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New Radiolaria from the "Ruhpolding Marmor" of Urschlaue (Late Jurassic, Chiemgau Alps, Bavaria)

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Mit 2 Abbildungen und 2 Tafeln

*Deutschland
Nördliche Kalkalpen
Lechtaldecke
Oberjura
Unterkreide
Radiolarien
Systematik*
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Neue Radiolarien aus dem Ruhpolding Marmor von Urschlaue (Oberjura, Chiemgauer Alpen, Bayern)

Zusammenfassung

Die Radiolarien-Fauna des „Gschwendlbach“-Profils der Rechenbergmulde westlich des Röhthelmooses nahe Urschlaue zeigt Unter- bis Mitteltithon-Alter. 2 neue Gattungen und 11 Arten werden aus einer reichen Probe beschrieben. Die morphologischen Merkmale vieler Formen repräsentieren Relikte von älteren (triadischen und liassischen) Vorläufern, wie gedrehte und abgeflachte Stacheln und triradiäre Apikalstrukturen. Der Grund für die Erhaltung dieser Strukturen wird in der geographischen Isolation der Tieferwasser-Becken gesehen. Dies kann durch tektonische Bewegungen während der geosynklinalen Extensionsphase in der Nordtethys im Bereich des Oberostalpins erklärt werden.

Abstract

The radiolarian fauna of the "Gschwendlbach" section in the Rechenberg syncline west of the Röhthelmoos near Urschlaue is of Early to Middle Tithonian age. 2 new genera and 11 species are described from one rich sample. The morphological characters of many forms show remnants of older (Triassic and Liassic) ancestors, like curled and spatulated spines and triradiate apical structures. The reason for the development of these structures are seen in geographical isolation of the deeper water basins. This can be caused by tectonic movements in the extensional geosynclinal stage of the Northern Tethyan Ocean in the area of the Austroalpine Zone.

1. Introduction

The area of the Röhthelmoos southwest of the village of Urschlaue in the Chiemgau Alps is a classical region of Late Jurassic and Early Cretaceous radiolarian research (RÜST, 1885; RÜST 1898; BÖCK, 1991). A current project is concerned with the reexamination of the type localities of RÜST's radiolarians. Close to these localities ("Sulzenmoos-Graben") in the "Gschwendlbach section" in the cen-

tral part of the "Rechenberg-Syncline" a very rich radiolarian fauna was found in the "Ruhpolding Marmor" facies.

The observed fauna is older than the forms described by RÜST and represents the base of the Jurassic to Early Cretaceous radiolarian event, which is distributed over the entire area of the Northern Calcareous Alps (vgl. DONOFRIO & MOSTLER, 1978; HOLZER, 1980; STEIGER, 1992).

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Fig. 1.
Geographical setting and tectonic position (after DOBEN, 1970) of the R thelmoos area SW of Urschlaue.

The specimens are stored in the "Bay-
erische Staatssammlung f r Pal ontologie
und historische Geologie" in Munich and
are numbered with BSP Prot. Nr.

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Foundation (DFG) for providing funds in
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paign and laboratory work.

1.1. Geological Setting

The investigated area belongs to the
"Bajuvaric" nappe system and is located
in the "Lechtal" nappe. This is a lateral
sequence of west-east directed syn-
clines. Their centres contain well bedded
calcareous and marly sediments of Late
Jurassic to Early Cretaceous age (Text-
Fig. 1). In the south the synclines are
folded isoclinally and the "Bajuvaric"
nappes are overthrust by the "Tirolian"
nappe-system. Here, the "Inntal" nappe
hits the "Lechtal" nappe (DOBEN, 1970;
LACKSCHEWITZ, 1987; RUHLAND, 1987;
LACKSCHEWITZ, GR TZMACHER & HENRICH,
1991; B CK, 1991).

1.2. Investigated Section and Lithologies

The observed section is situated at the
eastern slope of the "Rachelspitze"
mountain, at a forest road which crosses
the "Gschwendl-Bach" creek. It is part
of the "Rechenberg" syncline and covers the entire struc-
ture starting with Norian Hauptdolomit and ending in Early
Cretaceous "Aptychen Schichten" ("Schrambach-
Schichten") (Text-Fig. 2). Deeper marine intervals are in-
troduced by red nodular "Adnet" limestones in "Ammoniti-
co rosso" facies. Thin sections of this sediment show rare
radiolarians. All of them are calciticed. The stratigraphical
sequence of "cenozoone-organisms" fits with the general
succession given by DIERSCHKE (1980), where the basal
parts of the Jurassic deeper marine sediments in the Up-
per Austroalpine Zone mostly contain radiolarians. These
are followed by the *Saccocoma* interval. The sequence is ter-
minated by Calpionellid-bearing limestones.

65 samples were taken from the pelagic sediments in the
"Gschwendlbach" section. Only two of them contained
well preserved radiolarians. One sample is a radiolarian
"sand", where the specimens are densely packed. The
tests are deposited as quartz constituents bound by mi-
crite.

The fauna is extremely rich and shows after the first ana-
lysis (B CK, 1991) 47 genera with 122 species. Particular
aspects of the fauna are the variability of some forms
which gives hints for the conclusion that some genera are
closely related. The "transition" between the genera *Podocapsa*

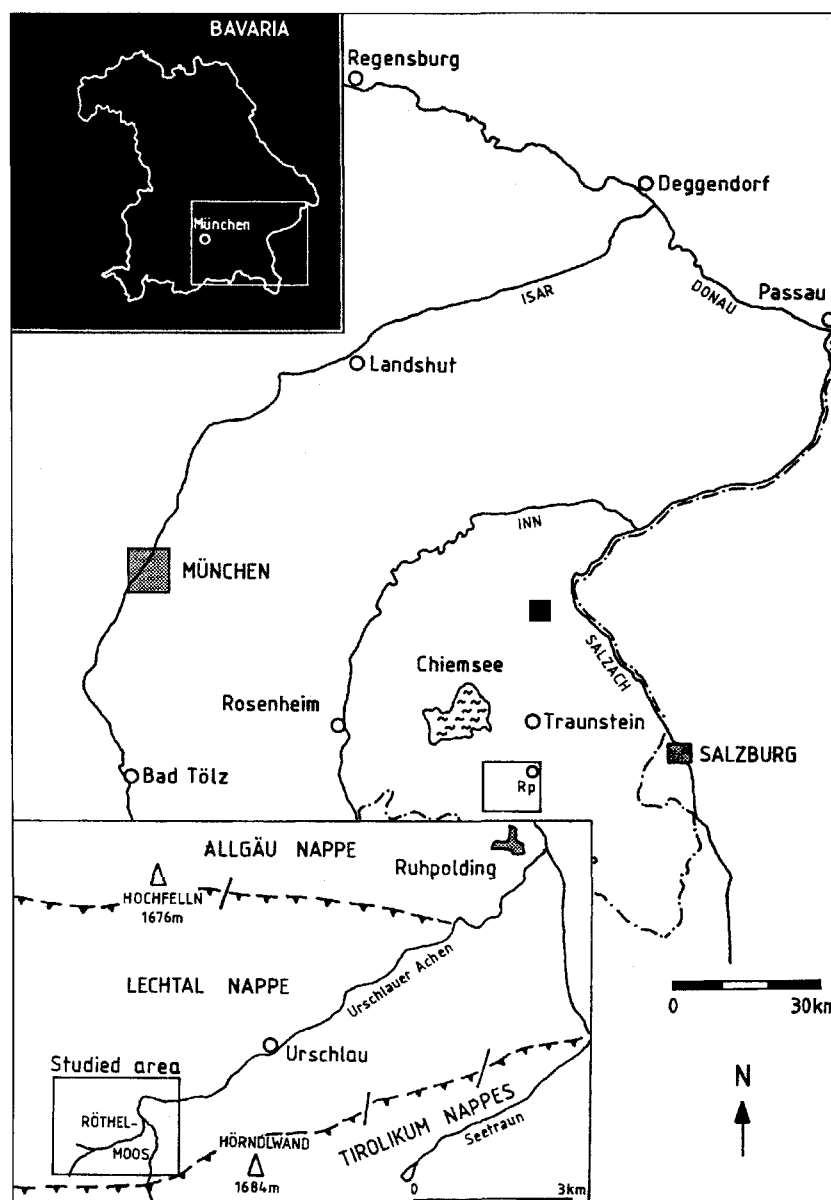
dobursa WISNIEWSKI 1889 and *Podocapsa* R ST 1885 is pub-
lished by STEIGER & STEIGER (1993).

The age of the fauna can be calibrated by the fact that
the sample is located between the "Saccocoma" ceno-
zone below and the "Calpionellid" cenozoone above. So,
the radiolarians can be approximately limited to Kim-
meridgian to Early Tithonian.

2. Systematic Paleontology

Phylum: Sarcomastigophora
Subphylum: Sarcodina
Class: Actinopoda
Subclass: Radiolaria MUELLER 1858
Order: Polycystida EHRENBURG 1838
Suborder: Spumellariina EHRENBURG 1875
Family: Hagiastriidae RIEDEL 1971
emend. BAUMGARTNER 1980

Type genus: *Hagiastrium* HAECKEL 1881.



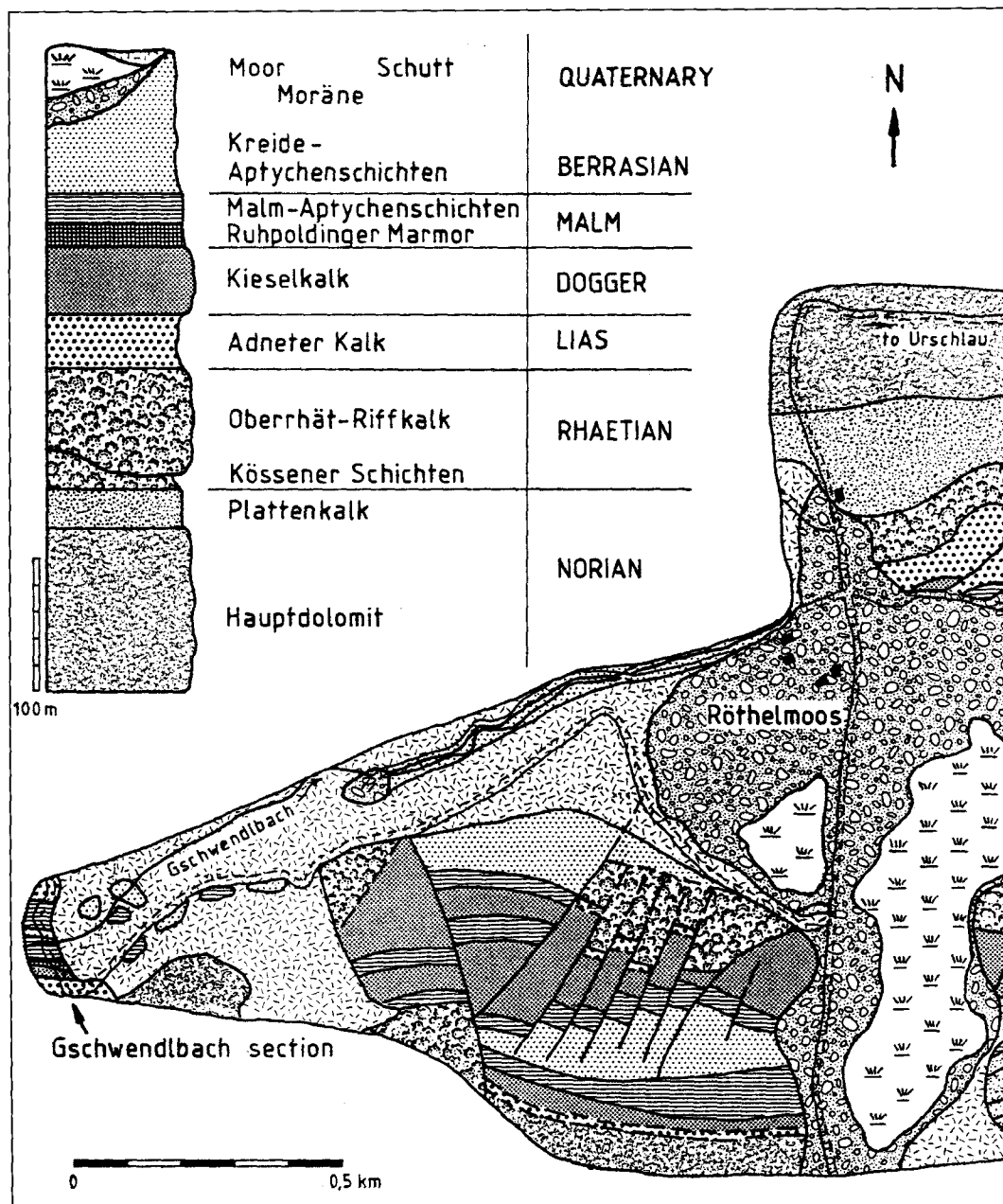


Fig. 2. Location of the Gschwendlbach section, lithostratigraphy and geological map of the studied area (after Böck, 1991).

**Subfamily: Hagiastrinae RIEDEL 1971
emend. BAUMGARTNER 1980**

Type genus: *Hagiastrium* HAECKEL 1881.

**Genus: *Hagiastrium* HAECKEL 1881
emend. BAUMGARTNER 1980**

Type species: *Hagiastrium plenum* RÜST 1885 emend. BAUMGARTNER 1980.

***Hagiastrium angulatum* n.sp.**

(Pl. 1, Fig. 1,2)

Material: 8 specimens.

Diagnosis: *Hagiastrium* of medium size. The four arms are arranged crosswise. They are interconnected by a large patagium. The patagium extends to the end of the arms and has a sharp linear external margin. This generates a square to rectangular outline of the test. The prominent arms show two or three distinct rows of single pores.

The pores are surrounded by square pore frames due to the rectangular arrangement of three or four longitudinal beams and intervening bars. All specimens have a central pore row on the top of the arm. The crossing points of beams and bars bear thick nodes. The central area is slightly elevated. Here, the central pore rows form a cross. The cortical shell grades into the patagium. It shows a very rough surface of irregularly distributed pores, nodes and spongy meshwork. The arms occasionally seem to be covered by the patagium. The arm ends terminate in a porous tip. One paratype has short triradiate central spines at two arm ends.

Differential diagnosis: The outer surface of this form corresponds to the definition of BAUMGARTNER (1980). The description of RÜST's *Hagiastrium plenum* shows similarities concerning the elevated central area and the number of pore rows on the arms. It contrasts in terms of the patagium and the lack of globulous arm ends.

Remarks: This species is relatively common in the observed material. It is interesting to compare these forms

with the drawings of *Hagiastrum astrictum* by RÜST (Pl. XXXIV, Fig. 2 and 3), which show a rhomblike outline of the adult test and a cross shaped skeleton of the questionably juvenile stage of this species. On the adult test a central line marks the arms and possibly the central pore row. The patagium is traced by irregularly distributed dots and a fringed margin. These forms also have porous tips at the arm ends. Apart from that the drawings of RÜST are not detailed enough to reestablish *Hagiastrum astrictum*.

Derivatio nominis: The species name is created to emphasize the square to rectangular outline of the test.

Dimensions: in microns

	Holotype		6 Paratypes					
Diagonal diameter of the test	464	471	536	500	478	586	457	
Length of arms	207	236	250	228	–	278	214	
	214	–	214	221	214	200	214	
	193	178	250	214	250	260	214	
	178	250	–	–	250	243	214	
Width of arms	57	57	36	50	–	64	57	
	–	50	43	57	50	–	43	
	43	50	50	50	57	50	43	
	43	57	–	–	57	64	64	
Diameter of pores	7	7	7	11	11	7	7	
BSP Prot.-Nr.	6158	6159	6160	6161	6162	6163	6164	

Stratum typicum: Ruhpolding Marmor in the Northern Calcareous Alps (Kimmeridgian to Early Tithonian).

Locus typicus: "Gschwendlbach" section at the eastern slope of the "Rachelspitze", Röthelmoos SW of Urschlau, Bavaria.

Family: Patulibracchiidae PESSAGNO 1971 emend. BAUMGARTNER 1980

Type genus: *Patulibracchium* PESSAGNO 1971.

Subfamily: Patulibracchiinae PESSAGNO 1971 emend. BAUMGARTNER 1980

Type genus: *Patulibracchium* PESSAGNO 1971.

Genus: *Paronaella* PESSAGNO 1971 emend. BAUMGARTNER 1980

Type species: *Paronaella solanoensis* PESSAGNO 1971.

Paronaella centrodepressa n.sp.

(Pl. 1, Fig. 3,4)

Material: 5 specimens.

Diagnosis: Three armed patulibracchiid with short thick arms and extended approximately globular arm ends. The central area has a round concave depression. On the arms the cortical shell is composed of a spongy meshwork containing rounded, partly nodose, irregularly arranged pore frames. The arm ends possess a denser meshwork of smaller round pores. These are occasionally arranged in a regular pattern, where the pore frames form a rectangular net. The central area shows a fine spongy meshwork. The angles between the arm have equally 120°.

Differential diagnosis: *Paronaella centrodepressa* n.sp. contrasts to the longarmed forms of the *Paronaella kotura* BAUMGARTNER type. The central depression could be an artefact due to etching. But the depression occurs in most of the specimens always showing a finer surface meshwork. So it is assumed to be a genuine character of the form.

Remarks: In the Northern Calcareous Alps specimens of this species and closely related forms particularly occur in Late Jurassic to Early Cretaceous bedded limestones. Although these "thick" Paronaellas are widely distributed in these areas, they never have been described. They seem to lack in the Southern Alps and other regions of the Tethyan realm.

Derivatio nominis: The species name refers to the depression in the central area of the form.

Dimensions: in microns

	Holotype		4 Paratypes			
Length of arms	207	200	146	136	143	
	193	186	160	143	136	
	193	179	168	136	150	
Diameter of central area	107	85	43	65	79	
Width of arms	86	64	50	64	64	
	86	71	44	64	71	
	89	64	50	57	71	
Width of arm ends	157	107	136	129	118	
	179	107	129	129	132	
	157	107	150	118	129	
Angle between arms	120	119	123	118	123	
	127	117	124	125	108	
	113	124	113	117	129	
BSP Prot.-Nr.	6165	6166	6167	6168	6169	

Stratum typicum: Ruhpolding Marmor in the Northern Calcareous Alps (Kimmeridgian to Early Tithonian).

Locus typicus: "Gschwendlbach" section at the eastern slope of the "Rachelspitze", Röthelmoos SW of Urschlau, Bavaria.

Subfamily: Angulobracchiinae BAUMGARTNER 1980

Type genus: *Angulobracchia* BAUMGARTNER 1980.

Genus: *Angulobracchia* BAUMGARTNER 1980

Type species: *Paronaella* (?) *purisimaensis* PESSAGNO 1971.

Angulobracchia zeissi n.sp.

(Pl. 1, Fig. 5)

Material: 6 specimens.

Synonymy:

1992 *Angulobracchia* sp. B STEIGER, p. 51, Pl. 13, Fig. 4 (Late Tithonian, Northern Calcareous Alps, Northern Tethyan Realm, Salzburg).

Diagnosis: Three armed test with spherical arm ends. Cortical shell of the central field and the arms is composed of irregularly distributed rounded pores of equal size. The central field is not distinctly separated from the arms. The rectangular cross section of the arms is emphasized by a pronounced ridge edge between the planar

surfaces and the lateral sides of the shell. The bulbous arm ends are covered by a smooth outer layer, which shows small pores arranged in a rectangular pattern. The angle between two arms is about 120°.

Differential diagnosis: This species is distinguished from other Angulobracchiids by having a distinct ridge at the edge from the planar surface to the lateral sides of the test and bulbous arm ends with a regularly porous surface.

Derivatio nominis: The species is dedicated to Dr. ARNOLD ZEISS, Professor of Paleontology in Erlangen.

Dimensions: in microns

	Holotype	5 Paratypes				
Diameter of test (distance between two arms including arm ends)	366 386 380	294 231 256	250 200 219	282 282 282	344 325 330	280 280 275
Width of arms	53 53 60	50 50 56	44 38 40	56 44 44	44 38 44	44 38 44
Width of arm ends	113 113 120	88 81 100	82 88 88	75 85 75	82 82 75	82 82 75
BSP Prot.-Nr.	6170	6171	6172	6173	6174	6175

Stratum typicum: Ruhpolding Marmor in the Northern Calcareous Alps (Kimmeridgian to Early Tithonian).

Locus typicus: "Gschwendlbach" section at the eastern slope of the "Rachelspitze", Röthelmoos SW of Urschla, Bavaria.

Family: ? Patulibracchiidae
PESSAGNO 1971
emend. BAUMGARTNER 1980
Subfamily: ? Angulobracchiinae
BAUMGARTNER 1980
Gattung: *Fluegelium* n.gen.

Diagnosis: The test is composed of a small central area from which three arms extend. The arms are rectangular in cross section. The cortical shell shows four thick parallel beams running from the central area to the ends of the arms. The beams are interconnected by bars forming a regular pattern of almost square pore frames. The central area has an irregular arrangement of pores. The arm ends are equally developed. They terminate with a thick brachhiopyle. The brachhiopyles are composed of longitudinal beams interconnected by bars. They also form a regular meshwork but mostly of rectangular pore frames. The arm ends are flanked by three-bladed spines at each side. These spines are arranged in the plane of the test. In lateral view the arms show the spongy meshwork of the medullary shell.

Differential diagnosis: *Fluegelium* n.gen. differs from all genera of the Patulibracchiidae by having three brachhiopyles, one brachhiopyle on each arm instead of one on the "primary arm" (comp. PESSAGNO, 1971: 18).

Remarks: The genus is questionably assigned to the family of the Patulibracchiidae resp. Angulobracchiinae because of the definition given by PESSAGNO (1971: 22) emended by BAUMGARTNER (1980: 297). Here these categories are defined to have only one brachhiopyle. Except of the brachhiopyle the test is closely related to the genus *Halesium* PESSAGNO. It is necessary to clarify the

significance of the brachhiopyle as a structure of taxonomic value. If it is a reproductive part of the skeleton which can be formed by the radiolarian itself for leaving swarms during the life cycle of the organism as mentioned by STEIGER (1992) it would have no taxonomic value. Actually most of the species of the Patulibracchiinae and the Angulobracchiinae have similar tests with and without one, two or three brachhiopyles.

For the reason to maintain the system of the Patulibracchiidae we firstly define the new genus *Fluegelium* to declare the existence of forms having three brachhiopyles. When we have more information about the number of brachhiopyles on the arms of the members of the family we will define new subfamilies.

Derivatio nominis: The genus is named after Dr. ERIK FLÜGEL, Professor of paleontology at the University of Erlangen.

Species: *Fluegelium symmetricum* n.sp.

Fluegelium symmetricum n.sp.

(Pl. 1, Fig. 6)

Material: 6 specimens.

Diagnosis: Test as with genus. The arms and the lateral spines at the arm ends are equal in length. The angle between the arms varies from 120 degrees in radial symmetric specimens to almost bilateral symmetric forms having a small angle of 95 to 110° and two wider angles of 125 to 145°. The brachhiopyles tend to be not equally developed. Most of the specimens of the type material show that one of the brachhiopyles is more fragile or stouter than the other two, which have comparable size. The differences of the brachhiopyles do not correspond to the symmetry of the test.

Differential diagnosis: All specimens found in the "Gschwendlbach" material belong to the same species. As discussed above with the exception of the number of the brachhiopyles and considering the surface structures of the test the species is very similar to *Halesium quadratum* PESSAGNO.

Derivatio nominis: The species name is related to the radial symmetry of the test which is given by the angles of almost 120 degrees between the arms and the almost equal length of arms and lateral spines.

Dimensions: in microns

	Holotype	3 Paratypes		
Length of arms without brachhiopyle	172 172 178	143 143 157	179 164 164	179 164 171
Diameter of central area	66	64	64	54
Width of arms	46 46 46	32 43 50	43 54 54	46 46 46
Width of arm ends without spines	73 73 73	57 93 86	71 79 79	58 64 57
Length of lateral spines	80-92	-	-	-
Width of brachhiopyle	40 46 46	29 43 43	43 43 46	36 36 36
Angle between arms	120 120 120	104 129 127	123 127 110	115 115 130
BSP Prot.-Nr.	6176	6177	6178	6179

Stratum typicum: Ruhpolding Marmor in the Northern Calcareous Alps (Kimmeridgian to Early Tithonian).

Locus typicus: "Gschwendlbach" section at the eastern slope of the "Rachelspitze", Röthelmoos SW of Urschlaun, Bavaria.

**Family: Staurolonchidae HAECKEL 1881
emend. PESSAGNO 1977a**

Type genus: *Staurolonche* HAECKEL 1881.

**Genus: Staurolonche HAECKEL 1881
emend. PESSAGNO 1977a**

Type genus: *Staurolonche robusta* RÜST 1885.

***Staurolonche spathulata* n.sp.**

(Pl. 1, Fig. 7,8)

Material: 10 specimens.

Diagnosis: The test corresponds to the genus diagnosis of PESSAGNO (1977). The cortical shell shows an irregular pattern of large rounded pores which tend to be equal in size. The lateral sides of the shell are convex. At each edge of the square shell a triradiate spine develops. The spines are equal in length. The ends of the spines terminate widened and flattened, like a rounded wedge.

Differential diagnosis: The species differs from the other members of the genus *Staurolonche* HAECKEL in possessing spatulated ends of the spines.

Derivatio nominis: The species name emphasizes the spatulated character of the ends of the spines.

Dimensions: in microns

	Holotype		5 Paratypes			
Diagonal diameter of the test without spines	200	193	193	175	181	188
Length of spines	192	157	200	187	175	200
	200	207	–	156	–	193
	200	–	200	187	–	125
	168	–	193	218	–	–
Width of spatulated ends	40	36	39	44	44	44
	32	43	–	50	–	44
	–	–	43	50	–	–
	28	–	46	–	–	–
Diameter of pores	28	21	25	19	23	25
BSP Prot.-Nr.	6180	6181	6182	6183	6184	6185

Stratum typicum: Ruhpolding Marmor in the Northern Calcareous Alps (Kimmeridgian to Early Tithonian).

Locus typicus: "Gschwendlbach" section at the eastern slope of the "Rachelspitze", Röthelmoos SW of Urschlaun, Bavaria.

***Staurolonche torquispina* n.sp.**

(Pl. 2, Fig. 1,2)

Material: 8 specimens.

Diagnosis: The test of this species is of *Staurolonche* type: the irregular pore pattern consists of relatively

large rounded pores. The shape of the test is sub-spherical to square. Four triradiate spines arise at the rounded edges. The porous shell can be inflated by the development of a large patagium. The triradiated construction of the spines is complicated by the fact that in the proximal part the number of ridges is six. More distally two parallel ridges join resulting a threefold cross-section of the spine. The ends of the spines are curled like a corkscrew. The tips are pointed and round in outline. Occasionally the tests show both curled and straight spines.

Differential diagnosis: The species differs from other species of *Staurolonche* by possessing curled tips at the ends of the spines.

Derivatio nominis: The name of the species refers to the curled ends of the spines.

Dimensions: in microns

	Holotype		5 Paratypes			
Diagonal diameter without spines	250	464	271	221	300	357
Length of spines	164	250	171	164	179	–
	186	–	164	172	178	–
	150	250	–	165	250	186
	157	–	164	171	193	179
Width of spines	29	46	28	28	32	32
	32	–	39	32	36	36
	29	39	29	35	36	36
	29	–	29	39	32	36
Diameter of pores	11–21	14–36	–	14–21	–	–
BSP Prot.-Nr.	6186	6187	6188	6189	6190	6191

Stratum typicum: Ruhpolding Marmor in the Northern Calcareous Alps (Kimmeridgian to Early Tithonian).

Locus typicus: "Gschwendlbach" section at the eastern slope of the "Rachelspitze", Röthelmoos SW of Urschlaun, Bavaria.

Genus: Emiluvia FOREMAN 1973

Type genus: *Emiluvia chica* FOREMAN 1973.

***Emiluvia pentaporata* n.sp.**

(Pl. 1, Fig. 9,10)

Material: 7 specimens.

Diagnosis: *Emiluvia* with a square test composed of an upper and lower surface of the cortical shell which contains a distinct pore pattern. At the edges of the test 4 triradiate spines develop. The spines are curved. Occasionally adjacent pairs of spines form concave arcs. Opposite spines have similar orientation of grooves and ridges. The pore pattern is composed of large pores which occur at each angle of the square. Between these pores and the base of the spines two thick nodes are visible. One large pore is located in the centre of the surface as well. The large pores are connected by rows of smaller pores which themselves show patterns of circular composition. The rings of smaller pores contain four, five and six pores.

Differential diagnosis: The morphology of this *Emiluvia* is distinguished from other species of the genus by the presence of a special pore pattern described above and the curved arrangement of the spines.

Remarks: One aspect of the test allows to compare the above specimens with the original drawing of *Staurisphaera antiqua* RÜST (1885, Pl. III, Fig. 2). The four large pores at the edges of the test are similarly arranged.

Derivatio nominis: The name of the species refers to the five large pores in the edges and in the centre of the cortical shell.

Dimensions: in microns

	Holotype	6 Paratypes					
Diagonal diameter without spines	228	160	224	143	176	136	179
Length of spines	143	121	192	118	160	129	121
	145	121	168	100	152	107	114
	143	136	–	107	136	107	121
	157	114	152	114	152	114	121
Width of spines	36	40	40	32	40	32	25
	36	40	40	36	40	32	25
	36	36	40	36	36	29	29
	36	39	40	29	36	25	29
Diameter of large pores	21	14	16	11	16	14	21
BSP Prot.-Nr.	6192	6193	6194	6195	6196	6197	6198

Stratum typicum: Ruhpolding Marmor in the Northern Calcareous Alps (Kimmeridgian to Early Tithonian).

Locus typicus: "Gschwendlbach" section at the eastern slope of the "Rachelspitze", Röthelmoos SW of Urschlaue, Bavaria.

Family: Parvivaccidae

PESSAGNO & YANG 1989

Genus: *Parvivacca* PESSAGNO & YANG 1989

Type species: *Parvivacca bloomei* PESSAGNO & YANG 1989.

Parvivacca rudicula n.sp.

(Pl. 2, Fig. 7)

Material: 5 specimens.

Diagnosis: The test is composed of a cylindrical cortical shell which shows polygonal, mostly hexagonal pore frames with nodose junctions. Two adjacent primary spines arise asymmetrically from the cortical shell. The spines are equal in length and triradiate. At the terminal part of the spines their ridges are turned clockwise in the view from the cortical shell.

Differential diagnosis: The specimen differs from the other species of *Parvivacca* PESSAGNO & YANG by having turned spines equal in length.

Remarks: This form seems to be very rare, so that only two complete and three broken specimens could be found until now in this rich material. Further observation of more rock samples of the same layer will possibly provide a more sufficient type material.

Derivatio nominis: The species name is given by the rotation symmetry which results from the spherical shell, the primary spines which are equal in length and the turned triradiate spines. The rotation of the spines does not generate an bilateral symmetry but a symmetry with an axis running from the top of the sphere to the middle between the bases of the spines.

Dimensions: in microns

	Holotype	4 Paratypes			
Diameter of sphere	143	125	125	144	94
Diameter of pores	15	14	13	14	14
Length of spines	314	250	275	343	275
	307	263	–	–	–
Width of spines	36	39	38	50	32
	32	40	–	–	–
Angle between spines	65	80	75	–	–
BSP Prot.-Nr.	6199	6200	6201	6202	6203

Stratum typicum: Ruhpolding Marmor in the Northern Calcareous Alps (Kimmeridgian to Early Tithonian).

Locus typicus: "Gschwendlbach" section at the eastern slope of the "Rachelspitze", Röthelmoos SW of Urschlaue, Bavaria.

Genus: *Lanubus* PESSAGNO & YANG 1989

Type species: *Lanubus holdsworthi* PESSAGNO & YANG 1989.

Lanubus sp. C sensu PESSAGNO & YANG 1989

(Pl. 2, Fig. 8)

Material: 2 specimens.

Synonymy:

1989 *Lanubus* sp. C PESSAGNO, SIX & YANG, p. 244, Pl. 8, Fig. 3,7,9,25 (Taman formation, east-central Mexico, Tethyan realm, Northern Tethyan province).

Description: The spherical shell shows large polygonal pore frames. Two triradiate primary spines develop from the cortical shell. The spines are slightly curved, unequal in length and they have straight ends.

Remarks: This form exactly corresponds to *Lanubus* sp. C sensu PESSAGNO & YANG comparing the morphological characters of the cortical shell. An exact diagnosis of a type material and a designation of a distinguished species has to be investigated on better preserved material. Such forms are expected in our sample.

Lithology and age: Ruhpolding Marmor in the Northern Calcareous Alps (Kimmeridgian to Early Tithonian).

Occurrence: "Gschwendlbach" section at the eastern slope of the "Rachelspitze", Röthelmoos SW of Urschlaue, Bavaria. BSP Prot.-Nr. 6204.

Family: Spongodiscidae HAECKEL 1882 emend. RIEDEL 1967b

Gen. et spec. indet.

(Pl. 2, Fig. 9,10)

Material: 2 specimens.

Description: These extremely rare forms could only be assigned to spongodiscids of unknown subfamily level. The tests consist of an irregularly porous shell with lenticular shape. The shell is rimmed by eight porous arms which are longitudinally pervaded by sharp ridges. The arms terminate in a triradiate spine formed by the ridges derived from the porous part. One of the two specimens bears a nodose ring at the surface examined with

the SEM-microscope. In the centre of the ring the shell shows a tiny spongy elevation.

Remarks: The above specimens are tentatively comparable to the Cretaceous genera *Patellula* KOZLOVA (1972) and *Godia* WU HAO-RUO (1986), which lack porous arms. *Staurocyclia martini* RÜST shown by THUROW (1988, Pl. 10, Fig. 8) has four diagonally arranged spines on a rectangular test and a nodose ring on the spongy surface.

Lithology and age: Ruhpolding Marmor in the Northern Calcareous Alps (Kimmeridgian to Early Tithonian).

Occurrence: "Gschwendlbach" section at the eastern slope of the "Rachelspitze", Röthelmoos SW of Ursch-lau, Bavaria. BSP Prot.-Nr. 6205, 6206.

Suborder: Nassellariina EHRENBERG 1875

Family: Syringocapsidae PESSAGNO 1977a

Type genus: *Syringocapsa* NEVIANI 1900.

Syringocapsa longituba n.sp.

(Pl. 1, Fig. 11)

Material: 9 specimens.

Diagnosis: Sethocapsid nassellarian with a poreless cephalis, a porous thorax, a mamillate abdomen and an extremely long postabdominal tube. The pores of the thorax are rounded with polygonal poreframes and regular distribution. The pores of the abdomen are irregularly distributed, almost equal in diameter. The outer surface of the shell is mamillate. Occasionally the porous nodes bear tiny spines. The long postabdominal tube is three to four times as long as the rest of the test. Just below the abdomen the tube the pores are irregularly arranged. Downward the pores are aligned in about eight straight single pore rows, separated by bars. At the end of the tube the pore rows converge. Finally the tube is terminated by a poreless collar having very small teeth at the end. Their number corresponds to the number of ridges reaching the end of the tube.

Differential diagnosis: The test of this species is composed like *Syringocapsa bulbosa* STEIGER (1992), but with a mamillate abdomen.

Remarks: Cephalis, thorax and abdomen of sethocapsids and syringocapsids are only distinguished by the latter having a postabdominal tube. Without tube the above form is a *Sethocapsa cetia* FOREMAN, and *Syringocapsa bulbosa* STEIGER is a *Sethocapsa leiostraca* FOREMAN. In fact, well preserved faunas contain several stages of developing postabdominal tubes from a short spine to a long porous tube (STEIGER, 1992).

Derivatio nominis: The species name describes the long postabdominal tube.

Dimensions: in microns

	Holotype		6 Paratypes					
Length of cephalis and thorax	54	54	46	54	54	68	61	
Length of abdomen	164	136	143	143	114	150	143	
Width of abdomen	232	186	196	204	168	221	214	
Length of postabdominal tube	528	464	457	511	346	–	385	
Width of postabdominal tube	50	43	43	50	43	50	43	
BSP Prot.-Nr.	6207	6208	6209	6210	6211	6212	6213	

Stratum typicum: Ruhpolding Marmor in the Northern Calcareous Alps (Kimmeridgian to Early Tithonian).

Locus typicus: "Gschwendlbach" section at the eastern slope of the "Rachelspitze", Röthelmoos SW of Ursch-lau, Bavaria.

Family: Incertae sedis

Genus: *Tridentocyrtis* n.gen.

Type species: *Tridentocyrtis groissi* n.sp.

Diagnosis: Monocyrtid nassellarian of oval shape. The test is bilateral marked by two spines which arise in the equatorial zone and an apical zone bearing a trident crown, where one of the apical horns points towards one of the lateral spines. All spines have a threefoiled cross section. The lateral spines are oriented distally. The pores of the shell are round, the pore frames are polygonal, mostly hexagonal. The spines of the apical crown and the lateral spines are arranged in a line which is obvious by a prominent ridge connecting adjacent spines. Vertical ridges also start from the angles between the apical spines downward, but end shortly after their beginning within the pore system. The pores are arranged in vertical rows. The test is closed distally and bears a long antapical spine. The spine is triradiate at the base.

Differential diagnosis: The only forms described in literature which are similar to *Tridentocyrtis* n.gen. is *Turanta* PESSAGNO & BLOME 1982. Although this genus also has two lateral spines, the apical part is different: The apical horns form a trident crown and the spines are arranged in the same plane. Furthermore a long antapical spine is part of the skeleton.

The presence of ridges between spines and apical horns, and the equally developed pores and pore frames of the shell conform with *Turanta*. Therefore, both *Turanta* PESSAGNO & BLOME and *Tridentocyrtis* n.gen. may belong to one family of monocyrtid radiolaria.

Remarks: Other similarities result from the comparison with the paleosceniid genera *Pentactinocarpus* DUMITRICA and *Parentactinia* DUMITRICA (1978). Whereas *Pentactinocarpus* is composed of a single latticed shell with an apical, four distally directed lateral spines and an antapical spine, *Parentactinia* is characterized by a triradiate symmetry with a trident apical crown and adjacent lateral spines connected by a skeletal ridge.

Derivatio nominis: The genus name is created to describe the trident crown of the test of this monocyrtid form.

Included species: *Tridentocyrtis groissi* n.sp.

Tridentocyrtis groissi n.sp.

(Pl. 2, Fig. 3–6)

Material: 6 specimens.

Diagnosis: Test as with genus. The ridges between the apical horns and the lateral spines are flanked by large polygonal pore frames not alternating but in opposite position to each other. The lower groove of the apical horns hides the largest pore of the test. Through this pore a questionably spongy meshwork is visible (Pl. 2, Fig. 5). From the distal end of the pore frame the connecting line is directed to the beginning of the lateral spine.

Differential diagnosis: The species described above is the only species found in the investigated material.

Derivatio nominis: The species name is dedicated to Dr. JOSEF THEODOR GROISS, Professor of Paleontology in Erlangen.

Dimensions: in microns

	Holotype		4 Paratypes			
Length of test without antapical spine	367	378	419	438	468	
Length of lateral spines	–	143	–	125	50	
Length of apical spines	71	–	105	156	106	
	80	93	90	106	80	
	110	86	93	120	–	
Length of antapical spine	124	157	–	–	65	
Diameter of pores	12–17	11–18	12–21	13–15	13–19	
BSP Prot.-Nr.	6214	6215	6216	6217	6218	

Stratum typicum: Ruhpolding Marmor in the Northern Calcareous Alps (Kimmeridgian to Early Tithonian).

Locus typicus: “Gschwendlbach” section at the eastern slope of the “Rachelspitze”, Röthelmoos SW of Urschlau, Bavaria.

3. The Significance of the “Gschwendlbach” Fauna

The radiolarian fauna of the “Gschwendlbach” contains some very interesting forms which possibly give further information of the radiolarian zonation in the Early to

Middle Tithonian interval. It seems that the species of *Hagiastrium* HAECKEL emend. BAUMGARTNER, special types of *Emiluvia* FOREMAN and *Staurolonche* HAECKEL, which are not described from other areas of the Northern Tethyan realm are valuable forms in the Northern Calcareous Alps.

Some species are distinguished by the presence of curled ends of their spines as in *Parvivacca rudicula* n.sp., *Staurolonche torquispina* n.sp. and, not shown in this paper, in a species of *Triactoma* RÜST. Such spines are mostly described from Triassic faunas (comp. LAHM, 1984; NAKASEKO & NISHIMURA, 1979; DE WEVER, 1984). The genus *Tridentocyrtis* also contains morphological characters of Triassic ancestors.

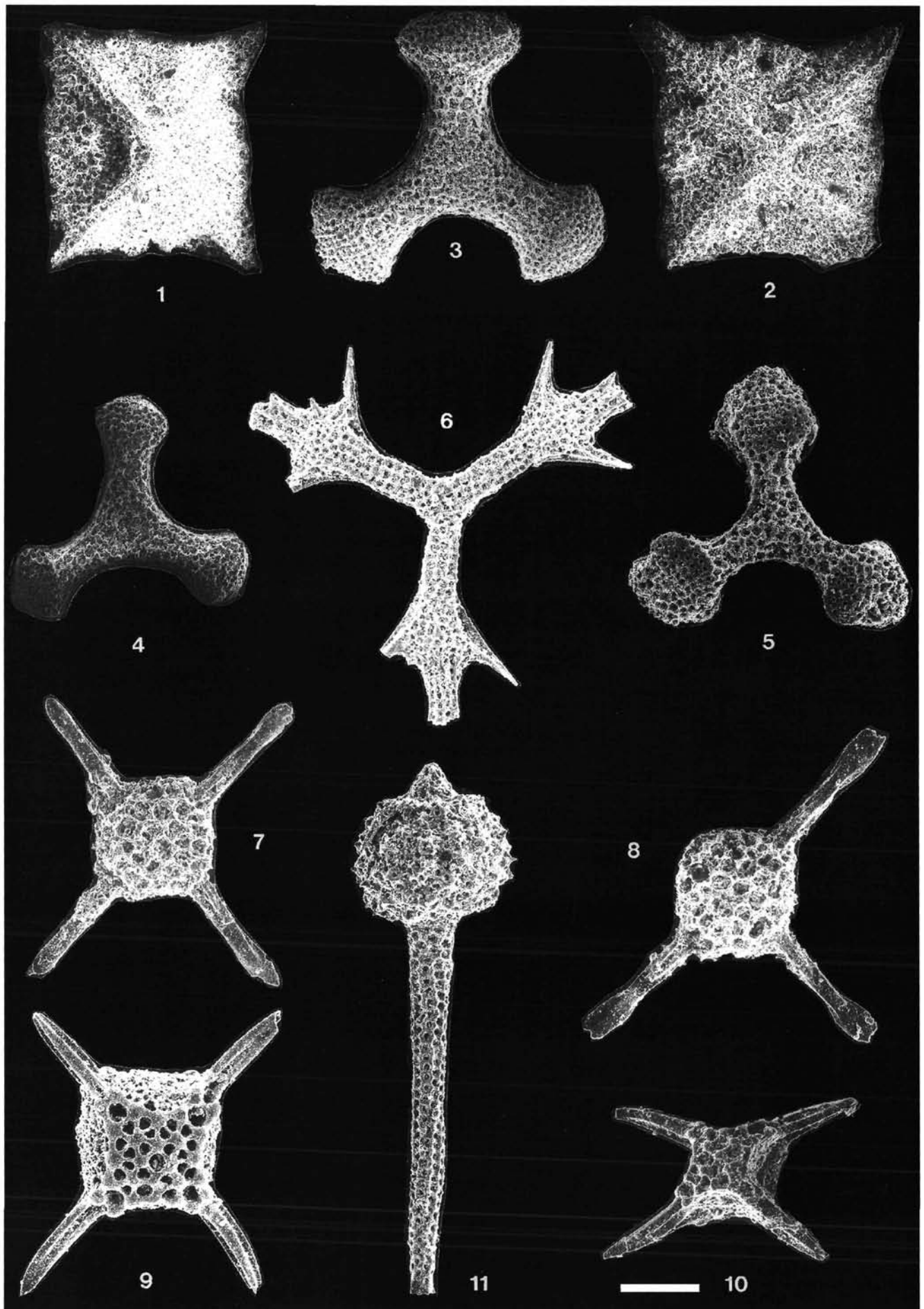
From the oceanographic point of view, the occurrence of remnants of Triassic morphological inventories, the radiolarians of the recent Northern Calcareous Alps could have been geographically separated from normal Tethyan watermasses. The paleogeographic situation in the area of the Austroalpine Zone is characterized by tilted block movement and progressively deepening half grabens (LACKSCHEWITZ et al., 1991). These structures are diagonally dislocated along transform faults locally forming “pull apart basins”.

As the Jurassic sedimentation in the Northern Calcareous Alps is strongly influenced by the geographical position of rhomb-like “old” Triassic shallow water platforms a distinct pattern of local deeper water basins results. These basins are separated by “channels” of moderate water depth. Here, endemic radiolarian faunas could easily develop since Late Triassic or Liassic times. The long isolation of deeper water basins can be the reason for the conservation of old morphologic characters in the genetic material of younger, in our case Early late Jurassic radiolarians.

Tafel 1

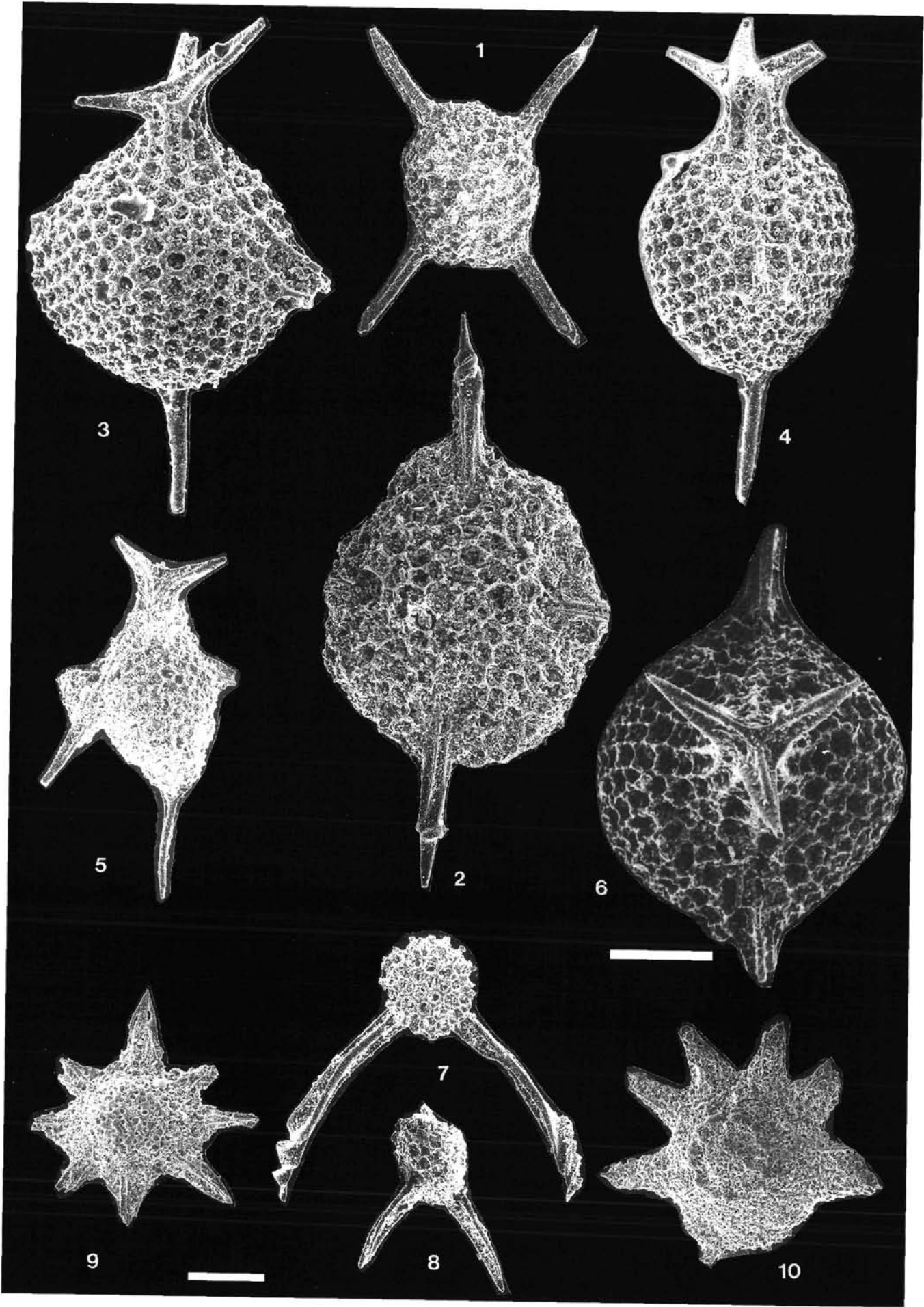
- Fig. 1: ***Hagiastrum angulatum n.sp.***
Holotype, BSP Prot. Nr. 6158.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 2: ***Hagiastrum angulatum n.sp.***
Paratype, BSP Prot. Nr. 6159.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 3: ***Paronaella centrodepressa n.sp.***
Holotype, BSP Prot. Nr. 6165.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 4: ***Paronaella centrodepressa n.sp.***
Paratype, BSP Prot. Nr. 6166.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 5: ***Angulobracchia zeissi n.sp.***
Holotype, BSP Prot. Nr. 6170.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 6: ***Fluegelium symmetricum n.sp.***
Holotype, BSP Prot. Nr. 6176.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 7: ***Staurolonche spathulata n.sp.***
Holotype, BSP Prot. Nr. 6180.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 8: ***Staurolonche spathulata n.sp.***
Paratype, BSP Prot. Nr. 6181.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 9: ***Emiluvia pentaporata n.sp.***
Holotype, BSP Prot. Nr. 6192.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 10: ***Emiluvia pentaporata n.sp.***
Paratype, BSP Prot. Nr. 6193.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 11: ***Syringocapsa longituba n.sp.***
Holotype, BSP Prot. Nr. 6207.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.

Length of scale bar: 100 microns.



Tafel 2

- Fig. 1: ***Staurolonche torquispina* n.sp.**
Holotype, BSP Prot. Nr. 6186.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 2: ***Staurolonche torquispina* n.sp.**
Paratype, BSP Prot. Nr. 6187.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 3: ***Tridentocyrtis groissi* n.sp.**
Holotype, BSP Prot. Nr. 6214.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 4: ***Tridentocyrtis groissi* n.sp.**
Holotype, BSP Prot. Nr. 6214.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 5: ***Tridentocyrtis groissi* n.sp.**
Paratype, BSP Prot. Nr. 6215.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 6: ***Tridentocyrtis groissi* n.sp.**
Paratype, BSP Prot. Nr. 6216.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 7: ***Parvivacca rudicula* n.sp.**
Holotype, BSP Prot. Nr. 6199.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 8: ***Lanubus* sp. C sensu PESSAGNO & YANG 1989.**
BSP Prot. Nr. 6204.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 9: **Spongodiscid, gen. et spec. indet.**
BSP Prot. Nr. 6205.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.
- Fig. 10: **Spongodiscid, gen. et spec. indet.**
BSP Prot. Nr. 6206.
Kimmeridgian – Early Tithonian, Gschwendlbach section, Röthelmoos, Urschlau.



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