

NORIAN - RHAETIAN CORAL REEF BUILDUPS IN BOHINJ AND RDEČI ROB IN SOUTHERN JULIAN ALPS (SLOVENIA)

**NORIJSKO-RETIJSKE KORALNE GREBENSKE TVORBE
V BOHINJU IN RDEČEM ROBU V JUŽNIH
JULIJSKIH ALPAH**

DRAGICA TURNŠEK IN STANKO BUSER

ABSTRACT

Norian - Rhaetian coral buildups in Bohinj and Rdeči rob in Southern Julian Alps (Slovenia)

From Bohinj and Rdeči rob 26 species of reef building organisms have been determined belonging to Upper Norian-Rhaetian ages. 15 species of corals are systematically described. Paleoecologically they represent the reef facies on the southern borders of the Julian carbonate platform.

IZVLEČEK

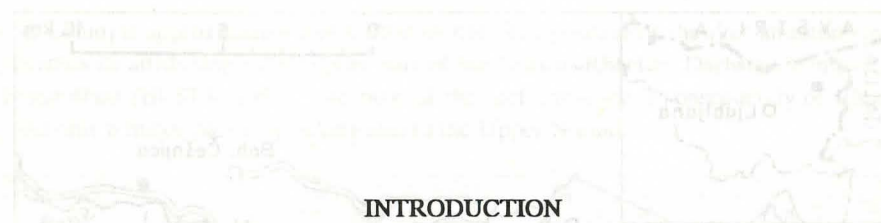
Norijsko-retijske koralne grebenske tvorbe v Bohinju in Rdečem robu v južnih Julijskih Alpah

Iz Bohinja in Rdečega roba je določenih 26 vrst grebenschkih organizmov, ki pripadajo zgornjemu noriju in retiju. 15 koralnih vrst je sistematsko opisanih. V paleokološkem pogledu predstavljajo grebenski facies na južnem obrobju Julijske karbonatne platforme.

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INTRODUCTION

Although Triassic reef limestones in Bohinj were discovered by HÄRTEL already in 1920, they were never given much attention. Upper Triassic reefs from northern Julian Alps were studied by RAMOVŠ and TURNŠEK (1984, 1987), and the Triassic reef complex from Pokljuka reported by TURNŠEK and BUSER (1989). A larger Upper Triassic reef complex, the systematical examination of whose paleontology has not been accomplished yet, is known from Karavanke on the Begunščica mountain (FLÜGEL & RAMOVŠ 1961, BUSER 1980).

During investigations for the Basic geological map of sheets of Tolmin and Videm (Udinje) in 1978, in Bohinj and northeast of Kobla in the Bohinj ridge, as well as south of Rdeči rob in the Krn mountains (Fig. 1), similar Norian-Rhaetian reef limestones as those on the Begunščica peak were found. Then also on Pokljuka a larger reef complex was discovered and owing to its similarity to the reef complex in Bohinj and on ground of its undetermined reef fauna, it was erroneously attributed to Norian-Rhaetian (BUSER 1986a, 1986b). Later, the adherence of the Pokljuka reef to uppermost Carnian was proved (TURNŠEK & BUSER 1989).

BOHINJ

Norian-Rhaetian reef limestones display their largest extent in Bohinj and northeast of Bohinjska Bistrica (Fig. 2). They can be followed continuously in an approximately 4.7 km long and a few hundred metres wide belt from Bitnje to Nomenj. In this area they build the steep southern, in part rocky slopes of hills of Šavnice, Gradišče, Babna gora, Drenova gora and Boltarje.

In southern steep slopes between Bitnje and Nomenj reef limestones are mostly covered by scree talus rolling from higher precipitous walls. Outcropping primary reef limestones with reef fossils are found in the abandoned quarry at the road near the bridge across Sava Bohinjka river (locality 14215). It is interesting that HÄRTEL (1920) noted from this locality also finds of ammonites which, however, during subsequent geological investigations could not be found by us.

Primary reef limestones are found also in steep rocky cliffs of Gradišče (locality 14199), on Drenova gora (locality 14184), Boltarje (locality 14189) and on Babna gora (locality 14184).

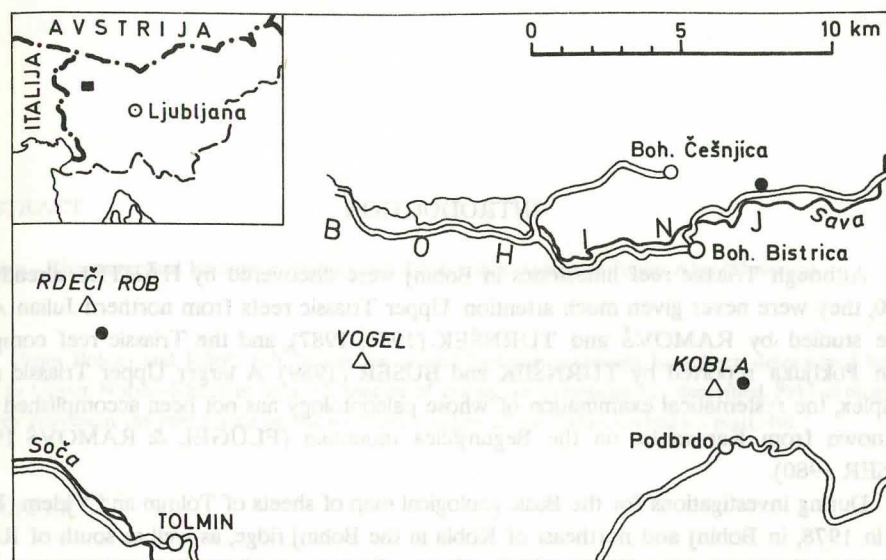


Fig. 1. Location sketch map of investigated Upper Norian-Rhaetian Reef limestone in southern Julian Alps.

Sl 1. Položajna skica obravnavanega zgornje norijsko-retijskega grebenskega apnenca v južnih Julijskih Alpah.

lity 14235). Especially well exposed are similar reef limestones also on Pokljuka, along the forest road east of Srednja Gorjuša; the reef organisms from them have not been investigated yet.

Numerous reef organisms investigated in this work were collected also in slope talus along the road about a kilometer east of Bitnje, at the foot of the Gradišče hill (locality Bitnje 14144). Here, on surface of limestone fragments of perfect naturally prepared sponges *Cheilosporites tirolensis* can be found.

Reef limestone is light grey to white in color and massive, it belongs to genuine biolithite. It is composed of reef organisms whose share attains at least 50 % of the rock mass. Reef organisms are predominantly corals which are unbroken and do not show any marks of redeposition. Among the corals predominate ramose and massive forms, common are also specimens of solitary corals.

Owing to considerable tectonic fragmentation of the reef limestone the former integral reef is not preserved at present any more. Mostly is preserved only the upper, youngest part of the reef. It is conformingly overlain by Liassic crinoidal limestone of the Hierlach type which is passing laterally and vertically into oolitic limestone. The thickness of the reef limes-

tone in Bohinj is approximately 250 to 300 metres. The position of the reef limestone in Bohinj permits its attribution to the upper part of the Norian-Rhaetian Dachstein complex, like on Begunščica (BUSER 1980). The bulk of the reef limestone is consequently of Rhaetian age, and only a minor part may belong also to the Upper Norian.

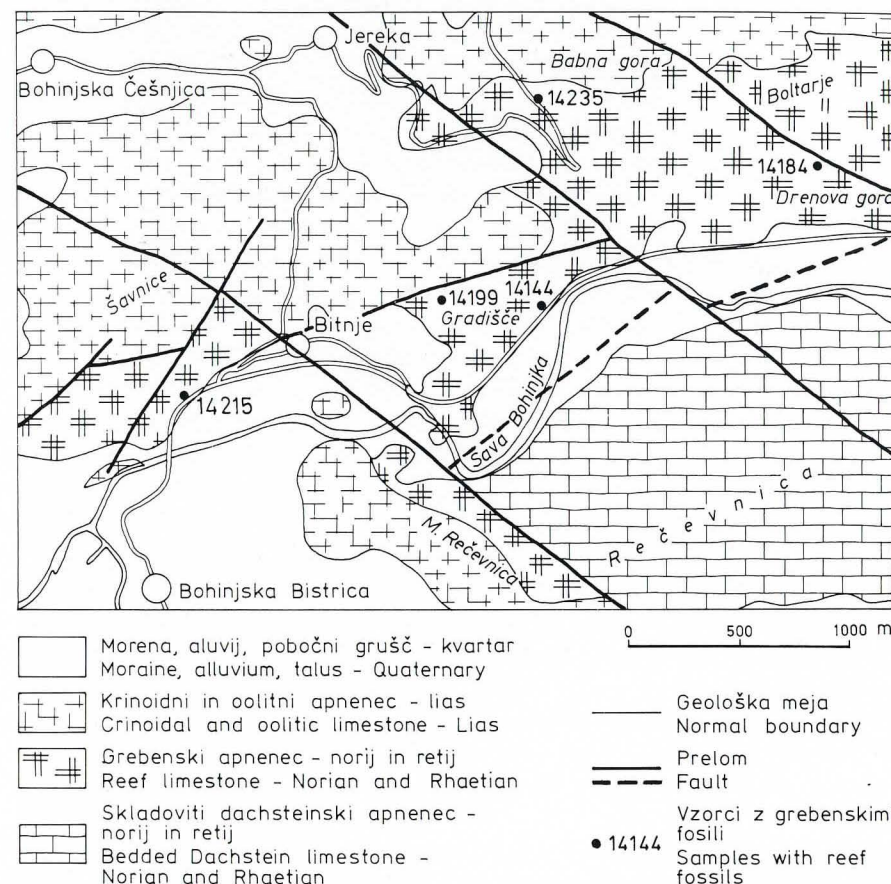


Fig. 2. Geological sketch map with Upper Norian-Rhaetian Reef limestone and investigated reef fossil sites at Bohinj.

Sl. 2. Shematska geološka karta z zgornje norijsko-retijskim grebenskim apnencem in obravnavanimi fosilnimi najdišči v Bohinju.



KOBLA

In the Bohinj ridge the Norian-Rhaetian reef limestone is developed only on a small surface. It can be found in the road-cut of the forest road, about 1800 m northeast as crow flies from the peak of Koblja, and 950 m north of the Vrh Bače saddle (locality 13804). The real extent of the outcropping reef limestone cannot be established owing to the cover by slope talus. The lower older part of the reef limestone is removed by fault from the Dachstein limestone, similarly as in Bohinj, and only its uppermost part is preserved. Also in this locality the Upper Triassic reef limestone is overlain by light crinoidal and oolitic Liassic limestone. Among reef organisms in limestone also here the typical sponge species *Cheilosporites tirolensis* was found. According to its position, also this limestone belongs to Rhaetian, and possibly at least to the upper part of the Norian.

RDEČI ROB

The reef limestone of Norian-Rhaetian age was found also in the Krn mountains, in the southern stony part of Rdeči rob, about 600 metres northeast of the alpine pasturage Sleme (locality 12666). This limestone represents the extreme southern overthrust margin of the Krn nappe, and is in south along the thrust plane in contact with Lower Cretaceous flysch. The reef limestone represents here only a small erosional remain or a tectonical cutoff. In the north it is separated by a fault from bedded Dachstein limestone which builds the southern abyssal walls of Rdeči rob. The extension of this mass of reef limestone is only a few tens of metres, whereas its true dimensions could not be established owing to inaccessible vertical cliffs. The proximity of overthrust resulted into tectonical fracturing of the limestone, and reef organisms in it are recrystallized.

ORIGIN OF REEF LIMESTONE

Norian-Rhaetian reef limestones occur in the Slovenian part of the Southern Alps in Julian Alps, Karavanke, and in Kamnik Alps. In Julian Alps they occupy besides the considered localities an appreciable area in the northern Julian Alps (TURNŠEK & RAMOVŠ 1987). On Begunščica (FLÜGEL & RAMOVŠ 1961) also the basal part of the reef is developed. In Kamnik Alps this reef limestone appears in southern slopes of Krvavec along the road above Cerklje and Šenturška gora (BUSER 1980).

Fig. 2a Locality Bitnje 14144.
Sl. 2a Nahajališče Bitnje 14144.

On the basis of the position of the hitherto studied Norian–Rhaetian reefs of the southern Julian Alps along the southern margin of the former Julian carbonate platform it can be presumed that these reefs represent the edge of the platform with which it was in contact with the southerly lying Slovenian basin. The present relatively small and widely scattered localities of reef limestone probably represent only insignificant remains of the originally more or less continuous reef.

Owing to overthrusting of the extended limestone mass of the Julian Alps, respectively the Julian carbonate platform towards the south, the former primary contact of the carbonate platform with the Slovenian basin was cut by the overthrust. Reef limestones which were associated especially with the southern margin of the carbonate platform, were mostly eroded owing to the steep stony reef protruding above softer basin sediments, and are preserved at present only in fragments.

SYSTEMATIC PALEONTOLOGY

For paleontological investigation in Bohinj and Rdeči rob the following specimens were taken into account:

Rdeči rob: To 12666 (P–905 to P–917)

Bohinj: E of Bitnje 14144 (P–864 to P–886)

Drenova gora 14184 (P–887)

Boltarje 14189 (P–889)

Gradišče 14199 (P–891)

W of Bitnje 14215 (P–892 to P–896)

Babna gora 14235 (P–897, P–898)

All specimens and thin section are deposited in the Ivan Rakovec Paleontological Institute, Scientific Research Centre of the Slovene Academy of Sciences and Arts.

The following corals were described and systematically arranged

Anthozoa

Suborder: Pachythecaliina Eliašova 1976

Familia: Gablonzeriidae Roniewicz 1989

Genus: *Gablonzeria* Cuif 1976

Gablonzeria profunda (Reuss 1854)

Familia: Cyclophylliidae Roniewicz 1989

Genus: *Cyclophyllia* Roniewicz 1989

Cyclophyllia raricorallita Turnšek 1991

Suborder: Stylophyllina Beauvais 1981

Familia: Stylophyllidae Frech 1890

Genus: *Stylophyllum* Reuss 1854

Stylophyllum paradoxum (Frech 1890)

Suborder: Archaeocoeniina Alloiteau 1952

Familia: Actinastraeidae Alloiteau 1952

Genus: *Chondrocoenia* Roniewicz 1989

Chondrocoenia paradoxa (Melnikova 1968)

Suborder: Distichophylliina Beauvais 1981

Familia: ?Reimaniphylliidae Melnikova 1975

Genus: *Distichophyllia* Cuif 1974

Distichophyllia norica (Frech 1890)

Genus: *Retiophyllia* Cuif 1966

Retiophyllia fenestrata (Reuss 1854)

Retiophyllia gosaviensis Roniewicz 1898

Retiophyllia paraclathrata Roniewicz 1974

Genus: *Parathecosmilia* Roniewicz 1974

Parathecosmilia langobardica (Stoppani 1875)

Genus: *Palacastraea* Kühn 1936

Palacastraea grandissima (Frech 1890)

Familia: Margarophylliidae Cuif 1977

Genus: *Margarosmilia* Volz 1896

Margarosmilia charliana (Frech 1890)

Margarosmilia cf. *charliana* (Frech 1890)

Suborder: Fungiina Verrill 1875

Familia: Procycolitidae Vaughan & Wells 1943

Genus: *Alpinoseris* Roniewicz 1989

Alpinoseris dendroidea Roniewicz 1989

Familia: Astraeomorphidae Frech 1890

Genus: *Astraeomorpha* Reuss 1854

Astraeomorpha sp.

Familia: Cuifastracidae Melnikova 1983
 Genus: *Cuifastraea* Melnikova 1983
Cuifastraea arthaberi (Haas 1909)

Description of coral species

Suborder: Pachythecaliina Eliašova 1976

Familia: Gablonzeriidae Roniewicz 1989

Genus: *Gablonzeria* Cuif 1976*Gablonzeria profunda* (Reuss 1854)

Pl. 1, Fig. 1–2

1854 *Isastraea profunda* n.sp. REUSS: 116, Pl.9, Fig.5–6.1890 *Isastraea profunda* Reuss. FRECH: 21–22, Taf.5, Fig.1–3a.1976 *Gablonzeria profunda* Reuss. CUIF: 113–114, Textfig.12, Pl.12, Fig. 2–6 (non 1).1986 *Gablonzeria profunda* (Reuss). STANLEY: 30, Pl.3.1, Fig. 13–14.1989 *Gablonzeria profunda* (Reuss). RONIEWICZ: 33–35, Pl.4, Fig.1; Pl.5, Fig.3.

Description: Modern description and revision were exactly given by CUIF (1976) and RONIEWICZ (1989). Our specimen is a small ceriod colony with irregularly polygonal corallites and thick wall. Septa are compact, in 4–5 cycles, with lateral corns or teeth and axial trabecular prolongations. Endotheca is of numerous vesicular dissepiments. Microstructure is not preserved.

Dimensions: $d = 2.5\text{--}4\text{ mm}$, $s = 48+s5$

Remarks: In systematics I follow RONIEWICZ (1989) which is based on microstructure, although wall in our specimen looks like septotheca, and not typical pachythecaliid epitheca.

Distribution: Norian–Rhaetian of Northern Calcareous Alps.

Locality: Rdeči rob: To–12666/6 (P–910). Norian–Rhaetian.

Familia: Cyclophyllidae Roniewicz 1989

Genus: *Cyclophyllia* Roniewicz 1989*Cyclophyllia raricorallita* Turnšek 1991

Pl. 1, Fig. 3–4

1991 *Cyclophyllia raricorallita* n.sp. RAMOVŠ & TURNŠEK: 183–184, Pl. 4, Fig. 1–4; Pl. 5, Fig. 1–2. (in present volume).

Our specimens are identical to those from Razor and Planja the wall being even better preserved.

Distribution: Planja and Razor, Lower Norian.

New locality: Rdeči rob: To–12666/1 (P–905). Norian–Rhaetian.

Suborder: Stylophyllina Beauvais 1981

Familia: Stylophyllidae Frech 1890

Genus: *Stylophyllum* Reuss 1854*Stylophyllum paradoxum* (Frech 1890)

Pl. 1, Fig. 5

1890 *Stylophyllum paradoxum* nov.sp. FRECH: 54–55, Taf.4, Fig.1–24; Taf.15, Fig.12.1972 *Stylophyllum paradoxum* Frech. CUIF: 227–232.1972 *Stylophyllopsis paradoxum* (Frech). MELNIKOVA: 56.1977 *Stylophyllum paradoxum* Frech. CUIF: 14, Pl.1, Fig.1–3.1979 *Stylophyllum paradoxum* Frech. STANLEY: 26.1979 *Stylophyllum paradoxum* Frech. SCHÄFER: 45–46, Taf.9, Fig.3.1980 *Stylophyllum paradoxum* Frech. CUIF: 362, Textfig.1.1986 *Stylophyllum paradoxum* Frech. STANLEY: 29, Pl.3.1, Fig. 1–3.

1989 *Stylophyllum paradoxum* Frech. RONIEWICZ: 121–122, Pl.36, Fig.3,4,8; Pl.38, Fig.5; Pl.42, Fig.9.

Description: The most modern description was given by RONIEWICZ (1989). Specimen in our collection is a solitary coral with very thick septa developed in 2–3 cycles. Columella is built of septal spines. Microstructure fibrous.

Dimensions: $d = \text{ca. } 15\text{ mm}$, $s = \text{ca. } 20$.

Distribution: "Zlambachschichten" (Rhaetian) of Northern Calcareous Alps.

Locality: Bohinj, W of Bitnje: 14215/5 (P–896). Upper Norian–Rhaetian.

Subordo: Archaeocoeniina Alloiteau 1952

Familia: Actinastraeidae Alloiteau 1952

Genus: *Chondrocoenia* Roniewicz 1989*Chondrocoenia paradoxa* (Melnikova 1968)

Pl. 2, Fig. 1–3

1968 *Cyathocoenia paradoxa* n.sp. MELNIKOVA: 16–17. Tab. 3, Fig. 1–2.1975 *Cyathocoenia paradoxa* Melnikova. MELNIKOVA: 61–63, Tab. 2, fig. 1–3, 6; Tab. 3, fig. 1. Textfig. 9.1989 *Chondrocoenia paradoxa* (Melnikova). RONIEWICZ: 113.

Description: Lamellate colony with small subplocoid to cerioid polygonal corallites. Septa are subcompact, columella weakly developed, styliform, sometimes rudimented. Wall septo-parathecal with rare pores. Peritheca lacking or very narrow, built of costate structures. Endotheca of thin tabular or vesicular dissepiments. Microstructure trabecular.

Dimensions:	Slovenia	<i>C. paradoxa</i> MELNIKOVA 1975	<i>C. schafhäutli</i> RONIEWICZ 1989
d	1.3–1.7(2)mm	1.5–2.2 mm	1.3–2.3 mm
c–c	1.3–1.8 (2)mm	1.7–2.3 mm	1.5–3.0 mm
s(c)	12–18(24)	22–28	16–26

Comparison: Our specimen fits in dimensions with *C. paradoxa* as well as with small examples of *C. schafhäutli*. I ascribe it to *C. paradoxa* because of constantly smaller corallites. Septa in our specimens seem to be less numerous, and a little shorter, although their costae are of the same number as in original materials. They show the same ontogenetic development (compare MELNIKOVA 1975: Textfig. 9).

Distribution: Norian–Rhaetian of SE Pamir.

Locality: Rdeči rob: To–12666/5 (P–909). Norian–Rhaetian.

Subordo: Distichophylliina Beauvais 1981

Familia: Reimaniphylliidae Melnikova 1975

RONIEWICZ (1989: 35–39) recognized family Distichophylliidae Cuif 1977 as younger synonym of Reimaniphylliidae Melnikova 1975.

Genus: *Distichophyllia* Cuif 1974*Distichophyllia norica* (Frech 1890)

Pl. 2, Fig. 4–5

1890 *Montlivaltia norica* nov.nom. FRECH: 39–40, Taf.3, Fig. 9; Taf.10, Fig.1–5; Taf.13, Fig.1–7; Taf.18, Fig.17.1966a *Montlivaltia norica* Frech. KOLOSARY: 182.1966b *Montlivaltia norica* Frech. KOLOSARY: 127.1974 *Distichophyllia* (*Montlivaltia*) *norica* (Frech). CUIF: 304–318,398, Textfig.2–6.1975 *Reimaniphyllia norica* (Frech). MELNIKOVA: 871977 *Distichophyllia norica*. *Montlivaltia norica* Frech. CUIF: 19,39, Textfig.4. Pl.3, Fig.4–8; Pl.4, Fig.5–7; Pl.5, Fig.3.1979 *Montlivaltia norica* Frech. SCHÄFER: 441979 "*Montlivaltia*" *norica* Frech. STANLEY: 12,24,28,32,34,38.1980 *Montlivaltia norica* Frech. SENOWBARI–DARYAN: 39, Taf.4, Fig.1.1980 *Montlivaltia norica* Frech. KRISTAN–TOLLMANN & al.: 173, Taf.5, Fig.6, Taf.6, Fig.1,3.1980 *Distichophyllia norica* (Frech). CUIF: 365, Textfig.3.1989 *Distichophyllia norica* (Frech). RONIEWICZ: 39–41, Pl.6, Fig.2–4.1989 *Distichophyllia norica* (Frech). STANLEY & WHALEN: 806–807, Fig.5.4, 5.6.

Description: and revisions were given by CUIF and RONIEWICZ. Our specimens are solitary corals with characteristic distichophylliid structure. In dimensions they fit with *D. norica*.

Dimensions: d = 30–50 mm, s = 120–150.

Distribution: Rhaetian of Northern Calcareous Alps, Upper Triassic of Hungary and Czechoslovakia, Norian of Pamir, Norian–Rhaetian of North America.

Localities: Bohinj, E of Bitnje: 14144 (P–868,P–869,P–870); W of Bitnje: 14215 (P–892); Kobla, S of Boh. Bistrica: 13804/1; Rdeči rob: To–12666/11 (P–915). Norian–Rhaetian.

Genus: *Retiophyllia* Cuif 1966

Retiophyllia fenestrata (Reuss 1854)

Pl. 3, Fig. 1

1987 *Retiophyllia fenestrata* (Reuss). TURNŠEK & RAMOVŠ: 41, Pl. 11, Fig. 4–5.
Synonymy.

Description: New specimens are phaceloid with irregularly branched corallites. $d = 5.8\text{--}12\text{ mm}$ in the same colony. Septa are developed in 4–5 cycles the first two being thicker.

Comparison: RONIEWICZ (1989) separated the Frech's specimens of *Thecosmilia fenestrata* from Reuss' species, and described them as a new species *Retiophyllia frechi*. She distinguished it by larger corallites and difference in cycles of septa and wall.

Our specimens have very different dimensions of corallites in a single colony, septa show several cycles, wall is not well preserved, so I am not able to distinguish the two species. I attribute our specimens to the *Retiophyllia fenestrata*.

Distribution: Norian–Rhaetian of Northern Calcareous Alps.

New locality: Bohinj, Boltarje: 14189 (P–889). Upper Norian–Rhaetian.

Retiophyllia paraclathrata Roniewicz 1974

Pl. 3, Fig. 4–5

1987 *Retiophyllia paraclathrata* Roniewicz. TURNŠEK & RAMOVŠ: 41, Pl. 10, Fig. 6–7.
Synonymy.

Dimensions: New specimen has dimensions $d = 4\text{--}5\text{ mm}$, $c\text{--}c = 6\text{--}9\text{ mm}$, $s = \text{ca. } 50$.

New locality: Bohinj, E of Bitnje: 14144 (P–867, P–871, P–882, P–883, P–884). Upper Norian–Rhaetian.

Retiophyllia gosaviensis Roniewicz 1989

Pl. 3, Fig. 2–3

1989 *Retiophyllia gosaviensis* n.sp. RONIEWICZ: 55–56, Pl.9, fig.1; pl.11, fig.4–5.

Description: Phaceloid colony with dense somewhat oval corallites. Septa are dense, in 4–5 cycles, costate. Axial thickenings of septa fill the axial place. Endotheca is of large vesicular dissepiments. Septotheca typical. Microstructure is not preserved.

Dimensions:	Slovenia	RONIEWICZ
d	9–10 mm	8–11 mm
s	ca 110 (12/3mm)	10–12/3

Comparison: RONIEWICZ (1989) stated that this species differs from all other *Retiophyllia* in thinner and denser septa having equal thickness in peripheral part. Our specimens fit with this description.

Distribution: Rhaetian of Northern Calcareous Alps (Kesselwand, Zlambach).

Locality: Rdeči rob: 12666 (P–907). Norian–Rhaetian.

Genus: *Parathecosmilia* Roniewicz 1974

Parathecosmilia langobardica (Stoppani 1857)

Pl. 4, Fig. 1–2

1987 *Parathecosmilia langobardica* (Stoppani). TURNŠEK & RAMOVŠ: 38, PL. 8, FIG. 1–2.

Remarks: RONIEWICZ (1989, 43) agreed with FANTINI–SESTINI in ascribing *Parathecosmilia* to genus *Retiophyllia*. I still recognize *Parathecosmilia* because it differs from *Retiophyllia* in constant lacking of septotheca.

New locality: Rdeči rob: 12666 (P–908, P–914). Norian–Rhaetian.

Genus: *Palaeastraea* Kühn 1936

Palaeastraea grandissima (Frech 1890)

Pl. 4, Fig. 3–4

1890 *Phyllocoenia grandissima* n.sp. FRECH: 31, Pl.3, Fig. 1–11; Pl.9, Fig.2,4,6,7 (non 1,2,3).

1936 *Palaeastraea grandistellata* n.sp. KÜHN: 27, Pl.1, Fig.2.

1989 *Palaeastraea grandissima* (Frech). RONIEWICZ: 68–70. Pl. 16, Fig.1; Pl.17, Fig.2.

Description and revision were given by RONIEWICZ. Our specimens are fragments of massive colonies, corallites having thick first septa and vesicular dissepiments, typical for this genus. In dimensions they fit with species *P. grandissima*. $d = 14\text{--}18(22)\text{ mm}$, $s = \text{ca } 24$.

Distribution: Rhaetian of Northern Calcareous Alps and redeposited in alluvial sediments near Graz.

Locality: Bohinj, E of Bitnje: 14144 (P–874, P–880). Upper Norian–Rhaetian.

Familia: Margarophylliidae Cuif 1977

Genus: *Margarosmilia* Volz 1896

Margarosmilia charliana (Frech 1890)

Pl. 5, Fig. 1–4

1890 *Thecosmilia charliana* nov.sp. FRECH: 11, Taf.3, Fig.5; Taf.5, Fig.6–7.

1975 *Paradistichophyllum charlianum* (Frech). MELNIKOVA: 89.

1989 *Margarosmilia charliana* (Frech). RONIEWICZ: 77–78, Pl. 19, Fig.1–4; Pl.22, Fig.3–4.

Description: Phaceloid colony has dense branching cylindrical corallites. Septa are in 5–6 cycles, laterally strongly dentate. Endotheca is of vesicular dissepiments. Wall is unclear paratheca.

Dimensions:	Bohinj	RONIEWICZ
d	7–9 mm	5–10 mm
c–c	10–11 mm	
s	ca. 100	74–107

Comparison: So far this is the only species of the genus *Margarosmilia* found in Norian–Rhaetian. All others are Carnian. Our specimens completely fit with modern description given by RONIEWICZ 1989.

Distribution: Rhaetian of Northern Calcareous Alps.

Locality: Bohinj, Babna gora: 14235 (P–897, P–898), Gradišče: 14199 (P–891). Upper Norian–Rhaetian.

Margarosmilia cf. *charliana* (Frech 1890)

Pl. 5, Fig. 5–6

The colony is similar to previously described. It is larger and has more regular corallite shapes. Septa seem to be more dentate and poorly preserved.

Dimensions: d = 10–15 mm, c–c = 13–20 mm, s = ca 100.

Locality: Bohinj, Drenova gora: 14184 (P–887). Upper Norian–Rhaetian.

Suborder: Fungiina Verrill 1865

Familia: Procycolitidae Vaughan & Wells 1943

Genus: *Alpinoseris* Roniewicz 1989

Alpinoseris dendroidea Roniewicz 1989

Pl. 6, Fig. 1–2

1989 *Alpinoseris dendroidea* n.sp. RONIEWICZ: 91–92, Pl.27, Fig. 1.

Description: Modern description was given by Roniewicz. Our specimens are branching corals with leaf-like corallites, monocentric with irregular budding. Septa are very thin, in 5 cycles excentrically arranged, with strong lateral medianae. Dissepiments are vesicular. Microstructure is not preserved.

Dimensions: d = 8–12 mm, s = ca. 100.

Distribution: Zlambach (Upper Rhaetian) of Northern Calcareous Alps.

Locality: Bohinj, E of Bitnje: 14144/9 (P–872), Upper Norian–Rhaetian.

Familia: Astraeomorphidae Frech 1890

Genus: *Astraeomorpha* Reuss 1854

Astraeomorpha sp.

Pl. 6, Fig. 4

Small fragment of bulbous colony has characteristics of the genus *Astraeomorpha*. Poorly preserved.

Locality: Rdeči rob: To–12666/2c (P–906). Norian–Rhaetian.

Familia: Cuifastreaeidae Melnikova 1983

Genus: *Cuifastrea* Melnikova 1983

Cuifastrea arthaberi (Haas 1909)

Pl. 6, Fig. 3

1909 *Thamnastraea ?Arthaberi* n.sp. HAAS: 151–152, Pl.5, Fig.13.

1989 *Cuifastrea arthaberi* (Haas). RONIEWICZ: 92–93, Pl.23, Fig.4.

Description: Encrusting thamnasterioid corallites have small axial fields. Septa are de-

veloped in two lengths in 2–3 cycles of equal thickness. Columella parietal, dissepiments vesicular. Microstructure not preserved.

Dimensions: $d = 6\text{--}12\text{ mm}$, $s = 28$.

Distribution: Rhaetian of Northern Calcareous Alps.

Locality: Rdeči rob: To-12666/8 (P-912). Norian-Rhaetian.

Other accompanying fossils

Stromatoporoidea:

Lamellata wöhneri Flügel & Sy 1959

Pl. 7, Fig. 1

Locality: Bohinj: 14215 (P-895).

Spongiomorpha acyclica Frech 1890

Pl. 7, Fig. 2

Locality: Rdeči rob: 12666 (P-917).

Spongia

Cheilosporites tirolensis Wöhner 1903

Pl. 7, Fig. 3–4

Locality: Bohinj: 14144 (P-864, P-875, P-877, P-886).

Paradeningeria alpina Senowb.-Dar. & Schäf. 1978

Pl. 7, Fig. 5

Locality: Bohinj: 14144 (P-866)

Chaetetida

Pseudoseptifer aktashi Boiko 1979

Pl. 7, Fig. 6

Locality: Bohinj: 14144 (P-878).

Microproblematica

Microtubus communis Flügel 1964

Pl. 7, Fig. 8

Localities: Bohinj: 14144 (P-864, P-875, P-877, P-879, P-883, P-884); 14184 (P-887), 14189 (P-889), 14190 (P-890); 14215 (P-893, P-895, P-896); Rdeči rob: 12666 (P-905, P-906, P-908, P-913).

Foraminifera

Alpinophragmium perforatum Flügel 1967

Pl. 7, Fig. 8

Localities: Bohinj: 14144 (P-865, P-877, P-884);

Rdeči rob: 12666 (P-905, P-909).

Galeanella panticae Brönnimann & al. 1973

Pl. 7, Fig. 7

Localities: Bohinj: 14144 (P-876, P-879, P-883);

Rdeči rob: 12666 (P-913, P-917).

STRATIGRAPHIC COMPARISON OF REEF FOSSILS

From all mentioned localities in Bohinj and Rdeči rob 15 species of corals, two species of stromatoporoids, one chaetetid and two species of sponges were found and described. The microorganisms contain one species of microproblematica and two species of foraminifers. Of these, 10 coral species were now found first in Slovenia.

Comparison of reef fauna with other localities in Slovenia indicates the most similarity with localities of Norian-Rhaetian age in the northern Julian Alps, where 9 common species of reef fossils were found (TURNŠEK & RAMOVŠ 1987). Comparison with Begunjščica was not possible, since the paleontological study of that fauna has not been accomplished yet. It can be stated, however, that the investigated areas differ from Lower Norian fossils on Razor and Planja (RAMOVŠ & TURNŠEK 1991, in the same journal), and from Tuvalian ones on Pokljuka (TURNŠEK & BUSER 1989).

Elsewhere in the world the mentioned fossils are known from various places: Northern Calcareous Alps (RONIEWICZ 1989), Pamir (DRONOV & al. 1982), Iran (KRISTAN-TOLLMANN & al. 1980), North America (STANLEY 1986, STANLEY & WHALEN 1989), where they were ranged into Norian and Rhaetian. Similar reef biotopes were mentioned also by RIEDEL (1990) from various areas of the Norian-Rhaetian Tethys.

Consequently, the two reef complexes in Bohinj and Rdeči rob do not contain any older Carnian or Lower Norian elements, and therefore can be reliably attributed to Upper Norian and Rhaetian on grounds of their position as well as their faunistic assemblage. List of fossils and comparison with known localities in Slovenia are presented in Fig. 3.

PALEOECOLOGY

In the paleoecological meaning all found fossils are typical reef organisms. Along with corals, stromatoporoids and sponges also microproblematica and foraminifers are characteristic for reef environments.

A slight difference between fossils from the studied localities can be estimated in their external shape. In Rdeči rob prevail cerioid crusty colonies, and in Bohinj mostly ramose phaceloid colonies (Fig. 4). One of explanations for richer phaceloid fauna may be in a somewhat larger depth, in which corals and other organisms could freely grow upwards. Just below the surface, however, the crusty forms that force their way laterally outwards could be better preserved. The locality in Rdeči rob would be consequently somewhat shallower from

Fig. 3. List of investigated reef fossils in Bohinj and Rdeči rob, and comparison with other localities in Slovenia.

Sl. 3. Seznam opisanih grebenskih fosilov iz Bohinja in Rdečega roba ter primerjava z drugimi najdišči v Sloveniji.

	Bohinj						Rdeči rob	Previous localities in Slovenia
	14144	14184	14189	14199	14215	14235	13804	12666
	Upper Norian - Rhaetian						Norian Rhaetian	Druga nahajališča v Sloveniji
Corals								
<i>Alpinoseris dendroidea</i>	•							
<i>Astraeomorpha</i> sp.							•	
<i>Crassistella</i> cf. <i>parvula</i>							•	
<i>Cuifastraea arthaberi</i>							•	
<i>Cyclophyllia raricorallita</i>							•	Raz Pl
<i>Distichophyllia norica</i>	•				•		•	
<i>Gablonzeria profunda</i>							•	
<i>Margarosmia charliana</i>				•		•		
<i>Margarosmia</i> cf. <i>charliana</i>		•						
<i>Palaeastraea grandissima</i>	•							
<i>Parathecosmia langobardica</i>							•	Dk
<i>Retiophyllia fenestrata</i>			•					Tp Šp
<i>Retiophyllia gosaviensis</i>							•	
<i>Retiophyllia paraclathrata</i>	•							Šp
<i>Stylophyllum paradoxum</i>					•			
Stromatoporoids								
<i>Lamellata wöhneri</i>					•			
<i>Spongiomorpha acyclica</i>							•	Šp
Chaetetids								
<i>Pseudoseptifer aktashi</i>	•							Šp
Sponges								
<i>Cheilosporites tirolensis</i>	•						•	Rm
<i>Paradeningeria alpina</i>	•							Rm Šp Pe
Microproblematica								
<i>Microtubus communis</i>	•	•			•		•	
Foraminifers								
<i>Alpinophragmium perforatum</i>	•						•	Dk Šp
<i>Galeanella panticae</i>	•						•	Pe
<i>Involutina</i> sp.							•	

those in the Bohinj area. In both areas, however, appear the fossils *Alpinophragmium perforatum* and *Galeanella panticae*, which are typical representatives of the central reef body (see also SENOWBARI-DARYAN 1984).

Species	type of colony	locality
<i>Astraeomorpha</i> sp.	cerioid-flat	Rr
<i>Gablonzeria profunda</i>	cerioid-lamellate	Rr
<i>Chondrocoenia paradoxa</i>	subploc-cerioid-lamellate	Rr
<i>Cuifastraea arthaberi</i>	thamnasterioid-foliose	Rr
<i>Cyclophyllia raricorallita</i>	phaceloid	Rr
<i>Retiophyllia gosaviensis</i>	phaceloid	Rr
<i>Parathecosmia langobardica</i>	phaceloid	Rr
<i>Retiophyllia fenestrata</i>	phaceloid	Bo
<i>Retiophyllia paraclathrata</i>	phaceloid	Bo
<i>Margarosmia charliana</i>	phaceloid	Bo
<i>Margarosmia</i> cf. <i>charliana</i>	phaceloid	Bo
<i>Alpinoseris dendroidea</i>	subphaceloid	Bo
<i>Stylophyllum paradoxum</i>	solitary	Bo
<i>Distichophyllia norica</i>	solitary	Rr Bo

Fig. 4. Type of fossil colonies in Rdeči rob and Bohinj. Cerioid - lamellate forms are limited to Rdeči rob.

Sl. 4. Tipi fosilnih kolonij v Rdečem robu in Bohinju. Cerioidno-lamelarne oblike so omejene na Rdeči rob.

POVZETEK

NORIJSKO-RETIJSKE KORALNE GREBENSKE TVORBE V BOHINJU IN RDEČEM ROBU V JUŽNIH JULIJSKIH ALPAH

Uvod

Čeprav je triasne grebenske apnenice v Bohinju zasledil že HÄRTEL 1920. leta, jim doslej nismo posvetili kaj več pozornosti. Iz severnih Julijskih Alp sta zgornjetriasne grebene obdelala RAMOVŠ in TURNŠEK (1984, 1987), na Pokljuki pa sta o triasnem grebenskem kompleksu poročala TURNŠEK in BUSER (1989). Večji zgornjetriasni grebenski kompleks

poznamo v Karavankah na Begunjščici (FLÜGEL & RAMOVŠ 1961; BUSER 1980), ki paleontološko še ni sistematično obdelan.

Leta 1978 smo pri raziskavah za Osnovno geološko karto listov Tolmin in Videm našli v Bohinju in severovzhodno od Koble v Bohinjskem grebenu ter južno od Rdečega roba v Krnskem pogorju (sl. 1) podobne norijsko–retijske grebenske apnenca kot so na vrhu Begunjščice. Takrat smo našli večji grebenski kompleks tudi na Pokljuki, ki smo ga zaradi podobnosti z onim v Bohinju in še neobdelane grebenske favne napačno uvrstili v norijsko–retijsko starost (BUSER 1986a, 1986b). Kasneje je bilo dokazano, da greben na Pokljuki pripada najzgornejšemu karniju (TURNŠEK & BUSER 1989).

Bohinj

Največji obseg imajo norijsko–retijski grebenski apneneci v Bohinju severovzhodno od Bohinjske Bistrice. Nprekinjeno jih sledimo v okoli 4,7 km dolgem in le nekaj sto metrov širokem pasu med Bitnjami in Nomnjem. Tukaj sestavljajo strma južna deloma skalovita pobočja hribov Šavnice, Gradišča, Babne in Drenove gore ter Boltarjev.

Na južnih strmih pobočjih med Bitnjami in Nomnjem so grebenski apneneci večji del pokriti s pobočnim gruščem, ki se vali z višje ležečih prepadnih sten. Primarno odkrite grebenske apnenca z grebenskimi fosili dobimo v opuščnem kamnolomu ob cesti nedaleč od mosta preko Save Bohinjke (najdišče 14215). Zanimivo je, da omenja HÄRTEL (1920) s tega mesta tudi najdbe amonitov, ki pa jih pri ponovnih geoloških raziskavah nismo uspeli najti.

Primarne grebenske apnenca najdemo še v strmih skalnatih pečeh na Gradišču (najdišče 14199), na Drenovi gori (najdišče 14184), na Boltarjih (najdišče 14189) in na Babni gori (najdišče 14235). Izredno lepo so odkriti podobni grebenski apneneci tudi na Pokljuki ob gozdni cesti vzhodno od Srednjih Gorjuš, iz katerih grebenski organizmi paleontološko še niso obdelani.

Številni grebenski organizmi, ki so obdelani v razpravi, so bili nabrani tudi v pobočnem grušču ob cesti dober kilometer vzhodno od Bitenj pod hribom Gradišče (najdišče Bitnje 14144). Tukaj je moč najti na površini apnenčevih kosov lepo naravno izpreparirane primerke spongie *Cheilosporites tirolensis*. Vsa nahajališča so označena na sl. 2.

Grebenski apnenec je svetlo sive do bele barve in masiven ter pripada pravemu biolitu. Sestavljajo ga grebenski organizmi, ki dosega vsaj 50 % (in več) celotne kameninske mase. Grebenotvorni organizmi pripadajo pretežno koralam, ki so cele oziroma nepolomljene in ne kažejo znakov presedimentacije. Med koralami prevladujejo vejate in masivne oblike, niso pa redki tudi primerki solitarnih koral.

Zaradi precejšnje tektonske razlomljenosti grebenskega apnenca danes ni več ohranjen nekdanji celotni greben. Večinoma je ohranjen le vrhnji oziroma najmlajši del grebena in normalno na njem leži liasni krinoidni apnenec hierlaškega tipa, ki lateralno in vertikalno prehaja v oolitni apnenec. Približna debelina grebenskega apnenca je okoli 250 do 300 metrov.

Po legi grebenskega apnenca v Bohinju moremo sklepati, da pripada vrhnjemu delu norijsko–retijskega dachsteinskega kompleksa, podobno kot na Begunjščici (BUSER 1980). Večina grebenskega apnenca je torej retijske starosti in le manjši del pripada mogoče tudi zgornjemu noriju.

Kobla

V Bohinjskem grebenu je razvit norijsko–retijski grebenski apnenec le na majhni površini. Najdemo ga v vseku gozdne ceste okoli 1800 metrov zračne črte severovzhodno od vrha Koble oziroma 950 metrov severno od sedla Vrh Bače (najdišče 13804). Zaradi pokritosti s pobočnim gruščem ni mogoče ugotoviti pravega obsega grebenskega apnenca. Spodnji oziroma starejši del grebenskega apnenca je tudi tukaj, podobno kot v Bohinju, odrezan s prelomom od dachsteinskega apnenca in je ohranjen le njegov najvišji del. Tudi v tem nahajališču leži nad zgornjetriasnim grebenskim apnenecem svetli krinoidni in oolitni liasni apnenec. Med grebenskimi organizmi smo našli v apnencu tudi tukaj značilno spongijsko vrsto *Cheilosporites tirolensis*. Po legi sodeč tudi ta apnenec pripada retiju in kvečjemu še zgornjemu delu norija.

Rdeči rob

Grebenski apnenec norijsko–retijske starosti smo našli tudi v Krnskem pogorju na južnem skalnatem delu Rdečega roba okoli 600 metrov severovzhodno od planine Sleme (najdišče 12666). Ta apnenec sestavlja skrajni južni narivni rob Krnskega pokrova in na jugu ob narivni ploskvi meji na spodnjekredni fliš. Grebenski apnenec predstavlja tukaj le majhno tektonsko čer ali odstružek ob narivu in je na severu odrezan s prelomom od skladovitega dachsteinskega apnenca, ki sestavlja južna prepadna ostenja Rdečega roba. Velikost te čeri grebenskega apnenca je le nekaj deset metrov, vendar zaradi prepadnih sten ni mogoče ugotoviti njegove prave razsežnosti. Zaradi bližine nariva je apnenec tektonsko pretrt, grebenski organizmi v njem pa so prekrystalizirani.

Nastanek grebenskega apnenca

Norijsko–retijske grebenske apnenca dobimo v slovenskem delu Južnih Alp v Julijskih Alpah, v Karavankah in v Kamniških Alpah. V Julijskih Alpah zavzemajo poleg sedaj obravnavanih najdišč še precejšen obseg v severnih Julijskih Alpah (TURNŠEK & RAMOVŠ 1987). Na Begunjščici (FLÜGEL & RAMOVŠ 1961) je razvit tudi bazalni del grebena. V Kamniških alpah pa se ta grebenski apnenec pojavlja na južnih pobočjih Krvavca ob cesti

nad Cerkljami in Šenturško goro (BUSER 1980).

Na podlagi dejstva, da leže sedaj obdelani norijsko–retijski grebeni južnih Julijskih Alp ob južnem robu nekdanje Julijske karbonatne platforme, moremo sklepati, da so ti grebeni predstavljali tisti rob platforme, s katerim je mejila na južneje ležeči Slovenski bazen. Današnja razmeroma majhna in daleč vsaksebi ležeča najdišča grebenskega apnenca pa verjetno predstavljajo le borne erozijske ostanke nekdanjega bolj ali manj povezanega grebena.

Zaradi narivanja obsežne apnenčeve gmote Julijskih Alp oziroma nekdanje Julijske karbonatne platforme proti jugu, je nekdanji prvotni stik karbonatne platforme in Slovenskega bazena ob narivu odrezan. Grebenki apneneci, ki so bili vezani prav na južni rob karbonatne platforme, so bili zaradi strmega skalnatega in naprej štrlečega grebena nad mehkejšimi bazenskimi sedimenti večinoma erodirani in so danes ohranjeni le fragmentarno.

Paleontološke raziskave grebenskih fosilov

Iz vseh omenjenih nahajališč v Bohinju in v Rdečem robu je bilo najdenih in opisanih 15 vrst koral, dve vrsti stromatoporoidov, ena hetetida in dve vrsti spongij. Mikroorganizmi vsebujejo eno vrsto mikroproblematik in dve vrsti foraminifer. Od tega je 10 koralnih vrst sedaj prvič najdenih pri nas.

Primerjava grebenske favne z drugimi najdišči v Sloveniji kaže največjo podobnost z nahajališči norijsko–retijske starosti v severnih Julijskih Alpah, kjer je najdenih 9 istih vrst grebenskih fosilov (TURNŠEK & RAMOVŠ 1987). Primerjava z Begunjščico je nemogoča, ker ta paleontološko še ni v celoti obdelana. Ugotavljamo pa, da se obe obdelani področji razlikujeta od spodnjenorijskih fosilov na Razorju in Planji (RAMOVŠ & TURNŠEK 1991, v isti reviji), in od tuvalskih na Pokljuki (TURNŠEK & BUSER 1989).

Drugod po svetu so omenjeni fosili znani iz raznih krajev: iz severnih Apneniških Alp (RONIEWICZ 1989), iz Pamirja (DRONOV & al. 1982), iz Irana (KRISTAN–TOLLMANN & al. 1980), iz severne Amerike (STANLEY 1986, STANLEY & WHALEN 1989), kjer so uvrščeni v norij in retij. Podobne grebenske biotope omenja tudi RIEDEL (1990) iz raznih krajev norijsko–retijske Tetide.

Nahajališča v Bohinju in Rdečem robu ne vsebujejo nobenega starejšega karnijskega ali spodnjenorijskega elementa, zato so zanesljivo tako po legi kot tudi po favnistični združbi zgornjenorijsko–retijska. Seznam fosilov in primerjava z drugimi že znanimi nahajališči v Sloveniji je podana na sl. 3.

Paleoekologija

V Paleoekološkem pomenu so vsi najdeni fosili tipični grebenki organizmi. Poleg koral, stromatopor in spongij so značilno grebenki tudi mikroproblematika in foraminifere.

Malenkostna razlika med fosili obdelanih nahajališč je v njihovi zunanji obliki. V Rdečem robu prevladujejo cerioidne skorjaste kolonije, v Bohinju pa so v glavnem vejnate faceloidne kolonije (sl.4). Ena od razlag za bogatejšo faceloidno favno je lahko nekoliko večja globina, ko korale in organizmi lahko nemoteno rastejo navzgor. Tik pod površjem se lažje ohranijo skorjaste oblike, ki si iščejo pot lateralno navzven. Torej bi nahajališča v Rdečem robu bila nekoliko plitvejša od onih v Bohinjskem predelu. V obeh področjih pa se pojavljata fosila *Alpinophragmium perforatum* in *Galeanella panticae*, ki sta tipična predstavnika centralnega grebenskega telesa (glej SENOWBARI–DARYAN 1984).

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Explanation to Plates

All photographs of thin sections are negatives. Thin sections are enlarged directly onto the photographic paper. Photos taken by Carmen Narobe.

PLATE 1

Fig. 1–2. *Gablonzeria profunda* (Reuss 1854)

Locality: Rdeči rob To–12666. Norian–Rhaetian.

1. Transverse section of cerioid colony with polygonal corallites. Thin section P–910b. x 4.
2. Longitudinal section of colony. Thin section P–910c. x 4.

Fig. 3–4. *Cyclophyllia raricorallita* Turnšek 1991

Locality: Rdeči rob To–12666. Norian–Rhaetian.

3. Transverse section of phaceloid corallites with typical wall. Thin section P–905d. x 4.
4. Longitudinal section of two corallites. Note vesicular dissepiments. Thin section P–905b. x 4.

Fig. 5. *Stylophyllum paradoxum* (Frech 1890)

Locality: Bohinj, Bitnje 14215. Upper Norian–Rhaetian.

Transverse section of solitary corallum with thick fibrous septa. Thin section P–896. x 4.

TABLA 1

Sl. 1–2. *Gablonzeria profunda* (Reuss 1854)

Nahajališče: Rdeči rob To–12666. Norij–retij.

1. Prečni presek cerioidne kolonije s poligonalnimi koraliti. Zbrusek P–910b. x 4.
2. Podolžni presek kolonije. Zbrusek P–910c. x 4.

Sl. 3–4. *Cyclophyllia raricorallita* Turnšek 1991

Nahajališče: Rdeči rob To–12666. Norij–retij.

3. Prečni presek faceloidnih koralitov s tipično steno. Zbrusek P–905d. x 4.
4. Podolžni presek dveh koralitov. Vidni so vezikularni disepimenti. Zbrusek P–905b. x 4.

Sl. 5. *Stylophyllum paradoxum* (Frech 1890)

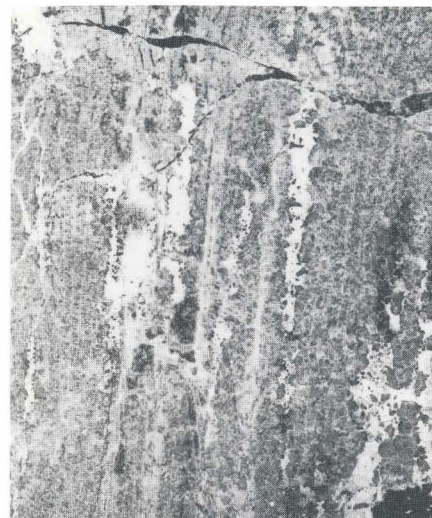
Nahajališče: Bohinj, Bitnje 14215. Zgornji norij–retij.

Prečni presek solitarnega koraluma z debelimi vlaknatimi septi. Zbrusek P–896. x 4.

TABLA – PLATE 1



1



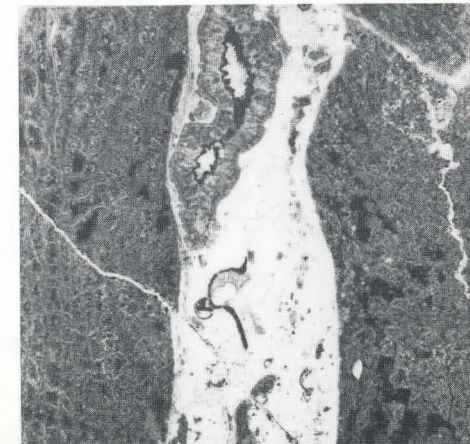
2



3



4



5

PLATE 2

Fig. 1–3. *Chondrocoenia paradoxa* (Melnikova 1975)

Locality: Rdeči rob To–12666. Norian–Rhaetian.

1. Transverse section of subplocoid–cerioid colony. Thin section P–909a. x 4.

2. Vertical section of the same colony. Thin section P–909b. x 4.

3. The same section as Fig. 1., showing costate third cycle septa. x 8.

Fig. 4–5. *Distichophyllia norica* (Frech 1890)

Locality: Bohinj, Bitnje 14144. Upper Norian–Rhaetian.

4. Surface of corallum from above and partly from side. Specimen P–869. x 1.

5. Transverse section of corallum with septa very differentiated. Thin section P–868a. x 4.

TABLA 2

Sl. 1–3. *Chondrocoenia paradoxa* (Melnikova 1975)

Nahajališče: Rdeči rob To–12666. Norij–retij.

1. Prečni presek subplokoidno–cerioidne kolonije. Zbrusek P–909a. x 4.

2. Podolžni presek iste kolonije. Zbrusek P–909b. x 4.

3. Isti presek kot na sl. 1., vidijo se kostatna septa tretjega cikla. x 8.

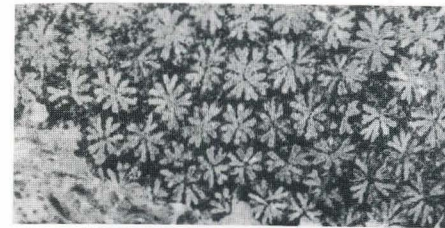
Sl. 4–5. *Distichophyllia norica* (Frech 1890)

Nahajališče: Bohinj, Bitnje 14144. Zgornji norij–retij.

4. Površina koraluma od zgoraj in deloma od strani. Vzorec P–869. x 1.

5. Prečni presek koraluma z zelo diferenciranimi septi. Zbrusek P–868a. x 4.

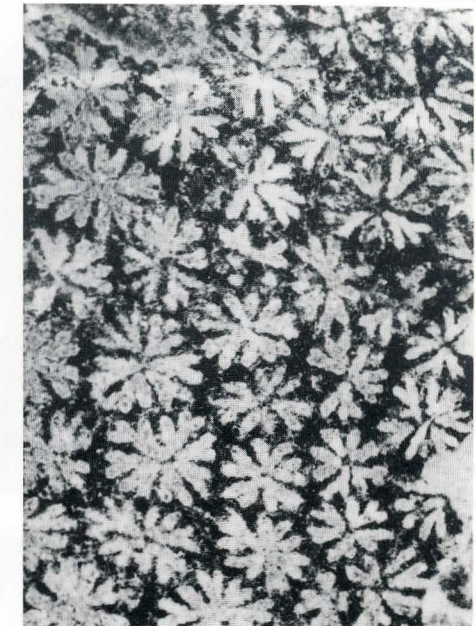
TABLA – PLATE 2



1



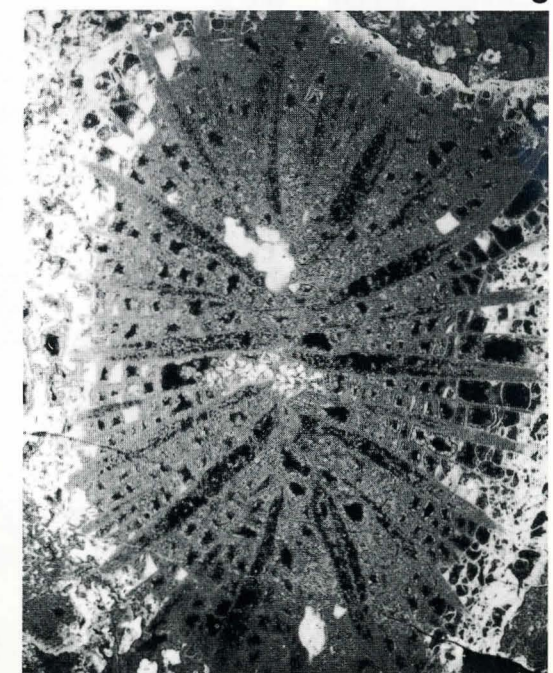
2



3



4



5

PLATE 3

Fig. 1. *Retiophyllia fenestrata* (Reuss 1854)

Locality: Bohinj, Boltarje 14189. Upper Norian–Rhaetian.

Transverse section of phaceloid corallites. Thin section P–889b. x 4.

Fig. 2–3. *Retiophyllia gosaviensis* Roniewicz 1989

Locality: Rdeči rob 12666. Norian–Rhaetian.

2. Transverse section of phaceloid corallites with thin dense septa of equal thickness. Thin section P–907a. x 4.

3. Longitudinal section of one corallite. Note vesicular dissepiments. Thin section P–907b. x 4.

Fig. 4–5. *Retiophyllia paraclathrata* Roniewicz 1974

Locality: Bohinj, Bitnje 14144. Upper Norian–Rhaetian.

4. Surface of phaceloid colony from above. Specimen P–867. x 1.

5. Transverse section of the same colony. Thin section P–867c. x 4.

TABLA 3

Sl. 1. *Retiophyllia fenestrata* (Reuss 1854)

Nahajališče: Bohinj, Boltarje 14189. Zgornji norij–retij. Prečni presek kolonije. Zbrusek P–889b. x4.

Sl. 2–3. *Retiophyllia gosaviensis* Roniewicz 1989

Nahajališče: Rdeči rob 12666. Norij–retij.

2. Prečni presek faceloidnih koralitov s tankimi gostimi septi enake debeline. Zbrusek P–907a. x 4.

3. Podolžni presek enega koralita. Vidni so vezikularni disepimenti. Zbrusek P–907b. x 4.

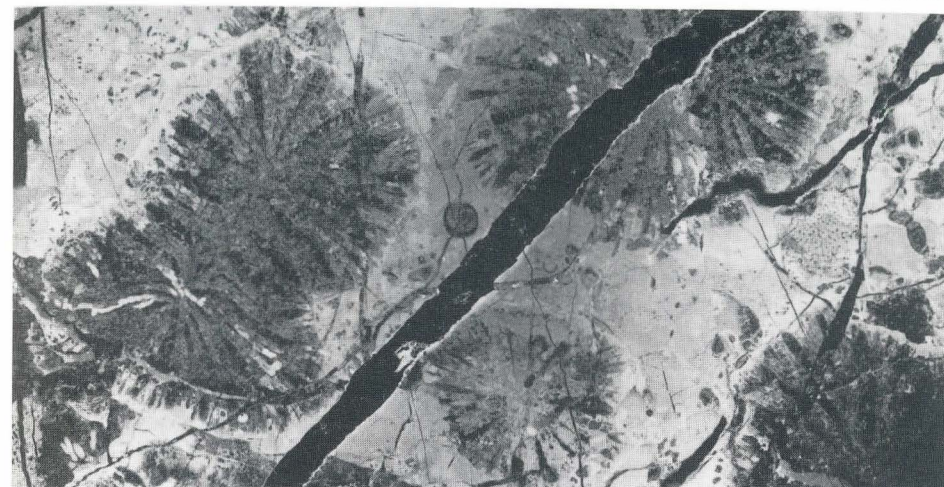
Sl. 4–5. *Retiophyllia paraclathrata* Roniewicz 1974

Nahajališče: Bohinj, Bitnje 14144. Zgornji norij–retij.

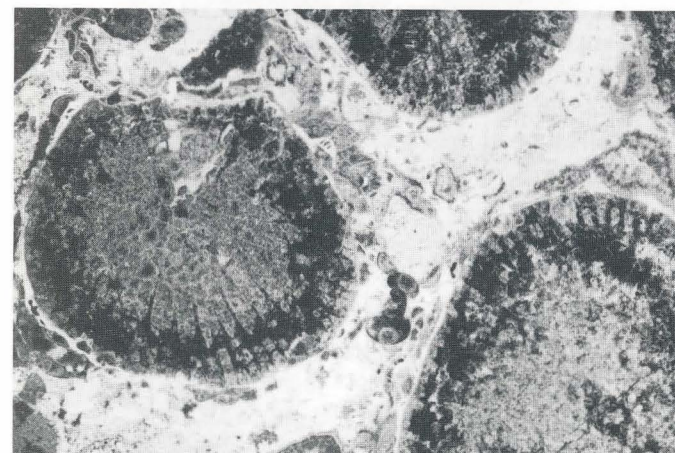
4. Površina faceloidne kolonije od zgoraj. Vzorec P–867. x 1.

5. Prečni presek iste kolonije. Zbrusek P–867c. x 4.

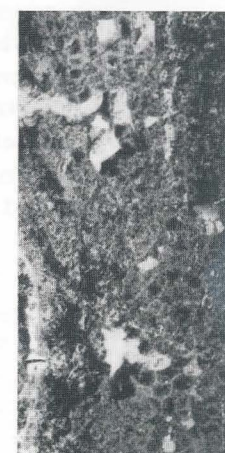
TABLA – PLATE 3



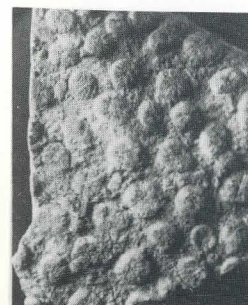
1



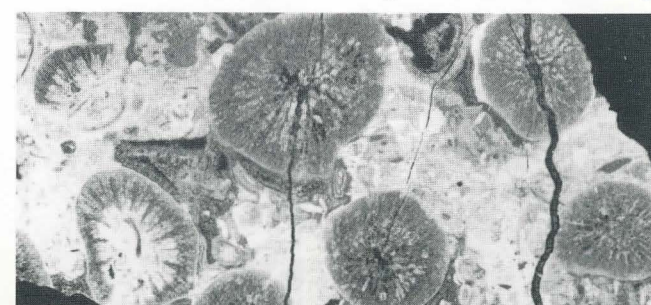
2



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4



5

PLATE 4

Fig. 1–2. *Parathecosmilia langobardica* (Stoppani 1857)

Locality: Rdeči rob 12666. Norian–Rhaetian.

1. Transverse section of phaceloid colony. No wall. Thin section P–914. x 4.

2. Longitudinal section of another colony. Thin section P–908b. x 4.

Fig. 3–4. *Palaeastraea grandissima* (Frech 1890)

Locality: Bohinj, Bitnje 14144. Upper Norian–Rhaetian.

3. Transverse section of massive plocoid colony with large corallites and thick first septa. Endotheca tabulate and vesicular. Thin section P–874b. x 4.

4. Detail from Fig. 3. x 8.

TABLA 4

Sl. 1–2. *Parathecosmilia langobardica* (Stoppani 1857)

Nahajališče: Rdeči rob 12666. Norij–retij.

1. Prečni presek faceloidne kolonije, brez stene. Zbrusek P–914. x 4.

2. Podolžni presek druge kolonije. Zbrusek P–908b. x 4.

Sl. 3–4. *Palaeastraea grandissima* (Frech 1890)

Nahajališče: Bohinj, Bitnje 14144. Zgornji norij–retij.

3. Prečni presek masivne plokoidne kolonije z velikimi koraliti in debelimi septi prvega cikla. Endoteka je tabulatna in vezikularna. Zbrusek P–874b. x 4.

4. Detajl s sl. 3. x 8.

TABLA – PLATE 4

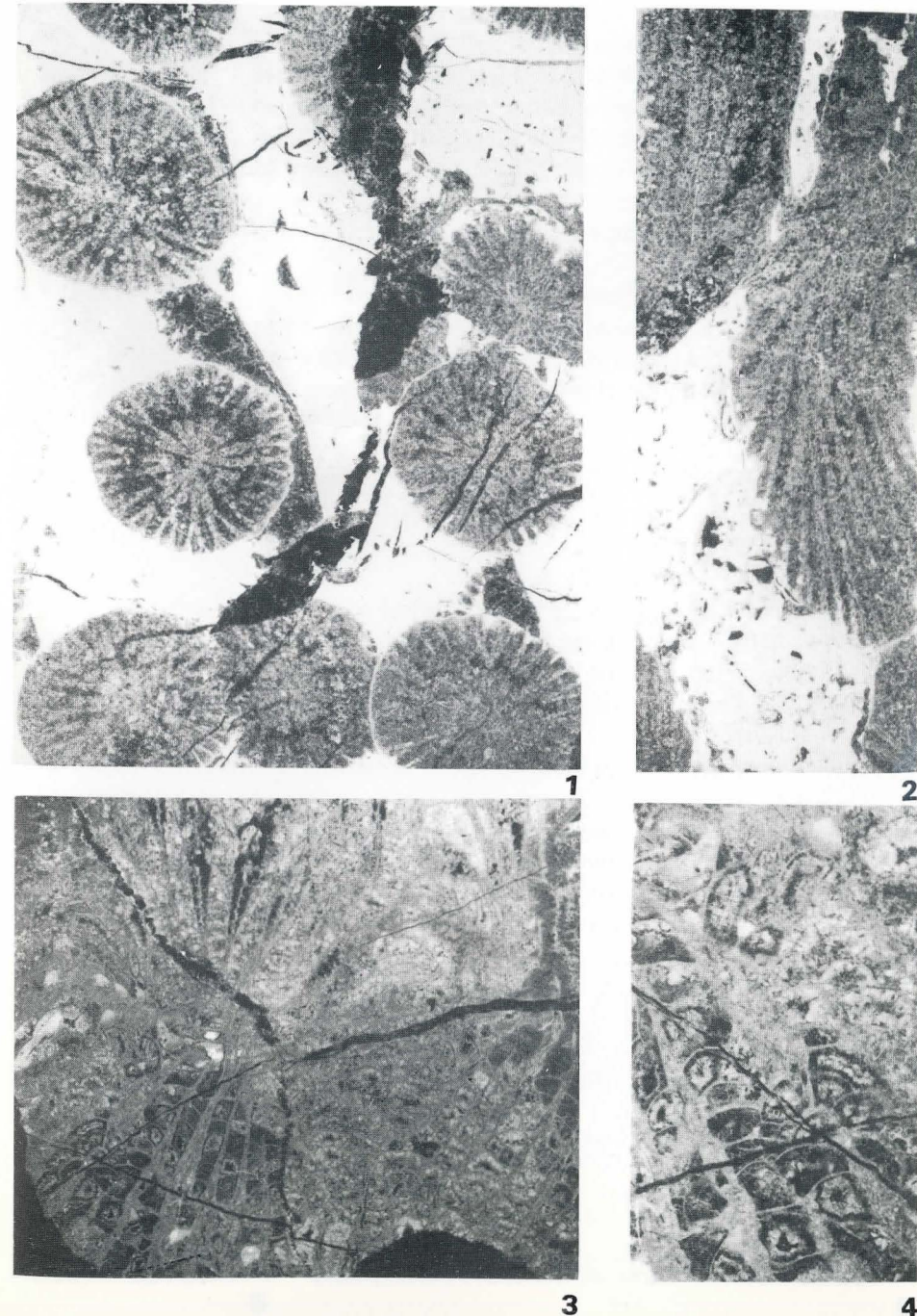


PLATE 5

Fig. 1–4. *Margarosmilia charliana* (Frech 1890)

Locality: Bohinj, Babna gora 14235. Upper Norian–Rhaetian.

1. Surface of the phaceloid colony from above. Specimen P–897. x 1.
2. Transverse section of corallites. Thin section P–898a. x 4.
3. Transverse section of colony from Fig. 1. Septa show lateral dentations. Thin section P–897c. x 4.
4. Longitudinal section of one corallite, showing vesicular dissepiments. Thin section P–898b. x 4.

Fig. 5–6. *Margarosmilia* cf. *M. charliana* (Frech 1890)

Locality: Bohinj, Drenova gora 14184. Upper Norian–Rhaetian

5. Surface of phaceloid colony from above. Specimen P–887. x 1.
6. Transverse section of two corallites from the same colony. Thin section P–887b. x 4.

TABLA 5

Sl. 1–4. *Margarosmilia charliana* (Frech 1890)

Nahajališče: Bohinj, Babna gora 14235. Zgornji norij–retij.

1. Površina faceloidne kolonije od zgoraj. Vzorec P–897. x 1.
2. Prečni presek koralitov. Zbrusek P–898a. x 4.
3. Prečni presek kolonije s sl. 1. Septa kažejo močno lateralno nazobčanost. Zbrusek P–897c. x 4.
4. Podolžni presek enega koralita, vidni so vezikularni disepimenti. Zbrusek P–898b. x 4.

Sl. 5–6. *Margarosmilia* cf. *M. charliana* (Frech 1890)

Nahajališče: Bohinj, Drenova gora 14184. Zgornji norij–retij.

5. Površina faceloidne kolonije od zgoraj. Vzorec P–887. x 1.
6. Prečni presek dveh koralitov iste kolonije. Zbrusek P–887b. x 4.

TABLA – PLATE 5

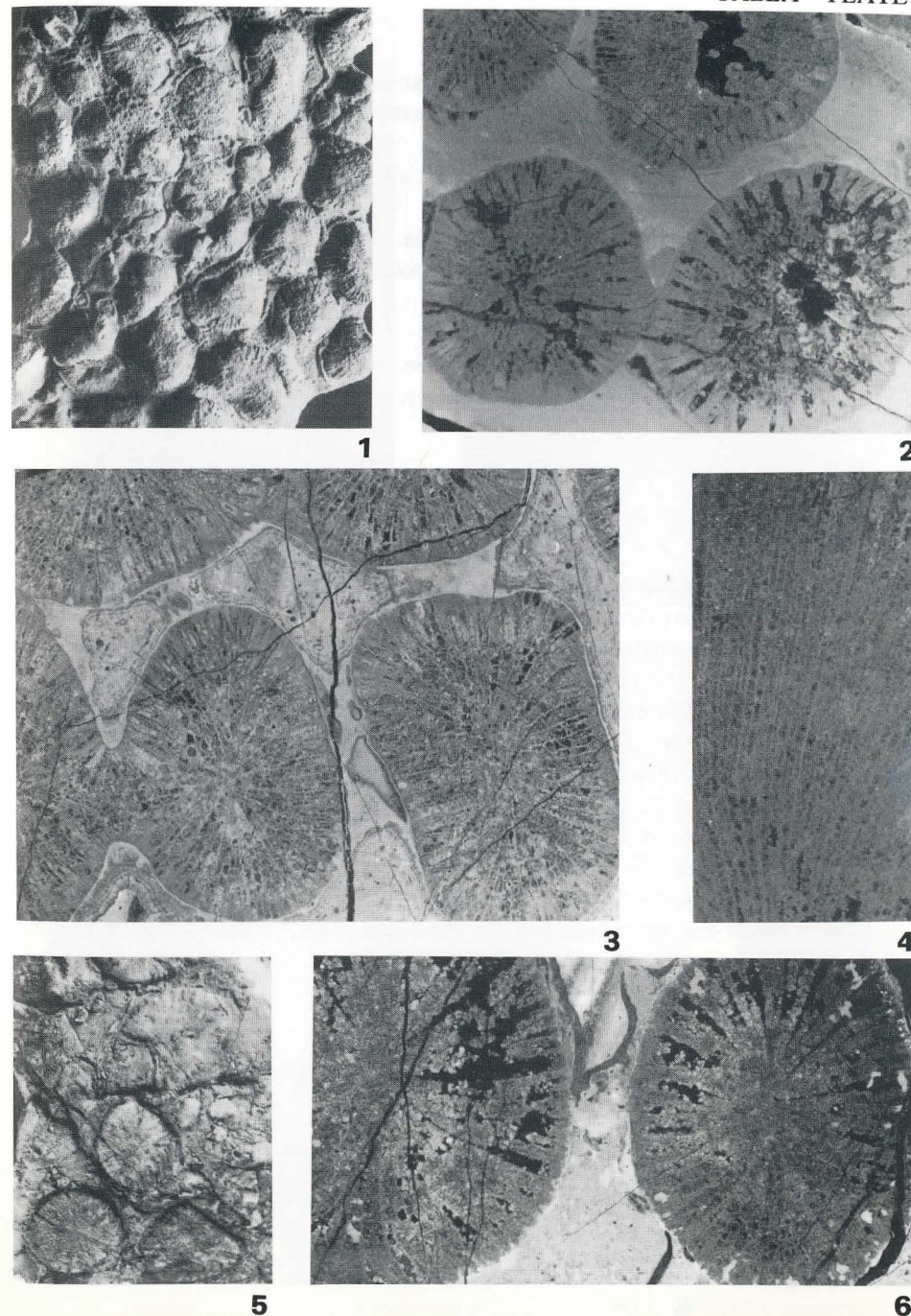


PLATE 6

Fig. 1–2. *Alpinoseris dendroidea* Roniewicz 1989

Locality: Bohinj, Bitnje 14144. Upper Norian–Rhaetian.

1. Transverse section of two leaf-like corallites with thin septa of equal thickness.

Thin section P–872a. x 4.

2. Detail from fig. 1. Note lateral pennulae. x 8.

Fig. 3. *Cuifastraea arthaberi* (Haas 1909)

Locality: Rdeči rob 12666. Norian–Rhaetian.

Transverse section of massive thamnasterioid colony with large corallites and small axial fields. Thin section P–912a. x 4.

Fig. 4. *Astraeomorpha* sp.

Locality: Rdeči rob 12666. Norian–Rhaetian.

Transverse section of massive small colony, poorly preserved. Thin section P–906c. x 4.

TABLA 6

Sl. 1–2. *Alpinoseris dendroidea* Roniewicz 1989

Nahajališče: Bohinj, Bitnje 14144. Zgornji norij–retij.

1. Prečni presek dveh listastih koralitov s tankimi septi enake debeline. Zbrusek P–872a. x 4.

2. Detajl s sl. 1. Vidne so lateralne penule. x 8.

Sl. 3. *Cuifastraea arthaberi* (Haas 1909)

Nahajališče: Rdeči rob 12666. Norij–retij.

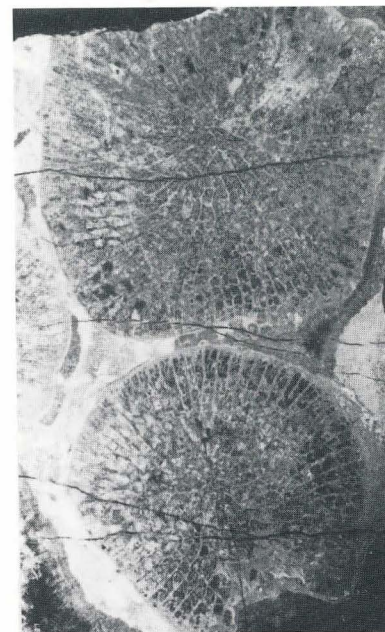
Prečni presek masivne tamnasteridne kolonije z velikimi koraliti in majhnimi aksialnimi polji. Zbrusek P–912a. x 4.

Sl. 4. *Astraeomorpha* sp.

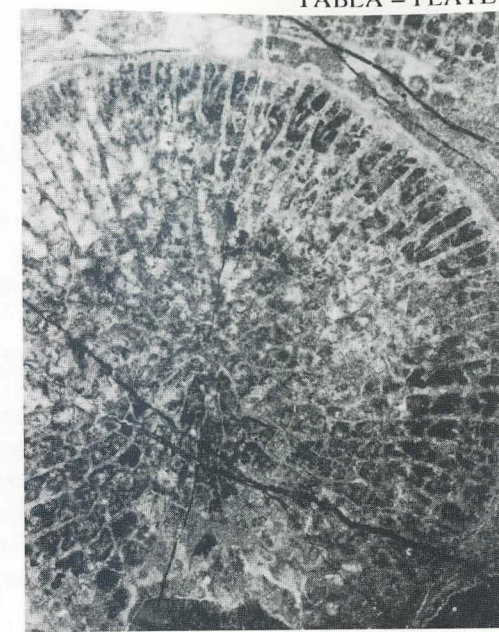
Nahajališče: Rdeči rob 12666. Norij–retij.

Prečni presek masivne majhne kolonije, slabo ohranjene. Zbrusek P–906c. x 4.

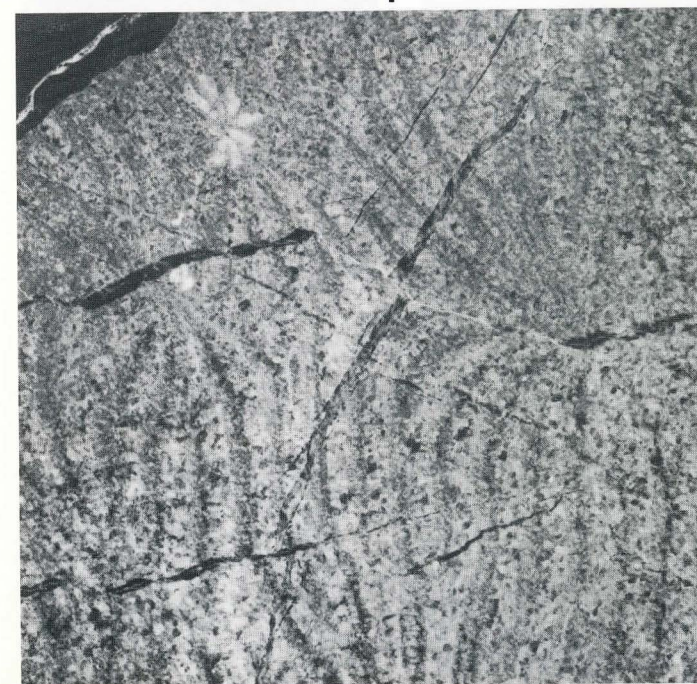
TABLA – PLATE 6



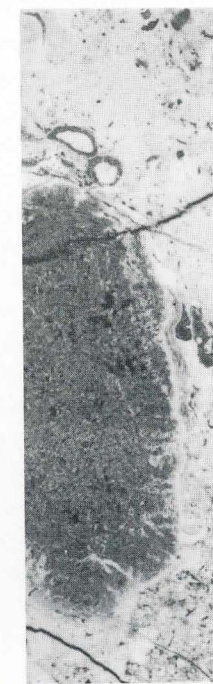
1



2



3



4

PLATE 7

- Fig. 1. *Lamellata wöhneri* Flügel & Sy 1959
Locality: Bohinj, Bitnje 14215. Upper Norian–Rhaetian. Thin section P–895a. x4.
- Fig. 2. *Spongiomorpha acyclica* Frech 1890
Locality: Rdeči rob 12666. Norian–Rhaetian. Thin section P–906b. x 4.
- Fig. 3–4. *Cheilosporites tirolensis* Wöhner 1903
Locality: Bohinj, Bitnje 14144. Upper Norian–Rhaetian.
3. Surface of specimen P–864. x 1.
4. Thin section of the same specimen P–864a. x 4.
- Fig. 5. *Paradeningeria alpina* Senowbari–Daryan & Schäfer 1978
Locality: Bohinj, Bitnje 14144. Upper Norian–Rhaetian. Thin section P–866a. x 4.
- Fig. 6. *Pseudoseptifer aktashi* Boiko 1979
Locality: Bohinj, Bitnje 14144. Upper Norian–Rhaetian. Thin section P–878a. x 4.
- Fig. 7. *Galeanella panticae* Brönnimann & al. 1973
Locality: Bohinj, Bitnje 14144. Upper Norian–Rhaetian. Thin section P–883a. x 15.
- Fig. 8. *Alpinophragmium perforatum* Flügel 1967 (left) and
Microtubus communis Flügel 1964 (right)
Locality: Bohinj, Bitnje 14144. Upper Norian–Rhaetian. Thin section P–877a. x 15.

TABLA 7

- Sl. 1. *Lamellata wöhneri* Flügel & Sy 1959
Nahajališče: Bohinj, Bitnje 14215. Zgornji norij–retij. Zbrusek P–895a. x 4.
- Sl. 2. *Spongiomorpha acyclica* Frech 1890
Nahajališče: Rdeči rob 12666. Norij–retij. Zbrusek P–906b. x 4.
- Sl. 3–4. *Cheilosporites tirolensis* Wöhner 1903
Nahajališče: Bohinj, Bitnje 14144. Zgornji norij–retij.
3. Površina vzorca P–864. x 1.
4. Zbrusek istega vzorca P–864a. x 4.
- Sl. 5. *Paradeningeria alpina* Senowbari–Daryan & Schäfer 1978
Nahajališče: Bohinj, Bitnje 14144. Zgornji norij–retij. Zbrusek P–866a. x 4.
- Sl. 6. *Pseudoseptifer aktashi* Boiko 1979
Nahajališče: Bohinj, Bitnje 14144. Zgornji norij–retij. Zbrusek P–878a. x 4.
- Sl. 7. *Galeanella panticae* Brönnimann & al. 1973
Nahajališče: Bohinj, Bitnje 14144. Zgornji norij–retij. Zbrusek P–883a. x 15.
- Sl. 8. *Alpinophragmium perforatum* Flügel 1967 (levo) in
Microtubus communis Flügel 1964 (desno)
Nahajališče: Bohinj, Bitnje 14144. Zgornji norij–retij. Zbrusek P–877a. x 15.

TABLA – PLATE 7

