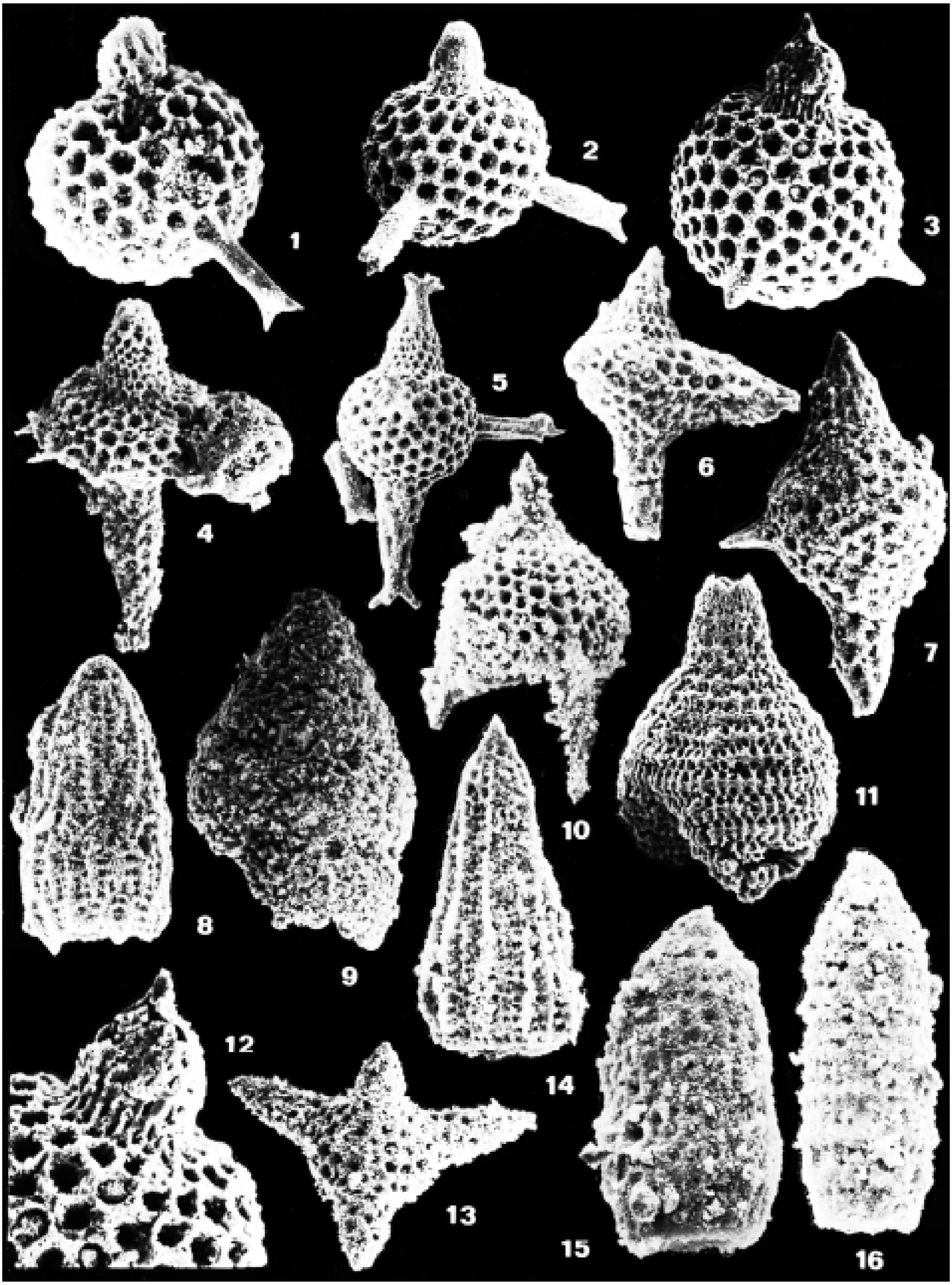
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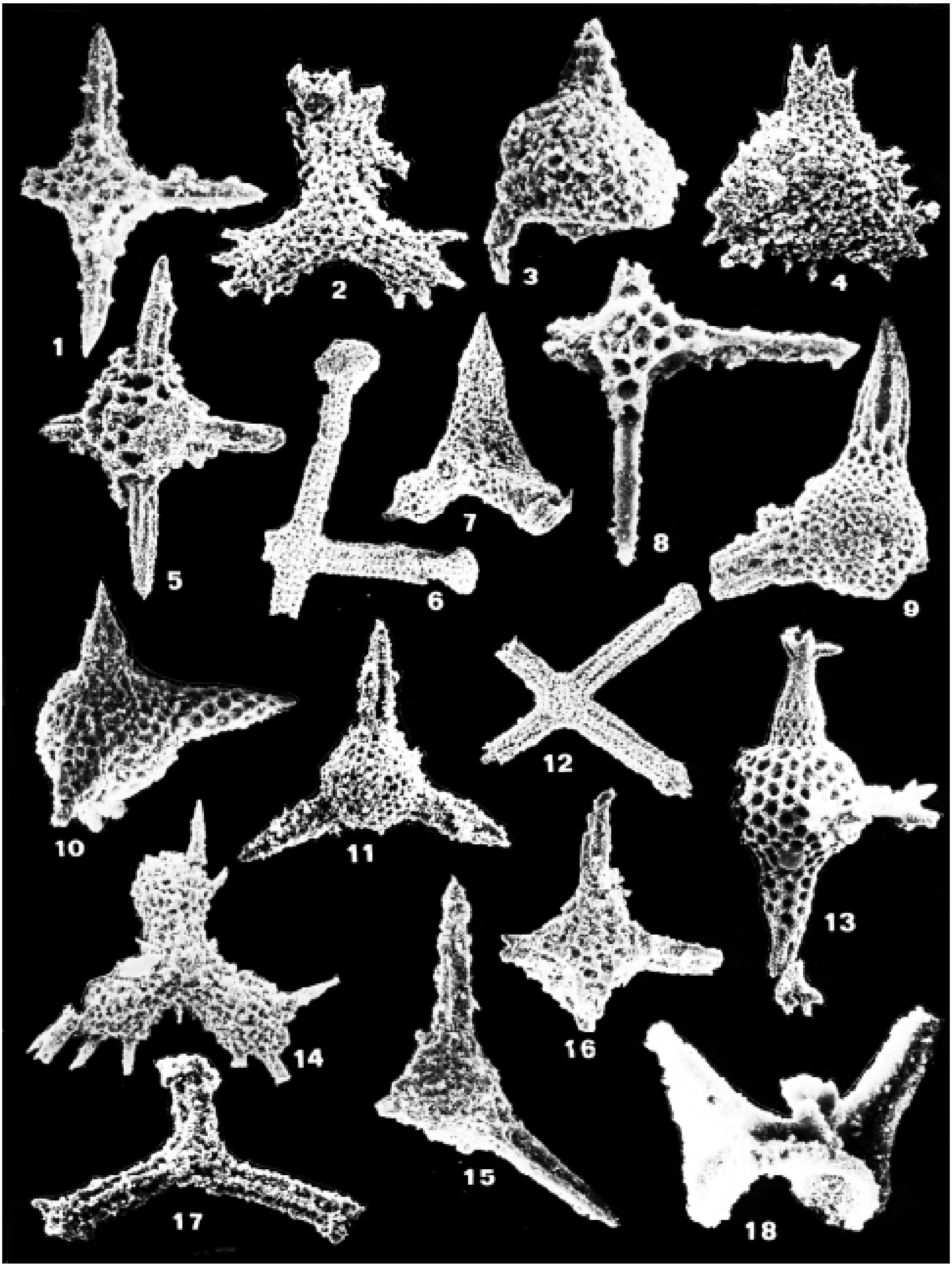
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The important result is the fact that radiolarites with Mn coatings (Sokolica Radiolarite Formation) extend to the middle Oxfordian (the presence of the species *Podocapsa amphitreptera* Foreman in the section ŠJDD).

The association found in the locality Lúčka represents middle Oxfordian–early Kimmeridgian (UAZones 9–10) (l.c.).

Plate IV: Fig. 1. *Orbiculiforma* (?) *catenaria* Ožvoldová — Ps-3, 2852, 125×. **Fig. 2.** *Tritrabs rhododactylus* Baumgartner — K-2, 4507, 120×. **Fig. 3.** *Tetraditryma pseudoplena* Baumgartner — K-1, 4579, 110×. **Fig. 4.** *Archaeodictyomitra prisca* Kozur & Mostler — ŠJ DD-6, 4499, 250×. **Fig. 5.** *Transhsuum brevicostatum* (Ožvoldová) — K-3, 4563, 250×. **Fig. 6.** *Emiluvia chica* Foreman — Ps-3, 5845, 160×. **Fig. 7.** *Haliodictya* (?) *hojnosi* Riedel & Sanfilippo — Ps-14, 4277, 220×. **Fig. 8.** *Syringocapsa spinellifera* Baumgartner — ŠJP-4, 8352, 170×. **Fig. 9.** *Haliodictya* (?) *antiqua* (Rüst) — ŠJP-4, 8327, 95×. **Fig. 10.** *Emiluvia salensis* Pessagno — Ps-14, 3028, 140×. **Fig. 11.** *Emiluvia pessagnoi* Foreman — Ps-14, 4287, 130×. **Fig. 12.** *Tritrabs exotica* (Pessagno) — ŠJP-4, 1574, 195×. **Fig. 13.** *Tetratrabs bulbosa* Baumgartner — Ps-14, 3014, 60×. **Fig. 14.** *Perispyridium ordinarium* Pessagno — Ps-14, 4275, 170×. **Fig. 15.** *Zhamoidellum ovum* Dumitrica — ŠJ DD-5, 4492, 420×. **Fig. 16.** *Parvicingula* cf. *dhimenaensis* Baumgartner — ŠJP-4, 8304, 240×. **Fig. 17.** *Parvicingula* cf. *mashitaensis* Mizutani — Ps-14, 4282, 300×. **Fig. 18.** *Pseudodictyomitra* cf. *primitiva* Matsuoka & Yao — Ps-14, 4273, 210×.

Plate V: Fig. 1. *Fultacapsa sphaerica* (Ožvoldová) nov. comb. — ŠJP-4, 1579, 210×. **Fig. 2.** *Fultacapsa sphaerica* (Ožvoldová) nov. comb. — Ps-14, 3039, 140×. **Fig. 3.** *Fultacapsa* aff. *sphaerica* (Ožvoldová) nov. comb. — Ps-14, 3051, 195×. **Fig. 4.** *Podobursa polyacantha* (Fischli) — ŠJP-4, 8346, 170×. **Fig. 5.** *Podobursa spinosa* (Ožvoldová) — Ps-3, 5837, 130×. **Fig. 6.** *Podocapsa amphitreptera* Foreman — Ps-14, 4509, 200×. **Fig. 7.** *Podobursa triacantha* (Fischli) — ŠJP-4, 1586, 210×. **Fig. 8.** *Transhsuum maxwelli* (Pessagno) — K-2, 4506, 220×. **Fig. 9.** *Spongocapsula perampla* (Rüst) — Ps-14, 5842, 175×. **Fig. 10.** *Napora lospensis* Pessagno — Ps-3, 6999, 190×. **Fig. 11.** *Mirifusus dianae* (Karrer) — K-1, 4567, 135×. **Fig. 12.** *Fultacapsa* aff. *sphaerica* (Ožvoldová) nov. comb., the apical view of Fig. 3 — Ps-14, 3052, 300×. **Fig. 13.** *Podocapsa amphitreptera* Foreman — Ps-14, 4266, 145×. **Fig. 14.** *Hsuum cuestaense* Pessagno — ŠJP-4, 8341, 210×. **Fig. 15.** *Archaeodictyomitra* cf. *apiarium* (Rust) — ŠJP-4, 8314, 380×. **Fig. 16.** *Archaeodictyomitra* cf. *minoensis* (Mizutani) — ŠJP-4, 8312, 290×.

Plate VI: Fig. 1. *Emiluvia salensis* Pessagno — Ps-3, 5821, 145×. **Fig. 2.** *Paronaella broennimanni* Pessagno — Ps-14, 4278, 160×. **Fig. 3.** *Napora lospensis* Pessagno — ŠJP-4, 8317, 155×. **Fig. 4.** *Paronaella pristidentata* Baumgartner — Ps-14, 4274, 150×. **Fig. 5.** *Haliodictya* (?) *antiqua* (Rüst) — K-1, 4585, 110×. **Fig. 6.** *Tetratrabs bulbosa* Baumgartner — ŠJ DD-9, 4512, 75×. **Fig. 7.** *Paronaella mulleri* Pessagno — K-1, 4582, 125×. **Fig. 8.** *Emiluvia salensis* Pessagno — ŠJP-4, 8316, 150×. **Fig. 9.** The transitional form between *Triactoma blakei* (Pessagno) and *Triactoma jonesi* (Pessagno) — K-2, 4589, 180×. **Fig. 10.** *Podocapsa amphitreptera* Foreman — ŠJP-4, 8331, 145×. **Fig. 11.** The transitional form between *Triactoma blakei* (Pessagno) and *Triactoma jonesi* (Pessagno) — Ps-14, 4272, 130×. **Fig. 12.** *Tetratrabs bulbosa* Baumgartner — K-1, 4573, 65×. **Fig. 13.** *Podobursa spinosa* (Ožvoldová) — ŠJP-4, 1585, 130×. **Fig. 14.** *Paronaella* sp. — Ps-3, 5820, 145×. **Fig. 15.** *Triactoma* sp. — ŠJP-4, 8318, 160×. **Fig. 16.** *Emiluvia salensis* Pessagno — K-1, 4578, 150×. **Fig. 17.** *Tritrabs casmaliaensis* Pessagno — ŠJ DD-9, 4259, 150×. **Fig. 18.** *Acanthocircus suboblongus* (Yao) — ŠJP-4, 1581, 380×.

In the locality Kyjov the assemblage in sample K-l represented a wide stratigraphical range: UAZone 8 – UAZone 10 (middle Callovian–early Kimmeridgian) (l.c.).

The association from the locality Milpoš were very poor.

At the locality Podsadek, near Stará Ľubovňa, the most siliceous part of the section contain radiolarians indicating a middle Oxfordian–early Kimmeridgian age (UAZones 9–10) (l.c.). Distribution of radiolarians in the studied sections shows Fig. 4.

Systematic part

Genus **Fultacapsa** Ožvoldová, nov. gen.

Derivatio nominis: Latin adjective *fultus* — leant, according to the spines, arranged as a support of the test. Latin noun *capsa* — chest. Feminine gender.

Type species: *Acotripus sphericus* Ožvoldová 1988

Diagnosis: Nassellariina possesing three or four chambers. Shape of proximal part of the test subglobose or conical. Cephalis usually bearing apical horn. Terminal segment large, globose lacking aperture. On its distal part spines occur. Lattice layer on terminal segment consists of hexagonal to polygonal pore frames.

Comparison: Genus *Podocyrtis* Ehrenberg, *Acotripus* Haeckel and *Hiscocapsa* O'Dogherty have aperture on the last segment. The spinose species of the genus *Sethocapsa* Haeckel and *Birkenmajeria* Widz have the spines as the ornamentation of the pore frames. This new genus only possesses spines on the distal part of the terminal segment.

Included species:

Cyrtocapsa sp. sensu De Wever et al. 1986

Sethocapsa (?) *sphaerica* (Ožvoldová) 1988

Sethocapsa (?) *concentrica* (Steiger) 1992

Sethocapsa tripes Yang 1993

Range: Middle Oxfordian – early Tithonian up to date known.

Fultacapsa sphaerica (Ožvoldová 1988) nov. comb., emend. diagnosis Pl. V: Figs. 1, 2

1988 *Acotripus sphericus* n.sp. — Ožvoldová, p. 376, pl. 5, Fig. 1–5, 7

1993 *Birkenmajeria sphaerica* (Ožvoldová) — Widz-De Wever, p. 82, pl. 1, Fig. 3–4

1995 *Sethocapsa* (?) *sphaerica* (Ožvoldová) — Baumgartner et al., p. 500, pl. 3168, Fig. 1–4

Emended diagnosis: The apical horn of variable thickness and length rises from cephalis. The apical horn and tips on the terminal segment can be split into three small spines (Pl. V: Figs. 1, 2 in this article. Pl. 1, Fig. 4 in Widz & De Wever 1993).

Remarks: In the type species (Ožvoldová 1988) the existence of apical horn was indistinct. But this character was confirmed in other occurrences of this species, (Danelian 1989, pl. 2, Fig.1–5, Mišík et al. 1994, pl. 1, Fig. 16).

archives GÚDŠ, Bratislava (in Slovak).

Range: Middle Oxfordian – early Tithonian according to Baumgartner et al. (1995)

						SJ	SJ	SJ	SJ	SJ				
	Ps	Ps	SJP	SJP	SJP	DD	DD	DD	DD	DD	K	K	L	M
Distribution of radiolarians in studied samples	3	14	2a	4	1	4	5	6	8	9	1	2	5	5
Acaeniotyle diaphorogona Foreman	*	*		*								*		
Acanthocircus suboblongus (Yao)		*	*	*								*		
Acanthocircus trizonalis (Rust)												*		
Archaeodictyomitra cf. apiarium (Rust)	*			*						*				
Archaeodictyomitra directiporata (Rust)			*											
Archaeodictyomitra cf. minoensis (Mizutani)				*										
Archaeodictyomitra prisca Kozur et Mostler			*					*						
Archaeospongoprunum imlayi Pessagno			*	*						*		*	*	*
Archaeospongoprunum sp.	*	*									*			
Angulobracchia biordinalis Ožvoldová										*				
Angulobracchia digitata Baumgartner											*			
Angulobracchia (?) cf. rugosa Jud		*												
Bernoullius dicera (Baumgartner)			*											
Cinguloturris carpatica Dumitrica			*									*		
Emiluvia chica Foreman	*													
Emiluvia orea Baumgartner	*								*	*	*		*	
Emiluvia ordinaria Ožvoldová	*	*		*										
Emiluvia pessagnoi s.l. Foreman		*		*						*				
Emiluvia pessagnoi multipora Steiger			*											
Emiluvia p+A35remyogii Baumgartner	*									*			*	
Emiluvia salensis Pessagno	*	*		*						*	*			*
Emiluvia sedecimporata (Rust)		*		*										*
Eucyrtidiellum ptyctum (Riedel et Sanfilippo)			*		*									
Fultacapsa sphaerica (Ožvoldová)		*		*			*			*			*	*
Fultacapsa cf. sphaerica (Ožvoldová)		*												
Fultacapsa aff. sphaerica (Ožvoldová)		*												
Halesium sp.	*										*			
Haliodictya (?) hojnosi Riedel et Sanfilippo		*												
Haliodictya (?) antiqua (Rust)	*	*		*							*			
Hexastylus sp.	*													
Hsuum cuestaense Pessagno				*										
Mirifusus dianae (Karrer)	*		*	*							*			
Mirifusus cf. fragilis Baumgartner			*											
Napora lospensis Pessagno	*			*										
Orbiculiforma (?) catenaria Ožvoldová	*			*										
Orbiculiforma (?) cf. catenaria Ožvoldová			*											
Paronaella broennimanni Pessagno		*	*								*			
Paronaella mulleri Pessagno		*	*							*	*			
Paronaella pristidentata Baumgartner		*												
Paronaella pygmaea Baumgartner										*				
Parvicingula cf. dhimenaensis Baumgartner			*	*										
Parvicingula cf. mashitaensis Mizutani		*												
Perispyridium ordinarium (Pessagno)		*												
Podobursa spinosa (Ožvoldová)	*	*		*			*	*	*		*	*	*	*
Podobursa triacantha (Fischli)	*			*			*			*	*		*	*
Podobursa polyacantha (Fischli)				*										
Podocapsa amphitreptera Foreman		*		*		*								
Pseudodictyomitra cf. primitiva Matsuoka et Yao		*								*				
Pseudodictyomitrella hexagonata (Heitzer)			*										*	
Sethocapsa sp.			*											
Spongocapsula perampla (Rust)	*	*								*				
Syringocapsa spinellifera Baumgartner				*										
Tetraditryma pseudoplena Baumgartner											*			*
Tetratrabs bulbosa Baumgartner		*		*						*	*			
Tetratrabs zealis (Ožvoldová)	*										*			
Transhsuum brevicostatum (Ožvoldová)			*	*			*			*		*		
Transhsuum maxwelli (Pessagno)			*									*		
Triactoma blakei (Pessagno)	*		*					*	*	*	*		*	*
Triactoma jonesi (Pessagno)			*	*						*		*		
Tricolocapsa yaoi Matsuoka		*	*									*		
Tricolocapsa undulata (Heitzer)			*											
Triactoma sp.			*											
Tritrabs casmaliaensis (Pessagno)				*						*				
Tritrabs exotica (Pessagno)	*	*		*						*	*			
Tritrabs rhododactylus Baumgartner	*	*	*	*								*		
Williriedellum sp. A sensu Matsuoka 1983			*											
Zhamoidellum ovum Dumitrica							*	*					*	

Fig. 4. Distribution of radiolarians in the studied sections (Ps — Podsadek, ŠJP, ŠJDD — Šarišské Jastrabie, K — Kyjov, L — Lúčka, M — Milpoš).

Fultacapsa aff. sphaerica (Ožvoldová 1988)
Pl. 5, Fig. 3, 12

Remarks: The specimen differs from the holotype by the subglobular instead conical shape of the first three (?) segments and by the existence of much shorter spines on the terminal segment.
Occurrence: Ps-14 (late Oxfordian–early Kimmeridgian — UAZone 10 sensu Baumgartner et al. 1995).

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