RAZPRAVE IV. RAZREDA SAZU | XXVIII | 2 | 27—67 | Fig. 5 | Pl. 16 | LJUBLJANA 1987

UPPER TRIASSIC (NORIAN-RHAETIAN) REEF BUILDUPS IN THE NORTHERN JULIAN ALPS (NW YUGOSLAVIA)

ZGORNJETRIASNE (NORIJSKO-RETIJSKE) GREBENSKE TVORBE V SEVERNIH JULIJSKIH ALPAH,

DRAGICA TURNŠEK, ANTON RAMOVŠ

IZVLEČEK UDK 551.761.3(234.323.6-17)

Zgornjetriasne (norijsko-retijske) grebenske tvorbe v severnih Julijskih Alpah

V norijsko-retijski dobi so nastajali na ozemlju severnih Julijskih Alp na karbonatni platformi skladnati dachsteinski apnenci in grebenski dachsteinski apnenci. Podrobno se obdelani grebenski fosili iz nahajališč Dovški križ, Šplevta, Kopice, Tominškova pot, Rušnata Mlinarica in Kot. Prevladujejo korale (23 vrst), manj je spongij, hidrozojev, alg, mikroproblematik in drugih organizmov. Dve koralni vrsti sta novi. Ugotovljene so različne fosilne združbe, ki se ločijo med seboj predvsem po starosti (spodnji norij, zgornji norij-retij), deloma pa imajo tudi različne paleoekološke značilnosti.

ABSTRACT UDC 551.761.3(234.323.6—17)

Upper Triassic (Norian-Rhaetian) Reef Buildups in the Northern Julian Alps (NW Yugoslavia)

During the Norian-Rhaetian times in the territory of northern Julian Alps on the carbonate platform bedded Dachstein limestones and reef Dachstein limestones were formed. The reef fossils from localities Dovški križ, Šplevta, Kopice, Tominškova pot, Rušnata Mlinarica and Kot were investigated in detail. Prevail corals (23 species), less frequent are sponges, hydrozoans, algae, microproblematica and other organisms. Two coral species are new. Distinct fossil assemblages were determined. They are distinguished principally by age (Lower Norian, Upper Norian-Rhaetian), and partly by various paleoecological characteristics.

Address — Naslov

Dr. Dragica TURNŠEK
Paleontološki inštitut Ivana Rakovca ZRC SAZU
61001 Ljubljana, Novi trg 5, pp. 323, Jugoslavija

Prof. dr. Anton RAMOVŠ
Katedra za geologijo in paleontologijo FNT
Univerza Edvarda Kardelja
61000 Ljubljana, Aškerčeva 12, Jugoslavija

INTRODUCTION

In the present treatise the results of the systematical investigation of Norian-Rhaetian reef buildups in the northern Julian Alps, i.e. on the Julian carbonate platform, are presented. Considered were organisms which build up reefs, fossil communities, and facies types in them. Up to now in Slovenia such studies of the youngest Triassic have not been performed.

In the period of six years of terrain investigations (from 1977 to 1983) of the biostratigraphy of Triassic beds in the northern Julian Alps A. RAMOVŠ systematically mapped the Dachstein reef development which is a continuation of the Lower Carnian and Julian-Tuvalian beds. He investigated facies developments and faunistic associations of the period and collected an abundance of various fossils and diverse lithological samples for paleontological, facies and sedimentological analyses. D. TURNŠEK determined and described fossils from reefs wich include primarily corals, hydrozoans, chaetetids and sponges, and also several foraminifers, microproblematica and calcareous algae.

All described fossils and other samples are kept in the paleontological collection of the Chair of Geology and Paleontology of the University Edvard Kardelj in Ljubljana.

ACKNOWLEDGEMENTS: The research was supported by the Research Community of Slovenia, the Technical Museum of the Jesenice Ironworks and the Community for Culture of the Jesenice Municipality.

The thin sections were made by KATA CVETKO and RENATO VIDRIH, photographs by CARMEN NAROBE and MARJAN GRM, graphics and plates by MILOJKA HUZJAN. The collection of fossil corals was inspected by EWA RONIEWICZ who also contributed useful suggestions. The text was translated into English by SIMON PIRC.

Warmest thanks are extended to all by the authors.

REVIEW OF PREVIOUS WORK

Among the investigators of the Julian Alps no one investigated in more detail the Upper Triassic Norian and Rhaetian beds and their fossil content; besides the bedded Dachstein limestone some of them mentioned also the reef limestone.

PETERS (1856, 685) discovered in the steep slopes of Cmir towards Vrata megalodontid lamellibranchs, and he compared the beds with the Kössen beds of the Northern Calcareous Alps.

DIENER (1884, 679—680) established in the area of Vrata and Kot, Špik, Frdamane police and Riglica a continuous passage of the reef development throughout the Carnian stage high into the Dachstein limestone. He mentioned in the western side of Vrata the bedded Dachstein limestone, and in freely lying blocks of dolomite at the foot of Cmir characteristic fossils of the Main dolomite.

In Krnica below Špik TELLER (1910, 181) found blocks of white limestone with remains of the brachiopod genus *Koninckina* which is characteristic for the boundary between the »Raibl« beds and the Dachstein limestone. Above the »Schlern« dolomite follows immediately well bedded Dachstein limestone which is overlain by non bedded reef limestone mass on the summit of Kukova špica and in the neighboring Triglav region. On TELLER'S geological map the top of the »Schlern« dolomite and of its limestone equivalents are overlain by Main dolomite and by Dachstein limestone.

SEIDL (1929, 17—20) was convinced that the 1200 m thick bedded limestone of the Triglav north wall is overlain by almost 450 m of non bedded dolomitized limestone, and that thus the Dachstein group attains its total thickness of 1650 m. In the bedded limestone of the Triglav summit SEIDL mentioned corals which, however, were not determined. He introduced for this massive limestone into the Slovenian geological literature the term Triglav limestone.

RAKOVEC (1933, 240) summarized the findings of earlier investigators and stated that in the Julian Alps the Main dolomite occurs with associated Dachstein limestone; all higher peaks consist of this limestone. In the Triglav mountain range the Triglav north wall consists of bedded limestone which attains a thickness of 1200 m, and is overlain by non bedded dolomitized limestone which builds up the summit of Triglav, so that the entire complex of the Dachstein limestone attains the thickness of 1650 m.

Later RAKOVEC (1951, 122—123) wrote that in the eastern Julian Alps the Main dolomite disappears, so that the entire Norian stage is represented only by Dachstein limestone of which the main part of the surface of the Triglav range consists. Further RAKOVEC mentioned that the Dachstein limestones in the eastern Julian Alps attain their maximal thickness, measuring in Krma 1300 to 1400 m, and in the Triglav north wall together with the non bedded limestone up to 1650 m.

RAMOVŠ (1986 a) established that the Triglav summit and neighboring peaks do not consist of the reef Dachstein limestone, but that they are a part of the nappe of the Lower Carnian reef limestone. Špik, Frdamane police, Rigljica and Prisojnik are also built of Lower Carnian limestone (RAMOVŠ & TURNŠEK 1984, 169), and the reef development does not pass through the Carnian stage continuously high into the Dachstein limestone, as presumed by DIENER. During the recent investigations in the northern Julian Alps also the Carnian-Rhaetian boundary was paleontologically established (RAMOVŠ 1986 b). In addition, the development of the Upper Triassic (Norian-Rhaetian) in the northern Julian Alps was systematically presented (RAMOVŠ 1985, 417—422; 1986 a, 99—112).

DISTRIBUTION OF THE NORIAN-RHAETIAN BUILDUPS BETWEEN DOVŠKI KRIŽ AND MACESNOVEC

All reef limestones, which were attributed by earlier investigators to Norian and Rhaetian, are of Carnian age.

Norian-Rhaetian reef buildups occur in two distinct areas. The first area lies in the Martuljek mountain group, including the massifs of the Dovški križ

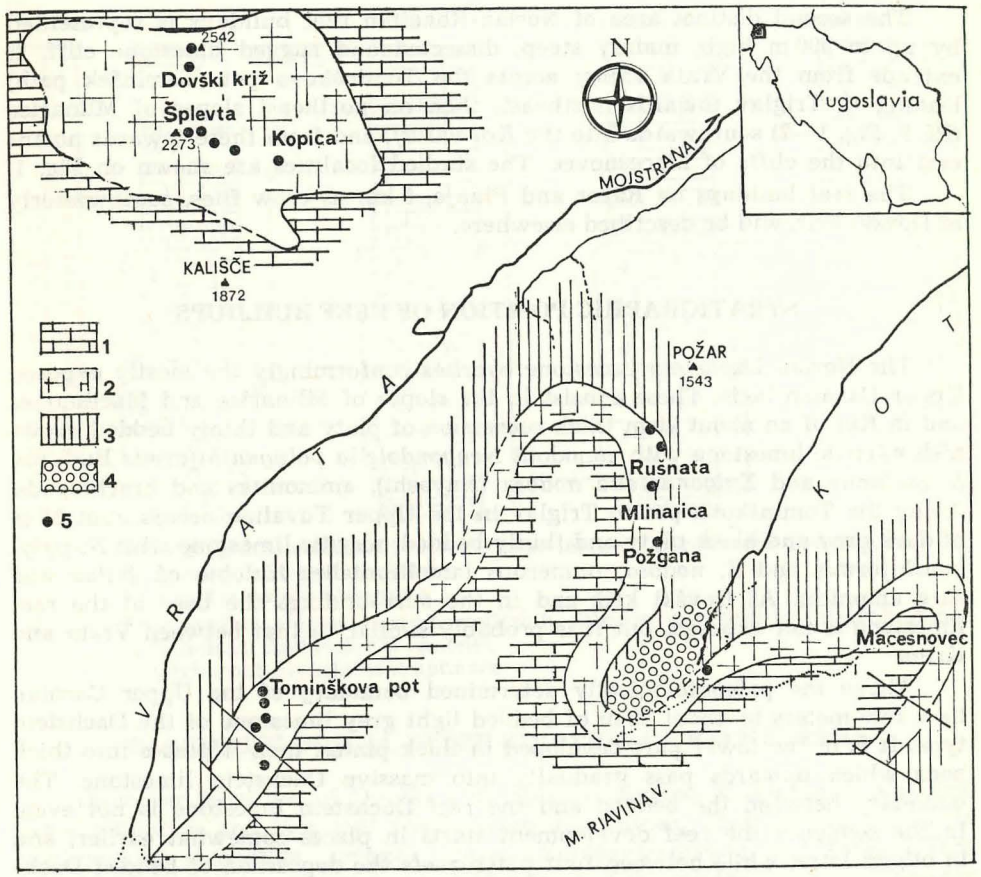


Fig. 1. Distribution of Norian-Rhaetian reef limestones in northern Julian Alps
1. Bedded Dachstein limestone
2. Reef Dachstein limestone. Between Vrata and Macesnovec occur in it a few meters of bedded Dachstein limestone which starts the Norian stage (compare Fig. 2)

Sl. 1. Razširjenost norijsko-retijskih grebenskih apnencev v severnih Julijskih Alpah
1. Skladnati dachsteinski apnenec
2. Grebenski dachsteinski apnenec. Med Vrati in Macesnovcem je vanj vključenih tudi nekaj metrov skladnatega dachsteiskega apnenca, ki začenja norijsko stopnjo. (Primerjaj sl. 2)

(2542 m, Pl. 1, Fig. 1), Šplevta (2273 m), Kopice, Oltarji (Pl. 1, Fig. 2), Visoki Rokav and a part of Ponce. The biolithite facies here laterally passes into bedded Dachstein limestone. Somewhat more to the west appears in the upper part of the entire Norian-Rhaetian development the tendency towards reef building, but reefs here do not attain appreciable thicknesses.

The second distinct area of Norian-Rhaetian reef buildups is represented by up to 300 m high, mainly steep, dissected and rugged limestone cliff. It extends from the Vrata valley across the Tominškova pot (Tominšek path) leading to Triglav towards northeast, then on northeast slopes of Mlinarice (Pl. 2, Fig. 1—2) southwards into the Kot valley, and from there towards northeast into the cliffs of Macesnovec. The studied localities are shown on Fig. 1.

The reef buildups on Razor and Planja, 5 km as crow flies, southwesterly of Dovški križ, will be described elsewhere.

STRATIGRAPHIC POSITION OF REEF BUILDUPS

The Norian Dachstein limestone overlies conformingly the mostly exposed Upper Carnian beds. These consist in the slopes of Mlinarice and Macesnovec and in Kot of an about 20 m thick succession of platy and thinly bedded brownish micritic limestone with conodont *Neogondolella polygnathiformis* Budurov & Stefanov and *Epigondolella nodosa* (Hayashi), ammonites and brachiopods. Along the Tominškova pot to Triglav in the Upper Tuvalian occurs abut 85 m of dark grey and black platy and thinly bedded micritic limestone with *N. polygnathiformis* and *E. nodosa,* numerous lamellibraches *Halobia* cf. *fallax* and rare amonites. At Dovški križ and in the surroundings the base of the reef limestone is not exposed, but it is probably similar to that between Vrata and Krma.

Above the paleontologically determined boundary of the Upper Carnian lie a few meters to about 20 m of bedded light grey limestone of the Dachstein type. It is in the lower part developed in thick plates, then it passes into thick beds which upwards pass gradually into massive Dachstein limestone. The boundary between the bedded and the reef Dachstein limestone is not even. In the sequence the reef development starts in places somewhat earlier, and in others later, while between first patch reefs the deposition of bedded Dachstein limestone still persisted.

Between the valleys of Vrata and Krma the reef Dachstein limestone extends from Prag in Vrata across the Tominškova pot, across Mlinarice to Kot, and then into the cliffs of Macesnovec. It is about 250 to 300 m thick. Already in the beginning of the Middle Norian the biolithitic facies was interrupted, and only the deposition of bedded Dachstein limestone continued until the termination of Triassic.

On Dovški križ and in the surroundings the reef deposition started approximately at the same time as in the area between Vrata and Krma, which is indicated by Upper Tuvalian limestone of the Hallstatt type on Kukova špica. This reef sedimentation continued probably without any important interruption until the end of the Triassic period, since above the reef limestone nonwhere the bedded Dachstein limestone appears. The Norian-Rhaetian reef limestone attains here its maximum thickness, up to 1000 m, representing the thickest reef development of these time in the Julian Alps and in Slovenia. Comparison of all successions see in Fig. 2.

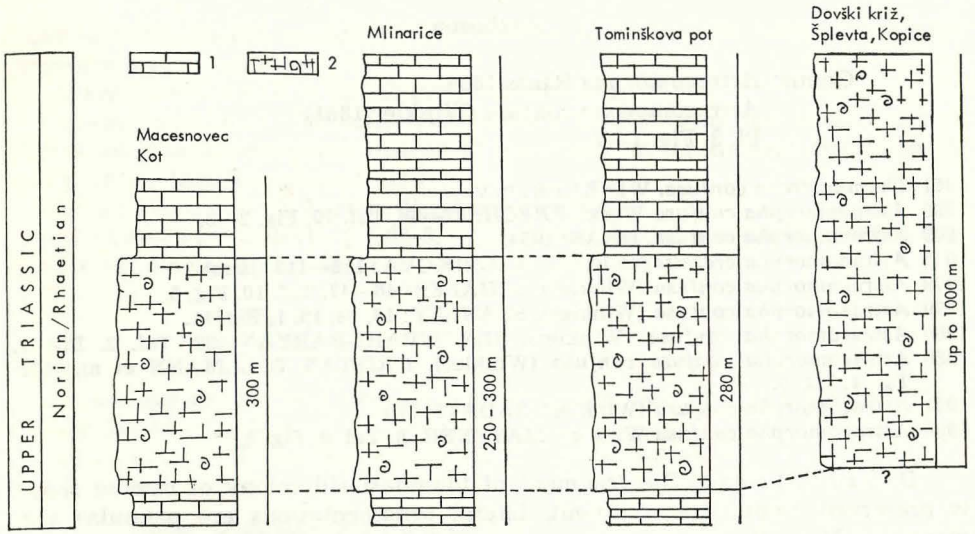


Fig. 2. Stratigraphical column of Norian-Rhaetian beds in northern Julian Alps
1. Bedded Dachstein limestone
2. Reef Dachstein limestone

Sl. 2. Stratigrafski stolpec norijsko-retijskih skladov v severnih Julijskih Alpah
1. Skladnati dachsteinski apnenec
2. Grebenski dachsteinski apnenec

PALEONTOLOGICAL DETERMINATION OF REEF FOSSILS

From the localities of Dovški križ, Šplevta, Kopice, Tominškova pot, Rušnata Mlinarica and Kot reef fossils were determined. They belong to corals, hydrozoans, chaetetids, sponges, algae, microproblematica and foraminifers.

Corals belong to 23 species and 16 genera. Two species are new. They are cited in alphabetical order of genera.

Synonymies with short description, comparisons and distribution of species are presented. Corals belong to suborders Pachythecalina, Archaeocoeniina, Faviina, Fungiina, Stylophyllina, and others, i.e. to almost all known suborders of this time. Final systematics will be presented after accomplished investigation of all Triassic corals from Slovenia, to enable a more complete comparison. In description international abbreviations of skeletal elements are used, as d = diameter of the corallite or corallum, s = number of septa.

Along with corals in reefs were determined and presented 3 species of hydrozoans, 1 of chaetetids, 6 species of sponges, 2 species of algae of solenoporid type, 2 species of microproblematica and *Alpinophragmium.* Also with these fossils synonymy is given, or at least detailed documentation of locations.

Defined were also rare dasycladaceans, small foraminifers, and snails, lamellibranchs, cephalopods, crinoids, although these fossils were not investigated into more detail. No specimens of *Tubiphytes* and *Microtubus,* which are quite frequent in reefs elsewhere, were found here.

Anthozoa

Genus: *Astraeomorpha* Reuss 1854
Astraeomorpha confusa (Winkler 1861)
Pl. 3, Fig. 1—2

1861 *Thamnastraea confusa.* WINKLER: n. v.
1890 *Astraeomorpha confusa* Winkl. *FRECH:* 67—68, Taf. 19, Fig. 2—3.
1909 *Astraeomorpha confusa.* HAAS: 1954.
1975 *Astraeomorpha crassisepta* Reuss. MELNIKOVA: 116—117 (pars).
1979 *Astraeomorpha confusa* (Winkler). SCHÄFER: 46—47, Taf. 10, Fig, 3.
1979 *Astraeomorpha confusa* (Winkler). STANLEY: 13, 24, Pl. 1, Fig. 11.
1980 *Astraeomorpha confusa* (Winkler). SENOWBARI-DARYAN: 38, Taf. 2, Fig. 1.
1980 *Astraeomorpha confusa confusa* (Winkler). KRISTAN-TOLLMANN et al.: 171, Taf. 4, Fig. 3.
1981 *Astraeomorpha confusa* (Winkler). SADATI: 199.
1986 *Astraeomorpha confusa* Winkler. MATZNER: 9, Taf. 9, Fig. 2.

Description: The fragment of thamnasterid colony of ramose shape is preserved. Septa are confluent, lateral ornamentations are pennulae and menianae. No wall, dissepiments are rare. Columella is styliform. Microstructure is not preserved.

Dimensions: d = 1.5—2 mm, s = ca 12.

Comparison: MELNIKOVA (1975, 116) the species *A. confusa* ascribed as synonymus to *A. crassisepta.* But the last one is larger (d = 2—3 mm).

Distribution: Norian-Rhaetian of Austrian Alps and Pamir, Rhaetian of Iran, Norian of Nevada.

Material: Šplevta (25/85-A 4 b), Upper Norian-Rhaetian.

Genus: *Craspedophyllia* Volz 1896
Craspedophyllia sp.
Pl. 4, Fig. 1

Small solitary coral with septa of more cycles, ornamented with menianae, and strong columella. Endotheca of thin rare dissepiments. Microstructure is not definable.

Dimensions: d= ca 5—6 mm, s = 30—40.

Material: Rušnata Mlinarica (15/82-3), Lower Norian.

Genus: *Cuifia* Melnikova 1975
Cuifia elliptica Melnikova 1975
Pl. 4, Fig. 3—4

1975 *Cuifia elliptica* sp. nov. MELNIKOVA: 84—85, Tab. 14, Fig. 3—4.

Description: Our specimens are large solitary turbinate corals, a little oval, with septa of 5—6 cycles, the first three being very thick. The wall is septotheca and in some places epitheca is preserved. Dissepiments are vesicular and lonsdaleoid, especially numerous in periphery. No columella, microstructure is not preserved.

Dimensions: d = 22—40 mm, s = 130—200.

Comparison: MELNIKOVA differs *Cuifia* from the similar genus *Distichophyllia* in septotheca instead of paratheca, in lonsdaleoid dissepiments, and in »fibro-lamellar microstructure«.

Distribution: Norian-Rhaetian of Pamir.

Material: Šplevta (25/85-5, -A 1), Tominškova pot (34/82, 5/85, 9/85); Kot (26/85), Norian-Rhaetian.

Cuifia sp.
Pl. 4, Fig. 2

Some specimens have the Cuifian structure but they are smaller than *C. elliptica,* (d = ca 15 mm).

Material: Tominškova pot (33/82-2), Lower Norian.

Genus: *Cyathocoenia* Duncan 1868
Cyathocoenia juvavica (Frech 1890)
Pl. 3, Fig. 3—4

1890 *Stephanocoenia juvavica* nov. sp. FRECH: 38—39, 2 Text-fig.
1968 *Cyathocoenia schafhäutli* (Winkler). MELNIKOVA: 14—16 (pars).
1975 *Cyathocoenia schafhäutli* (Winkler). MELNIKOVA: 59—61 (pars).
1979 *Actinastraea juvavica* (Frech). SCHÄFER: 47, Taf. 11, Fig. 6.
1979 *Actinastraea juvavica* (Frech). STANLEY: 13, 38, Pl. 1, Fig. 7.
1980 *Actinastraea juvavica* (Frech). SENOWBARI-DARYAN: 42, Taf. 5, Fig. 3.

Description: Description and revision were made by MELNIKOVA (1968, 1975). Our specimen is large massive cerioid to subplocoid colony, with roundish to oval or even polygonal corallites. Septa are costate and join with neighboring septa. Wall is septotheca. The axial ends of younger cycles form inner ring. Columella iz trabecular, microstructure is not preserved.

Dimensions: d = 1.5—2.5 mm, s = ca 20.

Comparison: *C. schafhäutli* has more septa (24—37), *Actinastraea* is consistently cerioid.

Distribution: Norian-Rhaetian of Austrian Alps and Pamir.

Material: Rušnata Mlinarica (15/82-4, 16/85-3), Lower Norian.

Genus: *Distichophyllia* Cuif 1974
Distichophyllia gosaviensis (Frech 1890)
Pl. 4, Fig. 5—6

1890 *Montlivaltia gosaviensis* nov. sp. FRECH: 41, Taf. 11, Fig. 7.
1975 *Reimaniphyllia gosaviensis* (Frech). MELNIKOVA: 87—89, Taf. 15, Fig. 1—2.

Description: Modern description and revision of the genus were given by CUIF (1974, 304—318). Our specimens are solitary corals with round calice. Septa in 5—6 cycles are thicker in first three ones. They have more dents

in axial part. The wall is parathecal. Dissepiments are tabulate and vesicular. Microstructure has axial line.

Dimensions: d = 15—22 mm, s = ca 96.

Remarks: Genus *Reimaniphyllia* Melnikova 1975 is a younger synonymus of *Distichophyllia* Cuif.

Distribution: Norian-Rhaetian of Austrian Alps and Pamir.

Material: Rušnata Mlinarica (18/85), Tominškova pot (5/85), and Šplevta (25/85-A 1, -A 3), Norian-Rhaetian.

Genus: *Elysastraea* Laube 1864
Elysastraea juliana n. sp.
Pl. 5, Fig. 1—4; Pl. 6. Fig. 1—2

Name: After Julian Alps
Holotypus: Specimen 61/81-1
Locus typicus: Kopice
Age: Lower Norian
Material: Two fragments of colonies, 4 thin sections.
Diagnosis: Elysastraea of cerioid-phaceloid-meandroid corallites and dimensions d = 3—4 mm, s = 20—30.

Description: Colony is cerioid-phaceloid-meandroid. Corallites are mono- to polycentric, with thick septotheca. Septa are developed in more cycles and differ in thickness. They are laterally dentate. No columella, multiplication with division: two opposite septa become thicker, they join forming new theca and dividing corallite. Endotheca is tabulate. Microstructure is not definable.

Comparison: In revision of the genus *Elysastraea,* CUIF (1976, 118—121) pointed out, that at the type species of *E. fischeri* Laube phaceloid appearance is emphasized. Our specimens differ from the type in smaller corallites (d of *E. fischeri* is 4—5 mm), and thinner septa of young cycles. In septal structure it approaches to *Stuoresia* Cuif 1976 which is completely cerioid. Our new species joins some characteristics of *Elysastraea* and *Stuoresia,* in phaceloid appearance even *Retiophyllia.*

Distribution: *E. fischeri* has been found in Cassian beds of Dolomites in Italy (Volz 1890). *Elysastraea* sp. was mentioned by RONIEWICZ (1974) in Rhaetian of Tatre Mts., nevertheless, this specimen is cerioid-plocoid.

Material: Kopice (61/81-1, -2), Lower Norian.

Genus: *Gillastraea* Melnikova 1983
Gillastraea delicata Melnikova 1983
Pl. 6, Fig. 3—4

1983 *Gillastraea delicata* sp. nov. MELNIKOVA: 52, Tab. 4, Fig. 1.

Description: Our specimen is phaceloid colony with cylindrical corallites. Septa are porous, thin, numerous, ornamented by pennulae and menianae. Synapticulae and dissepiments are rare. Columella seems to be trabecular.

Dimensions: d = 5—9 mm, s = ca 120.

Distribution: Upper Norian of Pamir.

Material: Šplevta (25/85-A 3 a, d), Upper Norian-Rhaetian.

Genus: *Margarosmilia* Volz 1896
? *Margarosmilia* sp.
Pl. 6, Fig. 5

Specimens of phaceloid colonies have characteristics of genus *Margarosmilia* Volz 1896 (cf. RAMOVŠ & TURNŠEK 1984, 176, Pl. 5, Fig. 3). Species is indeterminable.

Material: Rušnata Mlinarica (15/82-5), Kot (16/85-2) Lower Norian.

Genus: *Pachydendron* Cuif 1975
Pachydendron microthallos Cuif 1975
Pl. 7, Fig. 1—2

1975 *Pachydendron microthallos* n. sp. CUIF: 172, Text-fig. 7 a, b, c.
1977 *Pachydendron microthallos* Cuif. CUIF: 32, 37, Pl. 9, Fig. 3—6; Pl. 10, Fig. 3.

Description was given by CUIF. Our specimen is branched colony with round corallites. Wall is thick epitheca, septa in irregular system of cycles, sometimes the first septum larger, sometimes 4—5 first septa of equal size. Ornamentations are corns. Tabulate dissepiments are common, microstructure has axial line. No columella.

Dimensions: d = 2—4 mm, s = ca 10—12.

Distribution: Norian of Turqey.

Material: Šplevta (25/85-5), Upper Norian-Rhaetian.

Genus: *Paradistichophyllum* Melnikova 1975
Paradistichophyllum noricum (Frech 1890)
Pl. 7, Fig. 3—4

1890 *Thecosmilia norica* nov. sp. FRECH: 9, Taf. 1, Fig. 14—24, Taf. 10, Fig. 6.
1909 *Thecosmilia norica* Frech. HAAS: 144.
1915 *Thecosmilia norica* Frech. VINASSA de REGNY: 87, Tav. 21, Fig. 18.
1975 *Paradistichophyllum noricum* (Frech). MELNIKOVA: 90—91, Tab. 15, Fig. 3—4.
1979 »*Thecosmilia*« *norica* Frech. STANLEY: 13, 32, 38.
1980 *Thecosmilia norica* Frech. KRISTAN-TOLLMANN et el.: 174, Tav. 4, Fig. 2, 4.
1980 »*Thecosmilia*« *norica* Frech. SENOWBARI-DARYAN: 35.

Description was given by MELNIKOVA. Our specimen is phaceloid colony with round corallites. Septa are compact in 4—5 cycles, lateral dentations are rare. The wall is paratheca. Dissepiments are numerous, vesicular and long, especially in peripheral parts of corallites. Microstructure is not preserved.

Dimensions: d = 8—13 mm, s = ca 40 + s.

Comparison: Our specimen is a little smaller then those of MELNIKOVA, but FRECH, too, measured some specimens smaller than 10 mm.

Paradistichophyllum differs from *Retiophyllia* Cuif 1966 in paratheca and smoother septa, from *Parathecosmilia* Roniewicz 1974 in more abundant vesicular endotheca.

Distribution: Norian-Rhaetian of Austrian Alps, Pamir and Timor, Norian of north-western Amerika and Rhaetian of Iran.

Material: Tominškova pot (14/85), Lower Norian.

Paradistichophyllum sp.
Pl. 7, Fig. 5

Some specimens have paradistichophyllid structure, and differ from *P. noricum* in smaller corallites (d = 5—7 mm), but more septa (s = ca 48 + s).

Material: Rušnata Mlinarica (15/82-9, 16/8 -2), Kot (26/82-2), Lower Norian.

Genus: *Parathecosmilia* Roniewicz 1974
Parathecosmilia langobardica (Stoppani 1857)
Pl. 8, Fig. 1—2

1857 *Prionastraea langobardica* Stopp. STOPPANI: n. v.
1865 *Rhabdophyllia langobardica* Stopp. STOPPANI: 105, Pl. 23, Fig. 1—5.

Description: Phaceloid colony has roundish corallites. Septa are compact in 4—5 cycles, equally thick, they differ in length. In axial part dentate. No columella. Dissepiments are condensed in more levels. The wall is incomplete paratheca, somewhere epitheca. Microstructure is not preserved.

Dimensions: d = 6—7 mm, s = 40—70.

Distribution: Rhaetian of Lombardia, Italy.

Material: Dovški križ (59/81-3 a), Rhaetian.

Parathecosmilia sellae (Stoppani 1862)
Pl. 8, Fig. 3—5

1862 *Rhabdophyllia sellae* Stoppani. STOPPANI: 107, Pl. 25.
1890 *Thecosmilia sellae* Stoppani. FRECH: 17, Pl. 4, Fig. 12.
1974 *Parathecosmilia sellae* (Stoppani). RONIEWICZ: 110—111, Pl. 6, Fig. 1—3, Pl. 7, Fig. 1—2, Text-fig. 9—10.

Description: Modern description and revision were made by RONIEWICZ. Our specimens are phaceloid colonies with many corallites. Septa are compact, in 4 cycles, dentate in axial part. The wall is paratheca, somewhere epitheca. No columella. Dissepiments are tabulate and vesicular.

Dimensions: d = 3—4 mm, s = 48.

Distribution: Rhaetian of Austrian Alps and Tatre Mts.

Material: Šplevta (25/85-2 a, -7 a, -A 2 ab), Upper Norian-Rhaetian.

Genus: *Phacelostylophyllum* Melnikova 1972
Phacelostylophyllum pygmaeum (Frech 1890)
Pl. 9, Fig. 1

1890 *Stylophyllum pygmaeum* nov. sp. FRECH: 56—57, 4 Text-fig.
1972 *Stylophyllum pygmaeum* Frech. CUIF: 232—236, Fig. 12—13.
1972 *Phacelostylophyllum pygmaeum* (Frech). MELNIKOVA: 60.
1975 *Phacelostylophyllum pygmaeum* (Frech). MELNIKOVA: 179.

Description: Phaceloid colony has branching corallites. Septa are thick and short, in 2—3 cycles. The wall is septotheca. Endotheca is of tabulate dissepiments. Lateral ornamentations rare. Microstructure with medial line, poorly preserved.

Dimensions: d = 4—6 mm, s = ca 24.

Remarks: MELNIKOVA phaceloid stylophyllids ascribed to her new genus *Phacelostylophyllum,* to which *P. pygmaeum* can be arranged.

Distribution: Norian of Zlambach in Austrian Alps.

Material: Tominškova pot (5/85), Lower Norian.

Phacelostylophyllum cf. *medium* Roniewicz 1974
Pl. 9, Fig. 2—3

1974 *Phacelostylophyllum medium,* sp. n. RONIEWICZ: 106, Pl. 3, Fig. 5, Text-fig. 5—6.

Description was given by RONIEWICZ. Our specimen is dendroid colony with rare round corallites. Septa are in 3—4 cycles, columella parietal, wall epithecal, dissepiments tabulate, thin. Microstructure not preserved.

Dimensions: d = 6—8 mm, s = 24 + s.

Comparison: Our specimen differs from original in smaller number of septa, because the fourth cycle is not complete.

Distribution: *P. medium* from Rhaetian of Tatre Mts.

Material: Rušnata Mlinarica (15/82-2), Lower Norian.

Genus: *Procyclolites* Frech 1890
Procyclolites triadicus Frech 1890
Pl. 9, Fig. 4—5

1890 *Procyclolites triadicus* nov. sp. FRECH: 64—65, Taf. 18, Fig. 1—16.
1975 *Procyclolites triadicus.* CUIF: 85—91, Pl. 9—10, Text-fig. 11.
1979 *Procyclolites triadicus* (Frech). SCHÄFER: 49.
1980 *Procyclolites triadicus* Frech. CUIF: 366—367, Fig. 5.
1984 *Procyclolites triadicus* Frech. MATZNER: 9, Taf. 10, Fig. 7.

Description: Several fragments of solitary coral are preserved. Septa are numerous, with pennulae and large dissepiments.

Dimensions: d = ca 50 mm, s = ca 120.

Comparison: Similar *Procyclolites* sp. described by OKUDA & YAMAGYWA (1978, 303, Pl. 41, Fig. 3) has no pennulae. Its ornamentations are corns and probably does not belong to this genus.

Distribution: Norian-Rhaetian of Austrian Alps.

Material: Dovški križ (59/81-1), Rhaetian.

Genus: *Retiophyllia* Cuif 1966
Retiophyllia clathrata (Emmrich 1853)
Pl. 10, Fig. 1—5

1853 *Lithodendron clathratum.* EMMRICH: n. v.
1890 *Thecosmilia clathrata* Emmr. sp. FRECH: 15—16, Taf. 4, Fig. 1—5, 7—11.
1966[a] *Thecosmilia clathrata* (Emmrich). KOLOSVÁRY: 128.
1966[b] *Thecosmilia clathrata* (Emmrich). KOLOSVÁRY: 183.
1969 *Thecosmilia clathrata* Emmrich, forma B. ZANKL: 29, Pl. 9, Fig. 1, Text-fig. 18.
1974 *Retiophyllia clathrata* (Emmrich). RONIEWICZ: 108, Pl. 4, Fig. 1, Pl. 5, Fig. 3, Text-fig. 7.
1975 *Paradistichophyllum clathratum* (Emmrich). MELNIKOVA: 94—95, Tab. 17, Fig. 3.
?1979 *Thecosmilia clathrata* (Emmrich), Form B. SCHÄFER: 43—44, Taf. 9, Fig. 2.
1980 *Thecosmilia clathrata* (Emmrich). KRISTAN-TOLLMANN et al.: 174, Taf. 6, Fig. 5—6.
1980 »*Thecosmilia*« clathrata (Emmrich), Form B. SENOWBARI-DARYAN: 34, Taf. 1, Fig. 1.
?1982 »*Thecosmilia*« *clathrata* (Emmrich), Form B. SENOWBARI-DARYAN et al.: 169, Taf. 22, Fig. 1.

Description: Modern description was given by RONIEWICZ (1974). Our specimens are large phaceloid colonies with many corallites. Septa are in 4—5 cycles, laterally dentate. The wall is well developed septotheca, dissepiments are vesicular. Microstructure with median line is poorly preserved.

Dimensions: d = 5—8 mm, s = 50—70.

Comparison: Specimens of SCHÄFER (1979) have constant d = 5 mm and stay between the species *R. clathrata* and *R. paraclathrata.* Specimens of SENOWBARI-DARYAN (1982) are colonies with dense corallites which sometimes pass on to meandroid or cerioid forms. Such kind of forms from our collection I ascribed to the new species of the genus *Elysastraea.*

Distribution: Norian-Rhaetian of Austrian Alps, Hungary, Iran, Pamir, Rhaetian of Tatre Mts.

Material: Šplevta (64/81-1; 25/85-8, -9, -10, -A 3), Upper Norian-Rhaetian.

Retiophyllia defilippi (Stoppani 1865)
Pl. 11, Fig. 1—3

1865 *Rhabdophyllia De-Filippi* Stopp. STOPPANI: 106, Pl. 24, Fig. 5—7.
1890 *Thecosmilia De Filippi* Stopp. sp. FRECH: 14, Taf. 4, Fig. 13—15.
1966[a] *Thecosmilia defilippi* Stoppani. KOLOSVÁRY: 127.
?1980 *Thecosmilia* cf. *defilippi* Stoppani. DULLO: 63, Taf. 9, Fig. 1.

Description: *Retiophyllia* with irregularly branched corallites, in transverse section triangular, polygonal or irregularly prolongated. The wall is septotheca, somewhere poorly preserved.

Dimensions: d = 7—9 mm, s = 40—60.

Distribution: Rhaetian of Lombardia in Italy, Norian-Rhaetian of Austrian Alps, Upper Triassic of Hungaria.

Material: Šplevta (25/85-2, -5, -A 5, -A 6), Upper Norian-Rhaetian.

Retiophyllia fenestrata (Reuss 1854)
Pl. 11, Fig. 4—5

1854 *Calamophyllia fenestrata* n. sp. REUSS: 105, Pl. 5, Fig. 20.
1890 *Thecosmilia fenestrata* Reuss sp. FRECH: 9—10, Taf. 1, Fig. 25—27, Taf. 2, Fig. 1—17 (pars).
1966 *Retiophyllia fenestrata* (Reuss). CUIF: 125, 130—131, Pl. 4, Fig. 4, Text-fig. 4.
?1972 *Archaeophyllia fenestrata* (Reuss). *BEAUVAIS:* 311, Pl. 6, Fig. 8—10.
1974 *Retiophyllia fenestrata* (Reuss). CUIF: 369—375, Text-fig. 33—35.
?1979 »*Thecosmilia*« *fenestrata* Reuss. STANLEY: 32, Pl. 3, Fig. 1.
1986 *Retiophyllia fenestrata* (Reuss). MATZNER: 9, Taf. 9, Fig. 5, Taf. 10, Fig. 4.

Description: Modern description was given by CUIF (1974). Our specimens are branched colonies with rare round corallites. Septa in 3—4 cycles, strongly dentate. Septotheca large, complete. Microstructure with irregularly ondulate median line. Dissepiments more numerous in peripheral part of corallites.

Distribution: Norian-Rhaetian of Austrian Alps.

Material: Tominškova pot (33/82-1), Lower Norian; Šplevta (25/85-1), Upper Norian-Rhaetian.

Retiophyllia paraclathrata Roniewicz 1974
Pl. 10, Fig. 6—7

1969 *Thecosmilia clathrata* Emmrich, forma A. ZANKL: 28, Text-fig. 17.
1974 *Retiophyllia clathrata* sp. n. RONIEWICZ: 108—109, Pl. 4, Fig. 2, Pl. 5, Fig. 1—2, Text-fig. 8.
?1980 »*Thecosmilia*« *clathrata* (Emmrich). »Typ A/Zankl«. SENOWBARI-DARYAN: 34.

Description: was given by RONIEWICZ (1974).

Dimensions: d = (3) 4—4.5 mm, s = 50—60.

Comparison: The specimens of SENOWBARI-DARYAN (1980) have dimensions d = 2—5 mm, s = 50—90, and embrace the variation range of the species *R. paraclathrata* and *R. minima* Melnikova 1967.

Distribution: Rhaetian of Austrian Alps and Tatre Mts.

Material: Šplevta (25/85-3, -6), Upper Norian-Rhaetian.

Genus: *Toechastraea* Volz 1896
Toechastraea pachyphyllia Cuif 1976
Pl. 3, Fig. 5—6

1976 *Toechastraea pachyphyllia* nov. sp. CUIF: 146—148, Pl. 16, Fig. 3—4.

Description: was made by CUIF. Our only specimen is fragment of cerioid colony with intercalicinal marginal division. Corallites are roundish to polygonal with compact septa of 3—4 cycles, first two being stronger. Columella is large styliform, in our specimen not always preserved. Lateral ornamentations are dents. The wall between corallites is septotheca, poorly preserved. Endotheca is of thin dissepiments. Microstructure has medial line with offsets, poorly preserved, as well.

Dimensions: d = 3—5 mm, s = 24 + s.

Comparison: Our specimen differs from original in less preserved wall and columella.

Distribution: Norian of Turqey.

Material: Dovški križ (59/81-1), Rhaetian.

Genus: *Tropidendron* Cuif 1975
Tropidendron mlinaricensis n. sp.
Pl. 12, Fig. 1—6, Pl. 13, Fig. 1—5

Name: After locality Mlinarica
Holotypus: Specimen 15/82—6
Locus typicus: Rušnata Mlinarica
Age: Lower Norian
Material: five colonies with 7 thin sections
Diagnosis: *Tropidendron* with irregularly ramified corallites and dimensions d = 2 — 3.5(4) mm, s = 24 + s.

Description: Phaceloid colony has roundish corallites with lateral budding. Septa are compact, in 3—4 cycles, ornamented with thorns and pennulae. Columella styliform, well developed, in some corallites recrystalized. Endotheca is of thin tabulate and vesicular disseptiments. The wall is seen only on the utmost periphery and seems to be formed of thickenings of septa, i.e. some kind of incomplete septotheca. The microstructure poorly preserved.

Comparison: New species differs from the type *T. rhopalifer* (CUIF 1975, 94—95, Pl. 12, Fig. 1—6) in smaller corallites and less septa.

Material: Rušnata Mlinarica (15/82-6, holotype, 16/85-2, 17/85, 19/85-2); Tominškova pot (8/85), Lower Norian.

Hydrozoa

Genus: *Cylicopsis* Le Maitre 1935
Cylicopsis sp.
Pl. 14, Fig. 1

Bulbous coenosteum is built of almost equal vertical and horizontal elements. In transverse section they are vermiculate. Astrosystems are of more central canals.

The genus *Cylicopsis* was found for the first time in Liassic of Marocco (LE MAITRE 1935).

Material: Rušnata Mlinarica (15/82-7), Lower Norian.

Genus: *Pamirostroma* Boiko 1970
Pamirostroma cf. *astrorizoides* Boiko 1970
Pl. 14, Fig. 4

1970 *Pamirostroma astrorizoides* Boiko sp. nov. BOIKO: 48, Tab. 5, Fig. 1—4.
1979 *Pamirostroma astrorizoides* Boiko. BOIKO: 51, Tab. 6, Fig. 1—6. Tab. 7, Fig. 1.

Sphaerical coenosteum has uneven vertical and horizontal elements of equal number. Elements have concentric growth. Astrorhizae have more central canals. Zooid tubes are small.

Density of vertical elements: 6—7/2 mm.

Our specimen differs from type species in sparsed reticulum (in type it is 13—16/2 mm).

Distribution: *P. astrorizoides* is known from Norian of Pamir.

Material: Tominškova pot (5/85), Lower Norian.

Genus: *Spongiomorpha* Frech 1890
Spongiomorpha acyclica Frech 1890
Pl. 14, Fig. 2—3

1890 *Spongiomorpha acyclica* nov. sp. FRECH: 77—78, 2 Text-figs.
1979 *Spongiomorpha acyclica* Frech. SCHÄFER: 53, Taf. 13, Fig. 4.
1980 *Spongiomorpha acyclica* Frech. SENOWBARI-DARYAN: 72—73, Taf. 2, Fig. 1.

Skeleton of this spongiomorphid is the sparsest. Density of vertical elements iz 4—5/2 mm.

Distribution: Norian-Rhaetian of Austrian Alps.

Material: Šplevta (25/85-5 b), Upper Norian-Rhaetian.

Chaetetida

Genus: *Pseudoseptifer* Fischer 1970
Pseudoseptifer aktashi Boiko 1979
Pl. 14, Fig. 5

1979 *Pseudoseptifer aktashi* sp. nov. BOIKO: 71—72, Tab. 19, Fig. 3—4.
Colony has tubuls of diameter 0.25—0.35 mm (= 6—7/2 mm).

Distribution: Norian of Pamir.

Material: Šplevta (25/85-1 b), Upper Norian-Rhaetian.

Spongia

Genus: *Annaecoelia* Senowbari-Daryan 1978
Annaecoelia mirabilis Senowbari-Daryan & Schäfer 1979
Pl. 15, Fig. 4

1979 *Annaecoelia mirabilis* n. sp. SENOWBARI-DARYAN & SCHÄFER: 26, Taf. 6, Fig. 1—3, 5—6, Taf. 7, Fig. 6.

1980 *Annaecoelia mirabilis* S. D. et Sch. SENOWBARI-DARYAN: 54, Taf. 10, Fig. 3—5, Taf. 11, Fig. 5.
1986 *Annaecoelia mirabilis* S. D. et Sch. SENOWBARI-DARYAN: 252, Taf. 9, Fig. 8.

Distribution: Norian-Rhaetian of Salzburg region in Austria and Norian of Sicily.
Material: Šplevta (25/85-A 4 a), Upper Norian-Rhaetian.

Genus: *Battaglia* Senowbari-Daryan et Schäfer 1986
Battaglia minor Senowbari-Daryan et Schäfer 1986
Pl. 15, Fig. 1

1986 *Battaglia minor* n. sp. SENOWBARI-DARYAN & SCHÄFER: 245—246, Taf. 46, Fig. 1—2, 7, Abb. 5.

Distribution: Norian of Sicily.
Material: Šplevta (25/85-1, -A 3, -A 4), Tominškova pot (8/85), Norian-Rhaetian.

Genus: *Cheilosporites* Wähner 1903
Cheilosporites tirolensis Wähner 1903

1903 *Cheilosporites tirolensis* n. sp. WÄHNER: n. v.
1980 *Cheilosporites tirolensis* Wähner. SENOWBARI-DARYAN: 230—231, Taf. 24, Fig. 1—5. Synonymy.
1986 *Cheilosporites tirolensis* Wähner. SENOWBARI-DARYAN & SCHÄFER: 257, Taf. 48, Fig. 7.

Distribution: Spongia is known from Norian-Rhaetian of Austrian Alps and Norian of Sicily.
Material: Rušnata Mlinarica (15/82), Kot (27/82), Lower Norian.

Genus: *Cryptocoelia* Steinmann 1882
Cryptocoelia crassiparietalis Senowbari-Daryan & Schäfer 1986
Pl. 15, Fig. 3

1986 *Cryptocoelia crasssiparietalis* n. sp. SENOWBARI-DARYAN & SCHÄFER: 247—248, Taf. 50,, Fig. 1—4.

Distribution: Norian of Sicily.
Material: Dovški križ (59/81-1), Rhaetian.

Genus: *Paradeningeria* Senowbari-Daryan & Schäfer 1979
Paradeningeria alpina Senowbari-Daryan &Schäfer 1979
Pl. 15, Fig. 5

1979 *Paradeningeria alpina* n. sp. SENOWBARI-DARYAN & SCHÄFER: 22—24, Taf. 2, Fig. 2, 4—5, 7, Taf. 4, Fig. 6, Taf. 5, Fig. 6.
1980 *Paradeningeria alpina* S. D. & Sch. SENOWBARI-DARYAN: 50—51, Taf. 9, Fig. 1, Taf. 11, Fig. 7.

Distribution: Norian-Rhaetian of Salzburg region in Austria.
Material: Rušnata Mlinarica (19/85, 15/82-6), Šplevta (25/85-7), Norian-Rhaetian.

Genus: *Vesicocaulis* Ott 1967
Vesicocaulis sp.
Pl. 15, Fig. 2

Genus is known from Carnian of Dolomites and Northern Calcareous Alps.
Material: Rušnata Mlinarica (16/85-2), Lower Norian.

Microproblematica

Pycnoporidium eomesozoicum Flügel 1972 (Pl. 16, Fig. 1)

Material: Rušnata Mlinarica (15/82-1), Šplevta (25/85-A 1), Norian-Rhaetian.

Radiomura cautica Senowbari-Daryan & Schäfer 1979 (Pl. 16, Fig. 2—3)

Material: Rušnata Mlinarica (15/82-5), Lower Norian.

Foraminifera

Alpinophragmium perforatum Flügel 1967 (Pl. 16, Fig. 4—5)

Material: Dovški križ (59/81-1), Šplevta (25/85-1, -2, -3, -4, -5, -6, -8, -10, -A 2, -A 3, -A 4, -A 5), Upper Norian-Rhaetian.

Small foraminifers (Pl. 16, Fig. 6)

Material: Šplevta (25/85-1, -A 1, -A 4, 63/81), Dovški križ (59/81-1, -2, -3), Rušnata Mlinarica (15/82-5), Norian-Rhaetian.

Algae

Solenopora styriaca Flügel 1960 (Pl. 15, Fig. 6)

Material: Šplevta (25/85-2, -4, -5, -7, -A 4), Upper Norian-Rhaetian.

Cayeuxia sp. (Pl. 15, Fig. 7)

Material: Rušnata Mlinarica (15/82-8), Tominškova pot (2/85), Lower Norian.

Dasycladaceae (Pl. 16, Fig. 9)

Material: Šplevta (25/85-1, -A 1), Dovški križ (59/81-1), Rušnata Mlinarica (15/85-1), Norian-Rhaetian.

	Reef building fossils Grebenotvorni fosili	Localities in Julian Alps Nahajališča v Julijskih Alpah						Stratigraphical distribution Stratigrafska razširjenost		
		Dk	Šp	Kop	Tp	RM	Kot	Ca	No	Rh
		Norian/Rhaetian			Norian					
Anthozoa	Astraeomorpha confusa		•							
	Craspedophyllia sp.					•				
	Cuifia elliptica		•		•	•				
	Cuifia sp.				•					
	Cyathocoenia juvavica					•	•			
	Distichophyllia gosaviensis		•		•	•				
	Elysastraea juliana n. sp.			•						
	Gillastraea delicata		•							
	?Margarosmilia sp.					•				
	Pachydendron microthalos		•							
	Paradistichophyllum noricum				•					
	Paradistichophyllum sp.					•	•			
	Parathecosmilia langobardica	•								
	Parathecosmilia sellae		•							
	Phacelostylophyllum pygmaeum				•					
	Phacelostylophyllum cf. medium					•				
	Procyclolites triadicus	•				•				
	Retiophyllia clathrata		•							
	Retiophyllia defilippi		•							
	Retiophyllia fenestrata		•		•					
	Retiophyllia paraclathrata		•							
	Toechastraea pachyphyllia	•								
	Tropidendron mlinaricensis n. sp.				•	•				
Hydrozoa	Cylicopsis sp.					•				
	Pamirostroma cf. astrorizoides				•					
	Spongiomorpha acyclica		•							
Chae	Pseudoseptifer aktashi		•							
Spongia	Annacoelia mirabilis		•							
	Battaglia minor		•		•					
	Cheilosporites tirolensis					•	•			
	Cryptocoelia crassiparietalis	•								
	Paradeningeria alpina		•			•				
	Vesicocaulis sp.					•				
Microp.	Pycnoporidium eomesozoicum		•			•				
	Radiomura cautica					•				
Foram.	Alpinophragmium perforatum	•	•							
Algae	Solenopora styriaca		•							
	Cayeuxia sp.				•	•				

Other fossils

Gastropoda (Pl. 16, Fig. 8)

Material: Šplevta (25/85-1, -2), Dovški križ (59/81-1), Tominškova pot (3/85, 5/85, 14/85), Norian-Rhaetian.

Cephalopoda (Pl. 16, Fig. 7)

Material: Dovški križ (59/81-1), Upper Norian-Rhaetian.

Crinoidea (Pl. 16, Fig. 11)

Material: Tominškova pot (3/85), Lower Norian.

BIOSTRATIGRAPHIC COMPARISON OF REEF FOSSILS WITH OTHER LOCALITIES IN SLOVENIA AND IN THE WORLD

In Slovenia the first paleontological investigation of Norian-Rhaetian reef building organisms was performed on material from Begunjščica. The material was collected from a number of localities, but not systematically. On the basis of leading species *Cheilosporites tirolensis* Wähner and *Stromatomorpha rhaetica* Kühn, as well as the entire fauna and flora which, according to the knowledge of those days, entirely corresponds to fossils of the Rhaetian reef limestones in Northern Calcareous Alps, the reef development of Begunjščica was attributed to the Rhaetian stage (FLÜGEL & RAMOVŠ 1961, 287—294).

Preliminary were determined reef building organisms of the Norian-Rhaetian time from several localities of the Julian Alps, Pokljuka, Bohinj, Rdeči rob, Ratitovec and others. Fossils are not systematically determined yet, and also the age of the localities is not entirely established (BUSER et al. 1982, 21). A similar fossil associations with corals occur also on Zlatibor and in some other places, where they are not yet determined.

Elswhere in Europe and in South Asia the reefs of Julian Alps resemble more or less those which occur in a belt from Dolomites across the Northern Calcareous Alps to the Tatre Mountains, approximately between the 45th and the 50th parallel, and more to the south, in a belt from Sicily across Greece, Turkey and Iran to Pamir, approximately between the 35th and the 40th parallel.

Fig. 3. List of reef building fossils from the localities in northern Julian Alps and their previous stratigraphical distribution
DK = Dovški križ, Šp = Šplevta, Kop = Kopice, Tp = Tominškova pot, RM = Rušnata Mlinarica, Ca = Carnian, No = Norian, Rh = Rhaetian.

Sl. 3. Seznam grebenotvornih fosilov iz nahajališč v severnih Julijskih Alpah in njihova dosedanja stratigrafska razširjenost
Ca = karnij, No = norij, Rh = retij.

Most of the same species (16) as in the Julian Alps occur in the Northern Calcareous Alps (FRECH 1890, ZANKL 1969, SCHÄFER 1979, DULLO 1980, SENOWBARI-DARYAN 1980, SADATI 1981 and others). In Lombardia in Italy occur 4 same species (STOPPANI 1860—1865), in the Mecsek Mountains in Hungary only one (KOLOSVÁRY 1966 a), in Tatre Mountains in Czechoslovakia there are 5 (KOLOSVÁRY 1966 b, GAŹDZICKI 1974, RONIEWICZ 1974), and on Sicily 9 same species, mainly sponges and algae (SENOWBARI-DARYAN et al. 1982, SENOWBARI-DARYAN & SCHÄFER 1986, SENOWBARI-DARYAN 1984), in Greece two (SCHÄFER & SENOWBARI-DARYAN 1982), in Turkey two same species (CUIF 1975, 1976, 1977), in Iran 4 species (KRISTAN-TOLLMANN et al. 1980), and in Pamir 9 same species (BOIKO 1979, MELNIKOVA 1975, 1983). One same species has been mentioned from Timor (VINASSA de REGNY 1915), and two even from North America (STANLEY 1979).

Such quantitative comparison of fossils is in no way complete, since it is to a large degree dependent upon the methodology of work, and upon the present state of investigation of individual localities. It nevertheless gives an approximate picture of the distribution of reefs in individual geological times.

More than three quarters of the collected reef fossils were up to present found in Norian and Rhaetian reefs (Fig. 3). Therefore the considered localities in the northern Julian Alps can be in totality attributed to that time. Individual localities, however, differ somewhat between each other.

On Rušnata Mlinarica forms were found which were formerly known only in Carnian stage; these are the coral genera *Craspedophyllia, Margarosmilia, Tropidendron* and the sponge *Vesicocaulis*. Among them appear already the characteristic Norian-Rhaetian species as *Cuifia, Cyathocoenia, Distichophyllia, Paradistichophyllum, Phacelostylophyllum,* and others. Therefore the Mlinarice localities can be attributed according to fossils into the lower part of the Norian-Rhaetian complex, i.e. to Lower Norian, where these associations already mix with older Carnian elements. This age is confirmed also by the position of the mentioned localities in the stratigraphical column (compare with the text on the stratigraphic position of the localities, and Fig. 2, 4 c, d).

Also at the Tominšek path occurs the genus Tropidendron, similarily to Rušnata Mlinarica also Distichophyllia and Cuifia. In this locality in higher levels also genus Retiophyllia is found. The start of reef sedimentation is therefore comparable with that in Mlinarice. The reef at the Tominšek path, however, lasted somewhat longer.

In contrast, at Šplevta and on Dovški križ the Carnian elements are absent. Here occurs a number of Norian-Rhaetian genera and species which do not apear in afore mentioned localities, e.g several species of genus Retiophyllia, genus Gillastraea, Parathecosmilia, several sponges, Alpinophragmium, and others. Therefore Šplevta and Dovški križ may be placed somewhat higher in the stratigraphical column, in the Upper Norian and Rhaetian.

Also between Dovški križ and Šplevta appear certain differences in fossil associations. Dovški križ is the youngest, in it appear Parathecosmilia langobardica, Toechastraea pachyphyllia, Procyclolites triadicus, which are absent at Šplevta. Dovški križ probably belongs entirely to Rhaetian. (Compare Fig. 2, and 4 a, b).

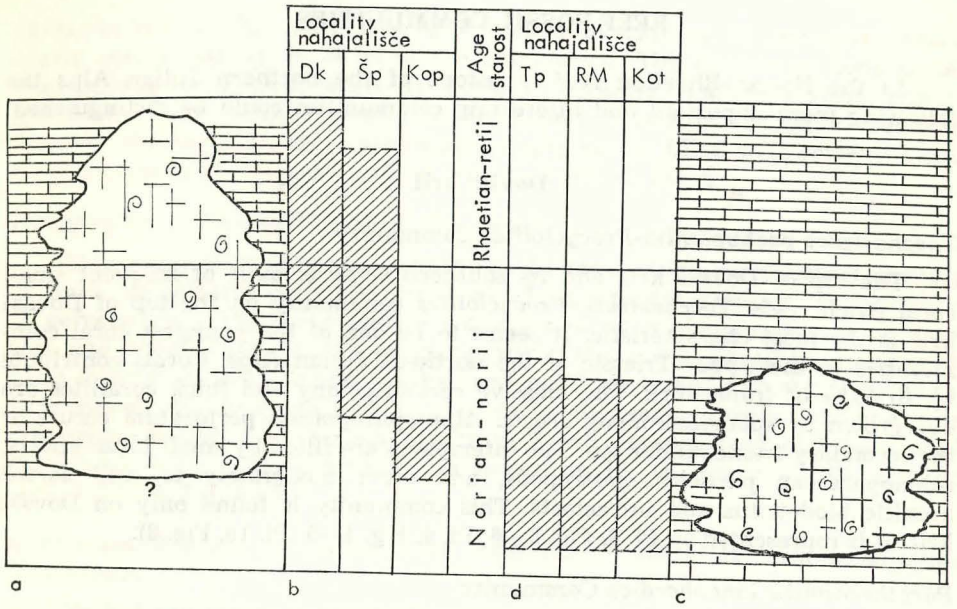


Fig. 4. Shematic cross-section of Norian-Rhaetian reef buildups in northern Julian Alps, and comparison with the stratigraphic position of reefbuilding fossils from the same localities
a) Position of reef complex Dovški križ — Šplevta — Kopice. The reef reaches to the uppermost Triassic. Laterally bedded Dachstein limestone occurs
b) Stratigraphic position of reef building fossils from the same localities: Dk = Dovški križ, Šp = Šplevta, Kop = Kopice. On the basis of fossils the reef complex was stratigraphycally subdivided into more detail
c) Position of reef complex Tominškova pot — Rušnata Mlinarica — Kot. Reef limestone is covered with thick stack of bedded Dachstein limestone
d) Stratigraphic position of reef building fossils from the same localities: Tp = Tominškova pot, RM = Rušnata Mlinarica, Kot = Kot. The age of fossils fits the field position of beds

Sl. 4. Shematski presek norijsko-retijskih grebenskih tvorb v severnih Julijskih Alpah in primerjava s stratigrafskim položajem grebenotvornih fosilov iz istih nahajališč
a) Položaj grebenskega kompleksa Dovški križ—Šplevta—Kopice. Greben sega do vrha triasa, lateralno so skladnati dachsteinski apnenci
b) Stratigrafski položaj grebenotvornih fosilov iz istih nahajališč: Dk = = Dovški križ, Šp = Šplevta, Kop = Kopice. S pomočjo fosilov je grebenski kompleks podrobneje razčlenjen
c) Položaj grebenskega kompleksa Tominškova pot—Rušnata Mlinarica—Kot. Grebenski apnenec je prekrit z debelo skladovnico skladnatega dachsteinskega apnenca
d) Stratigrafski položaj grebenotvornih fosilov iz istih nahajališč: Tp = Tominškova pot, RM = Rušnata Mlinarica, Kot = Kot. Starost fosilov se ujema s položajem na terenu

REEF FOSSIL COMMUNITIES

In the Norian-Rhaetian reef limestone of the northern Julian Alps the following more important and interesting communities could be distinguished:

Dovški križ

Toechastraea pachyphyllia-Procyclolites Community

The top of Dovški križ and its southern slope is built of frequent small coral patch reefs. *Toechastraea-Procyclolites* community on the top of Dovški križ is the most characteristic. It seems to be one of the youngest coral communities in the Upper Triassic of the northern Julian Alps. Corals contribute up to 40 % of framework. The massive cerioid colony and thick corallites are overgrown by spongiostromate crusts. *Alpinophragmium perforatum* occurs as the secondary framebuilder too. The interspaces are filled by small foraminifers, solenoporacean particles, gastropods, and other moderately to well sorted arenitic biodetritus and intraclasts. This community is found only on Dovški križ. It is represented on Pl. 3, Fig. 5—6; Pl. 9, Fig. 4—5; Pl. 16, Fig. 8).

Parathecosmilia langobardica Community

Also *Parathecosmilia langobardica* on the top of Dovški križ is one of the youngest Upper Triassic communities in the Julian Alps. Corals with spongiostromate crusts build up to 40 % of rock. In micritic interspaces with mollusc fragments and small foraminifers small onkolithic pieces are frequent. This community is shown on Pl. 8, Fig. 1—2.

Calcisponge-Community

The most frequent community on Dovški križ is the calcisponge community which builds up to 70 % of the framework. Calcareous algae and juvenile amonites also occur. Between the skeleton there are larger spaces filled with cement A and B. This community is shown on Pl. 15, Fig. 3, Pl. 16, Fig. 7, 8).

Echinodermal limestone

On many places echinodermal limestone was found. Crinoidal and echinoidal fragments occur.

Detrital reef limestone and bioclastic detrital limestone filled interspaces between the patch reefs (Pl. 16, Fig. 10).

Šplevta

Parathecosmilia sellae-Solenopora styriaca Community

On Šplevta, south of Dovški križ the *Parathecosmilia sellae-Solenopora styriaca* community builds some small patch reefs. This community is probably older than the *P. langobardica* community of Dovški križ. It is

characterized by the only species *P. sellae* overgrown by spongiostromate crusts and builds up to 50 % of the framework. The encrusting foraminifer *Alpinophragmium perforatum* is present. Sponges *(Paradeningeria alpina)* are rare, in part solenoporaceans *(Solenopora styriaca)* are quite frequent. Between the corallites there are in part empty spaces filled with cement A and B. This community is shown on Pl. 8, Fig. 3—5; Pl. 15, Fig. 6.

Retiophyllia — Alpinophragmium Community

This community is most abundant on Šplevta. Patch reefs consist entirely of large, irregularly branched corallites of *Retiophylia defilippi, R. clathrata, R. paraclathrata* which are always accompanied by *Alpinophragmium perforatum* and densely surrounded by spongiostromate crusts. Corallites stand with little interspaces next to one another and build up to 80 % of the framework. Interspaces are frequently filled by early diagenetic cement A and late diagenetic cement B. Sponges are rare. Small foraminifers and individual gastropods occur. This community is shown on Pl. 10, Fig. 1—7; Pl. 11, Fig. 1—3, 5; Pl. 16, Fig. 4—5.

Gillastraea delicata — Retiophyllia clathrata — Distichophyllia gosaviensis Community

On Šplevta many small buildups consist entirely of irregularly branched corallites of *Gillastraea delicata* as primary frame builders which stand with small interspaces next to one onother and build up to 70 % of the framework. Corallites are overgrown by spongiostromate crusts. *Gillastraea* is partly accompanied by *Retiophyllia clathrata* and *Distichophyllia gosaviensis.* Secondary frame builders are spongiostromate crusts and sessile foraminifer *Alpinophragmium perforatum.* Empty interspaces are filled with cement A and B. This community is shown on Pl. 6, Fig. 3—4; Pl. 10, Fig. 5.

Cuifia elliptica Community

On Šplevta this rather frequent large solitary coral appears alone. It is encrusted by thick spongiostromate crusts. Dasycladacean fragments and small foraminifera occur. Intracorallite pores are filled with arenitic detritus. High framework porosity. This community is shown on Pl. 4, Fig. 3—4.

Pachydendron microthallos — Alpinophragmium Community

Small phaceloid corallites with thick wall are densely encrusted by spongiostromate crusts and build only about 10 % of the framework. Sessile foraminifer *Alpinophragmium perforatum* is present. This community was found only on Šplevta. It is presented on Pl. 7, Fig. 1—2.

Annaecoelia mirabilis — Battaglia minor — Alpinophragmium Community

Some small patch reefs on Šplevta are built of inozoans *Annaecoelia mirabilis* and *Battaglia minor,* surrounded by spongiostromate crusts and *Alpinophragmium perforatum.* This community is shown on Pl. 15, Fig. 1 and 4.

Kopice

Elysastraea juliana Community

The massive cerioid-phaceloid meandroid coral colony was found in a small patch reef on the south margin of Kopice. It is shown on Pl. 5, Fig. 1—4; Pl. 6, Fig. 1—2.

Tominškova pot

The lowermost part of the reef limestone on Tominškova pot consists of various bioclastic grainstones and packstones, partly crinoidal remnants are very frequent. Oncolitic grainstone predominates in many horizons. Calcisponge/algal facies is placed just below the lowermost coral patch reefs. (Pl. 16, Fig. 11)

Phacelostylophyllum pygmaeum — Cuifia elliptica — Distichophyllia gosaviensis Community

The lowermost (the oldest) coral community on the Tominškova pot (1355—1360 m) builds some patch reefs. Solitary corals *Cuifia elliptica* and *Distichophyllia gosaviensis* are not frequent. Corallites of *Phacelostylophyllum pygmaeum* are encrusted by thick spongiostromate crusts. Corals and hydrozoans *(Pamirostroma* cf. *astrorizoides)* build up to 50 % of the framework. Micritic interspaces contain crinoidal remnants, gastropods, lamellibranchs and foraminifers. This community is shown on Pl. 9, Fig. 1; Pl. 14, Fig. 4.

Paradistichophyllum noricum Community

Many small buildups (at ca 1460 m) entirely consist of phaceloid coral *Paradistichophyllum noricum* which builds up to 60 % of framework. Corallites are overgrown by spongiostromate crusts. Sponges are not present. This community is presented on Pl. 7, Fig. 3—4.

Cuifia sp. Community

Between 1450 and 1490 m some small buildups consist of single corallums of *Cuifia* which are encrusted by thick spongiostromate crusts. This community is shown on Pl. 4, Fig. 2.

Kot

Paradistichophyllum sp. — *Cuifia elliptica — Cheilosporites tirolensis* Community

Patch reef, 3 m × 0.6 m, on the way Kot — Staničeva koča, at 1300 m, consists of the predominating *Paradistichophyllum* sp. which builds up to 70 % of primary framework and the large solitary coral *Cuifia elliptica.* Corallites are overgrown by thick spongiostromate crusts. Among sphinctozoans *Cheilosporites tirolensis* occurs.

Another patch reef with *Paradistichophyllum* sp. and *Cuifia* was found at about 1320 m on the same way. Here echinoid remnants are very frequent (Pl. 7, Fig. 5).

Rušnata Mlinarica

Tropidendron mlinaricensis — Paradeningeria alpina Community

On Rušnata Mlinarica this community is characterized merely by the new coral species *T. mlinaricensis* which builds small tufty frameworks, and contributes up to 50 % to the biolithite. Corallites are encrusted by thick spongiostromate crusts. The calcisponge *Paradeningeria alpina* appears in some buildups as the other primary framebuilder. Small forminifers are rare. The interspaces are frequently filled by cement A and B. This community is represented on Pl. 12, Fig. 1—6; Pl. 13, Fig. 1—5.

Cyathocoenia juvavica Community

Two small buildups consist of *C. juvavica,* the massive cerioid colony which is encrusted by spongiostromate crusts. See Pl. 3, Fig. 3—4.

Paradistichophyllum sp. — *Vesicocaulis* sp. Community

Primary framework consists of the coral *Paradistichophyllum* sp. and calcisponge *Vesicocaulis* sp. both overgrown by spongiostromate crusts and sessile microproblematica. They contribute up to 60 % of framework. This community is shown on Pl. 15, Fig. 2.

Distichophyllia gosaviensis Community

Skeleton of solitary coral *D. gosaviensis* is overgrown by very thick spongiostromate crust. It is shown on Pl. 4, Fig. 5.

Margarosmilia sp. — *Radiomura cautica* Community

This community is known only on Rušnata Mlinarica. Primary reefbuilders *Margarosmilia* sp. and *Radiomura cautica* are encrusted by spongiostromate crusts and build up to 25 % of the framework. This community is shown on Pl. 6, Fig. 5; Pl. 16, Fig. 2—3.

Calcisponge Community

Cryptocoelia crassiparietalis and *Paradeningeria alpina* encrusted by spongiostromate algal crusts, are the important reef builders of some small patch reefs. They are accompanied by tubelike microproblematica. See Pl. 15, Fig. 5.

Cayeuxia biocoenose

On Rušnata Mlinarica *Cayeuxia* biocoenose was found. It consists of thiny *Cayeuxia* which grew in tufts and built small coenostea with irregular growth of skeleton. During the growth of this *Cayeuxia* biocoenose remained irregular empty spaces which became cemented during the early diagenesis; shown on Pl. 15, Fig. 7.

PALEOECOLOGICAL CHARACTERISTICS

During Norian and Rhaetian in the northern Julian Alps deposition of the carbonate platform occurred. Deposited were bedded Dachstein limestones, and within them grew in many places reef organisms and formed various biological associations which built smaller or larger patch reefs. Of them more extensive reef complexes were formed (Fig. 1, 2, 4).

Corals are the most important and prevailing reef builders. Sponges and hydrozoans are subordinate. Spongiostromate crusts contribute important volumes to biolithite. Interesting is the absence of individuals of *Tubiphytes* and *Microtubus* as secondary framebuilders. Dasycladaceans and small foraminifers are very rare.

Most of the corals found in northern Julian Alps are of phaceloid type. Everywhere in the world they are attributed to representatives of reef environment with a high energy index. This is confirmed also by *Alpinophragmium perforatum*. Hydrozoan coenostea, sponges, solenopors and solitary, as well as encrusting corals are common in central parts of reefs, and also in their marginal parts, especially closer to the backreef, in better protected parts of the reef with a lower water energy (comp. STANTON & FLÜGEL 1987).

In reefs of the northern Julian Alps no zonation of fossils into reef, forereef and back-reef units can be observed. There is, however, a high diversity of fossil associations among individual localities. More than half, and even three quarters of species are associated with a single locality only. These differences are explained partly by various age of individual reef complexes

	Dk	Šp	Kop	Tp	RM	Kot
Dk	⑤	1	-	-	1	-
Šp	1	⑱	-	4	4	-
Kop	-	-	①	-	-	-
Tp	-	4	-	⑩	4	-
RM	1	4	-	4	⑯	2
Kot	-	-	-	-	2	③

a

Dk=Dovški križ
Šp=Šplevta
Kop=Kopice
Tp=Tominško-va pot
RM=Rušnata Mlinarica
Kot=Kot

	Dk	Šp	Kop	Tp	RM	Kot
Dk	③	-	-	-	1	-
Šp	-	⑩	-	3	2	-
Kop	-	-	①	-	-	-
Tp	-	3	-	⑦	3	-
RM	1	2	-	3	⑨	1
Kot	-	-	-	-	1	②

b

Fig. 5. Diversity of reef building fossil species in investigated localities
a) All determined fossil species considered
b) Only coral species considered

Sl. 5. Raznolikost grebenotvornih fosilnih vrst v raziskanih nahajališčih
a) Upoštevane so vse določene vrste fosilov
b) Upoštevane so samo koralne vrste

(e. g., Rušnata Mlinarica and Šplevta), and partly by different local ecosystems in which lived individual biotopes, which in spite of the localization on the same platform differred somewhat between each other in depth, light, water currents and other (e. g. Šplevta and Dovški križ, or Rušnata Mlinarica and Kot).

Also within a single reef complex individual asseblages were limited to specific places where they built patch reefs which were distinct units. Often a single genus, or even a single species build the major part of the frame of individual patch reefs (compare fossil communities in previous chapter).

Between particular patch reefs deposited bioclastic detritic limestone with fragments of various organisms and other detritogenic material (Pl. 16, Fig. 10—11). Elements are usually surrounded with spongiostromate crusts. This deposition represents the inter patch-reef development.

During Norian and Rhaetian the Julian carbonate platform was a stable unit with uniform subsidence which enabled forming of up to 1000 m of reef beds. A connection with deeper sea may be found more to the south in the Slovenian trench in which during this time the Bača dolomite deposited, and in individual intraplatform canals (on Pokljuka) in which limestones with chert were formed (BUSER et al. 1982).

POVZETEK

Zgornjetriasne (norijsko-retijske) grebenske tvorbe v severnih Julijskih Alpah

UVOD

V pričujoči razpravi podajava raziskavo norijsko-retijskih grebenskih tvorb v Julijskih Alpah, to je na julijski karbonatni platformi. Obravnavava organizme, ki gradijo grebene, fosilne združbe in facialne tipe v njih. Nikjer v Sloveniji doslej še niso bile opravljene takšne raziskave najmlajšega triasa.

V obdobju šestletnih terenskih raziskav (od 1977 do 1983) biostratigrafije triasnih plasti v severnih Julijskih Alpah je A. RAMOVŠ sistematično izdvojil dachsteinski grebenski razvoj, ki je nadaljevanje spodnjekarnijskih in julsko-tuvalskih kamnin. Raziskoval je facialne razvoje in favnistične združbe tega obdobja, zbral veliko različnih fosilov in raznih litoloških vzorcev za paleontološke, facialne in sedimentološke analize. D. TURNŠEK je determinirala in opisala fosile iz grebenov, ki zajemajo predvsem korale, hidrozoje, spongije in hetetide ter tudi nekaj mikroproblematik, foraminifer in apnenčevih alg.

Vsi opisani fosili in drugi vzroci so shranjeni v paleontološki zbirki Katedre za geologijo in paleontologijo Univerze Edvarda Kardelja v Ljubljani.

ZAHVALE: Raziskave so financirali Raziskovalna skupnost Slovenije, Tehniški muzej Železarne Jesenice in Kulturna skupnost občine Jesenice. Zbruske sta izdelala KATA CVETKO in RENATO VIDRIH, fotografije CARMEN NAROBE in MARJAN GRM, grafične priloge in table je oblikovala MILOJKA HUZJAN, fosilno zbirko koral je pregledala in dala dragocene nasvete EWA RONIEWICZ, tekst je prevedel v angleščino SIMON PIRC.

Vsem se avtorja najlepše zahvaljujeva.

PREGLED PREJŠNJIH DEL

Med dosedanjimi raziskovalci Julijskih Alp se nihče ni podrobneje ukvarjal z zgornjetriasnimi norijskimi in retijskim kamninami in njihovimi fosilnimi ostanki, omenjajo pa nekateri razen skladnatega dachsteinskega apnanca tudi grebenskega.

PETERS (1856, 685) je odkril na strmem pobočju Cmira proti Vratom megalodontidne školjke in tamkajšnje plasti primerjal s kössenskimi skladi Severnih Apneniških Alp.

DIENER (1884, 679—680) je ugotovil, da sega na ozemlju Vrat in Kota, na Špiku, Frdamanih policah in Rigljici grebenski razvoj skozi karnijsko stopnjo neprekinjeno visoko v dachsteinski apnenec. Na zahodni strani Vrat

omenja plastnati dachsteinski apnenec, v dolomitih na podnožju Cmira pa v prosto ležečih blokih še značilne okamnine glavnega dolomita.

V Krnici pod Špikom je našel TELLER (1910, 181) bloke belega apnenca z ostanki brahiopodnega rodu *Koninckina,* ki je značilen za mejo med rabeljskimi plastmi in dachsteinskim apnencem. Nad schlernskim dolomitom sledi skladnat dachsteinski apnenec, ki ga na vrhu Kukove Špice in na sosednjem Triglavskem pogorju pokriva neplastnata grebenska apnenčeva masa. Na Tellerjevi geološki karti ležita vrh schlernskega dolomita in njegovih apnenčevih ekvivalentov glavni dolomit in dachsteinski apnenec.

SEIDL (1929, 17—20) je bil prepričan, da je na 1200 m debeli skalnati apnenec Triglavske severne stene naloženega še skoraj 450 m neskladnatega podolomitenega apnenca in da tako tu doseže dachsteinska skupina debelino 1650 m. V skladnatem apnencu vrha Triglava omenja SEIDL koralnjake, ki pa jih ni nihče določil. Za ta masivni apnenec je uvedel v slovensko geološko literaturo ime triglavski apnenec.

RAKOVEC (1933, 140) je strnil ugotovitve starejših raziskovalcev in zapisal, da je v Julijskih Alpah glavni dolomit, v njegovi družbi pa nastopa dachsteinski apnenec in vsi višji vrhovi so zgrajeni iz tega apnenca. V Triglavskem pogorju sestoji Triglavska severna stena iz skladnatega apnenca, ki doseže debelino 1200 m, nad njim pa sledi neskladnati dolomitizirani apnenec, iz katerega je vrh Triglava, tako da doseže ves kompleks dachsteinskega apnenca debelino 1650 m.

Kasneje piše RAKOVEC (1951, 121, 123), da v vzhodnih Julijskih Alpah izgine glavni dolomit in vso norijsko stopnjo zastopa samo dachsteinski apnenec, iz katerega sestoji večina površja Triglavskega pogorja. Navaja, da dosežejo dachteinski apnenci v vzhodnih julijskih Alpah največjo debelino in merijo v Krmi 1300 do 1400 m, v Triglavski severni steni pa z neskladnatim apnencem vred 1650 m.

RAMOVŠ (1986a) je ugotovil, da vrh Triglava in sosednjih vrhov ni iz grebenskega dachsteinskega apnenca, pač pa predstavlja pokrov spodnjekarnijskega grebenskega apnenca. Špik, Frdmane police, Rigljica in Prisojnik so prav tako iz spodnjekarnijskega apnenca (RAMOVŠ & TURNŠEK 1984, 169) in grebenski razvoj ne gre skozi karnijsko stopnjo neprekinjeno visoko v dacsteinski apnenec, kot je predpostavljal DIENER.

Pri novejših raziskavah je bila v severnih Julijskih Alpah tudi paleontološko ugotovljena karnijsko-norijska meja (RAMOVŠ 1986 b). Pregledno je bil podan razvoj zgornjega triasa (norij/retij) v severnih Julijskih Alpah (RAMOVŠ 1985 a, 1986 a).

RAZŠIRJENOST NORIJSKO-RETIJSKIH GREBENOV MED DOVŠKIM KRIŽEM IN MACESNOVCEM

Vsi grebenski apnenci, ki so jih prejšnji raziskovalci uvrščali v norij in retij, so karnijske starosti.

Norijsko-retijske grebene sestavljata dve sklenjeni področji. Prvo je v Martuljkovi gorski skupini in obsega masive Dovškega križa 2542 m (Tab. 1,

sl. 1), Šplevte, 2273 m, Kopic, Oltarjev (Tab. 1, sl. 2), Visokega Rokava in dela Ponc. Biolititna facija tu lateralno prehaja v skladnati dachsteinski apnenec. Nekoliko zahodneje od tod se pojavlja v višjem delu celotnega norijsko-retijskega razvoja tendenca k tvorbi grebenov, vendar grebeni ne dosežejo večje debeline.

Drugo sklenjeno področje norijsko-retijskih grebenskih tvorb predstavlja do 300 m visoka, večinoma strma razkosana in razgrapana apnenčeva stena, ki se vleče iz doline Vrat preko Tominškove poti na Triglav proti severovzhodu, nato po vzhodnem pobočju Mlinaric (Tab. 2, sl. 1, 2) proti jugu v dolino Kota, od tam proti severovzhodu v stene Macesnovca. Z njegovega vzhodnega pobočja se vleče proti jugozahodu. Položaj grebenskih tvorb in raziskanih nahajališč je prikazan na sl. 1.

Grebenske tvorbe na Razorju in Planji, 5 km zračne črte jugozahodno od Dovškega križa, bodo opisane na drugem mestu.

STRATIGRAFSKI POLOŽAJ GREBENSKIH TVORB

Norijski dachsteinski apnenec leži konkordantno na večinoma razgaljenih zgornjekarnijskih plasteh. Te sestoje na pobočju Mlinaric in Macesnovca ter v Kotu iz okoli 20 m debele skladovnice ploščastega in drobnoskladnatega rjavkastega mikritnega apnenca s konodontoma *Neogondolella polygnathiformis* Budurov & Stefanov in *Epigondolella nodosa* (Hayashi), amoniti in brahiopodi. Ob Tominškovi poti na Triglav pa je v vrhnjem tuvalu okoli 85 m temno sivega in črnega ploščastega in drobnoskladnatega mikritnega apnenca z *N. polygnathiformis* in *E. nodosa*, *številnimi* školjkami *Halobia* cf. *fallax* in redkimi amoniti. Na Dovškem križu in v okolici baza grebenskega apnenca ni odkrita, je pa verjetno enaka kot med Vrati in Krmo.

Nad paleontološko ugotovljeno mejo vrhnjega karnija (RAMOVŠ 1986 b) leži od nekaj m do približno 20 m plastnatega svetlo sivega apnenca dachsteinskega tipa. Sprva je debeloploščast, nato pa prehaja v debele sklade in ti navgor postopno v masivni dachsteinski apnenec. Meja med skladnatim in grebenskim apnencem ni ravna, marveč se v sekvenci začne grebenski razvoj nekje malo prej, drugje pozneje in se med prvimi »patch« grebeni še nadaljuje sedimentacija skladnatega apnenca.

Med dolinama Vrat in Krme se vleče grebenski dachsteinski apnenec s Praga v Vratih čez Tominškovo pot preko Mlinaric v Kot in nato v ostenje Macesnovca in je debel okoli 250 do 300 m. Že nekje v noriju pa je bila ta biolititna facija prekinjena in nadaljevala se je le še sedimentacija skladnatega dachsteinskega apnenca do kraja triasa.

Na Dovškem križu, Šplevti in okolici se je začela grebenska sedimentacija približno istočasno kot med Vrati in Krmo, na kar kažejo zgornjetuvalski apnenci hallstatskega tipa na Kukovi špici. Takšna grebenska sedimentacija se je nadaljevala najbrž brez večje prekinitve do kraja triasne periode, saj nikjer nad grebenskim apnencem ni skladnatega dachsteinskega apnenca. Norijsko-

retijski grebenski kompleks doseže tu največjo debelino, do 1000 m, in predstavlja najdebelejši grebenski razvoj tega časa v Julijskih Alpah in v Sloveniji sploh (Sl. 2).

PALEONTOLOŠKA OBDELAVA GREBENSKIH FOSILOV

Iz nahajališč Dovški križ, Šplevta, Kopica, Tominškova pot, Rušnata Mlinarica in Kot so obdelani grebenski fosili, ki pripadajo koralam, hidrozojem, hetetidam, spongijam, algam, foraminiferam in mikroproblematikam.

Korale pripadajo 23 vrstam in 16 rodovom. Dve vrsti sta novi. Opisi so podani v angleškem besedilu; obsegajo sinonimiko vsake vrste s kratkim opisom, primerjavo in razširjenostjo. Korale pripadajo podredovom Pachythecalina, Archaeocoeniina, Faviina, Fungiina, Stylophyllina, to je skoraj vsem doslej znanim podredovom tega obdobja. Dokončna sistematika bo podana, ko bomo obdelali vse triasne korale naših krajev in bo primerjava popolnejša. Pri opisu vrst so uporabljane mednarodne kratice za skeletne elemente, to je d = premer koralita ali koraluma, s = število sept. Dve novi vrsti sta tudi v slovenskem besedilu posebej opisani.

Poleg koral so iz omenjenih grebenov opisani ali determinirani še: 3 vrste hidrozojev, 1 hetetida, 6 vrst spongij, 2 vrsti alg solenopornega tipa, 2 vrsti mikroproblematik in foraminifera *Alpinophragmium perforatum*. Tudi pri teh fosilih je v angleškem besedilu navedena sinonimika ali vsaj točna lokacijska dokumentacija. Vsi omenjeni fosili so prikazani v abecednem redu na tabeli (Sl. 3).

Ugotovljene so še redke dazikladaceje, majhne foraminifere, polži, školjke, cefalopodi in krinoidi, vendar ti fosili niso podrobneje obdelani. Nismo pa našli mikroproblematik *Tubiphytes* in *Microtubus*, ki so sicer precej pogostni spremljevalci grebenov v raznih krajih.

Opis novih vrst koral

Genus *Elysastraea* Laube 1865
Elysastraea juliana n. sp.
Tab. 5, sl. 1—4; Tab. 6, sl. 1—2

Ime: Imenovana po Julijskih Alpah
Holotypus: Vzorec 61/81-1
Locus typicus: Kopice
Starost: Spodnji norij
Material: Dva odlomka kolonij, 4 zbruski
Diagnoza: *Elysastraea* s cerioidno-faceloidno-meandroidnimi koraliti in dimenzijami d = 3—4 mm, s = 20—30.

Opis: Kolonija je cerioidno-faceloidno-meandroidna. Koraliti so mono- do policentrični. Imajo debelo septoteko. Septa so v več redovih, ki se ločijo po debelini. Lateralno so nazobčana. Kolumele ni. Razmnoževanje z delitvijo, tako

da se dva nasprotna septuma močno odebelita in spojita, iz česar nastane nova stena in nov koralit. Endoteka je tabulatna, mikrostruktura prekristalizirana.

Primerjava: Pri ponovnem opisu rodu *Elysastraea* Laube 1865 je *Cuif* (1976, 118—121, Pl. 12, Fig. 1—3) poudaril, da je pri holotipu *E. fischeri* močno poudarjen faceloidni videz kolonije. To lastnost vidimo na našem primerku, ki se od tipične vrste loči po manjših koralitih (d = 485 mm) in tanjših septih mlajših ciklov. Po strukturi sept spominja na rod *Stuoresia* Cuif 1976, ki je pa v celoti cerioiden. Naša vrsta nekako povezuje rodova *Elysastraea* in *Stuoresia,* v faceloidnem videzu delno tudi *Retiophyllia.*

Razširjenost: *E. fischeri* Laube 1865 je najdena v kasijanskih skladih Dolomitov (VOLZ 1896). Primerek *Elysastraea* sp. omenja RONIEWICZ (1974) v retiju v Tatrah. Njen primerek je cerioidno-plokoiden.

Material: Kopice (61/81-1, -2). Spodnji norij.

Genus *Tropidendron* Cuif 1975
Tropidendron mlinaricensis n. sp.
Tab. 12, sl. 1—6; Tab. 13, sl. 1—5

Ime: Imenovana je po nahajališču Mlinarice
Holotypus: Vzorec 15/82-6
Locus tyicus: Rušnata Mlinarica
Starost: Spodnji norij
Material: 5 kolonij s 7 zbruski
Diagnoza: *Tropidendron* z nepravilno razvejanimi koraliti in dimenzijami d = 2—3,5(4) mm, s = 24 + s.

Opis: Faceloidna kolonija ima okrogle koralitete, ki brstijo lateralno. Septa so kompaktna, v 3—4 ciklih, okrašena so s trnki in penulami. Kolumela je stiliforma, zelo razvita. V nekaterih koralitih je prekristalizirana. Endoteka je iz tankih tabulatnih in vezikularnih disepimentov. Stena se vidi samo na skrajnem perifernem robu in zgleda, da je iz odebelitev sept, torej neke vrste nepopolna septoteka. Mikrostruktura slabo ohranjena.

Dimenzije: Holotip ima premer 2—3 mm, nekateri drugi primerki 2—4 mm.

Primerjava: Nova vrsta se loči od tipa *T. rhopalifer* (CUIF: 1975: 94—95, Pl. 12, Fig. 1—6) po manjših koralitih in manjšem številu sept.

Material: Rušnata Mlinarica (15/82, holotip, 16/85-2, 17/85, 19/85-2), Tominškova pot (8/85). Spodnji norij.

BIOSTRATIGRAFSKA PRIMERJAVA FOSILOV Z DRUGIMI NAHAJALIŠČI V SLOVENIJI IN V SVETU

V Sloveniji je bila prva paleontološka obdelava norijsko-retijskih grebenotvornih organizmov napravljena iz materiala na Begunjščici. Material je bil nabran na več lokalitetah, vendar ne sistematično. Na podlagi vodilnih vrst *Cheilosporites tirolensis* in *Stromatomorpha rhaetica* in celotne favne ter

flore, ki se po takratnem poznavanju skoraj popolnoma sklada s fosili retijskih grebenskih apnencev v Severnih Apneniških Alpah, je bil grebenski apnenec na Begunjščici uvrščen v retijsko stopnjo (FLÜGEL & RAMOVŠ 1961, 287—294).

Preliminarno so bili določeni grebenotvorni organizmi norijsko-retijskega obdobja iz več krajev Julijskih Alp, Pokljuke, Bohinja, Rdečega roba, Ratitovca, Cerkelj pri Kranju, toda favna in flora še nista sistematično obdelani in tudi starost omenjenih nahajališč še ni v celoti rešena (BUSER & al. 1982: 21). Podobna fosilna združba je tudi na Zlatiboru, ki prav tako še ni obdelana.

Drugod po Evropi in v južni Aziji so grebenom severnih Julijskih Alp bolj ali manj podobni tisti, ki se pojavljajo v pasu od Dolomitov preko Severnih Apneniških Alp do Tater, približno med 45. in 50. vzporednikom, ter južneje v pasu od Sicilije preko Grčije, Turčije, Irana do Pamirja, približno med 35. in 40. vzporednikom.

Največ istih vrst (16) kot v Julijskih Alpah je v Severnih Apneniških Alpah (FRECH 1890, ZANKL 1969, SCHÄFER 1979, DULLO 1980, SENOWBARI-DARYAN 1980, SADATI 1981, WURM 1982, MATZNER 1986 in drugi). V Langobardiji v Italiji so 4 iste vrste (STOPPANI 1860—1865), v gorovju Mecsek na Madžarskem je samo ena (KOLOSVÁRY 1966 a), v Tatrah na Češkem jih je 5 (KOLOSVÁRY 1966 b, GAŹDZICKI 1974, RONIEWICZ 1974), na Siciliji pa 9 istih vrst predvsem spongij in alg (SENOWBARI-DARYAN & al. 1982, SENOWBARI-DARYAN 1984, SENOWBARI-DARYAN & SCHÄFER 1986), v Grčiji dve (SCHÄFER & SENOWBARI-DARYAN 1982), v Turčiji dve isti vrsti (CUIF 1975, 1976, 1977), v Iranu so 4 (KRISTAN-TOLLMANN & al. 1980) in na Pamirju 9 istih vrst (BOIKO 1970, 1977, MELINKOVA 1967, 1968, 1972, 1975, 1983). Ena ista vrsta je omenjena na Timorju (VINASSA de REGNY 1915) in dve celo v Ameriki (STANLEY 1979).

Taka kvantitativna primerjava fosilnih vrst nikakor ni popolna, saj je v veliki meri odvisna od metodike dela in sedanje stopnje raziskanosti v posameznih nahajališčih, vendarle pa daje približno sliko razširjenosti grebenov v posameznih geoloških obdobjih.

Več kot tri četrtine najdenih grebenskih fosilov je bilo doslej znanih v norijskih in retijskih grebenih. Zato lahko uvrstimo obravnavana nahajališča v severnih Julijskih Alpah v celoti v to obdobje. Posamezna nahajališča pa se vendar nekoliko razlikujejo med seboj.

Na Rušnati Mlinarici so najdene oblike, znane doslej v karnijski dobi, in sicer so to koralni rodovi *Craspedophyllia, Margarosmilia, Tropidendron* ter spongija *Vesicocaulis.* Med njimi pa se pojavljajo tudi že značilne norijsko-retijske vrste kot so *Cuifia, Cyathocoenia, Distichopyllia, Paradistichopyllum, Phacelostylophyllum* in druge. Zato nahajališča v Mlinaricah lahko po favni uvrstimo v spodnji norij, kjer so se te združbe še mešale s starejšimi karnijskimi elementi. Táko starost potrjuje tudi položaj omenjenih nahajališč v stratigrafskem zaporedju (primerjaj poglavje o stratigrafskem položaju nahajališč ter sl. 2 in 4 c, d.).

Tudi na Tominškovi poti se pojavlja rod *Tropidendron,* enaka kot v Rušnati Mlinarici sta še *Distichophyllia* in *Cuifia.* V tem nahajališču pa v višjih plasteh dobimo tudi rod *Retiophyllia.* Začetek grebenske sedimentacije zato lahko pri-

merjamo s tistim v Mlinaricah, greben pa je v Tominškovi poti trajal nekoliko dlje.

Grebenski kompleks Kopice, Šplevta in Dovški križ pa lahko s pomočjo fosilov razdelimo na različne stratigrafske horizonte.

Nova vrsta doslej karnijskega rodu *Elysastraea* v Kopicah je najstarejša in lahko ustreza spodnjemu noriju.

Nasprotno pa v Šplevti in Dovškem križu karnijskih elementov ni več. Tu dobimo več norijsko-rexijskih rodov in vrst, ki jih ni v prej omenjenih nahajališčih, na primer več vrst rodu *Retiophyllia*, rod *Gillastraea*, *Parathecosmilia*, nekatere spongije, pa *Alpinophragmium* in druge. Zato Šplevto in Dovški križ lahko postavimo nekoliko više v stratigrafski lestvici, to je v zgornji norij in retij. Pa tudi med Dovškim križem in Šplevto so nekatere razlike v fosilnih združbah. V Dovškem križu se pojavljajo *Parathecosmilia langobardica, Toechastraea pachyphyllia, Procyclolites triadicus,* ki jih v Šplevti ni. Verjetno spada Dovški križ v celoti v retij (primerjaj Sl. 2 in 4 ab).

FOSILNE ZDRUŽBE

V norijsko-retijskih grebenskih apnencih severnih julijskih Alp so bile ugotovljene naslednje pomembnejše fosilne združbe:

Dovški križ

Združba *Toechastraea pachyphyllia — Procyclolites triadicus* (Tab. 3, sl. 5—6; Tab. 9, sl. 4—5; Tab. 16, sl. 8).
Združba *Parathecosmilia langobardica* (Tab. 8, sl. 1—2).
Združba kalcispongij (Tab. 15, sl. 3; Tab. 16, sl. 7—8).
Detritični apnenec z odlomki grebenskih fosilov (Tab. 16, sl. 10).

Šplevta

Združba *Parathecosmilia sellae — Solenopora styriaca* (Tab. 8, sl. 3—5, Tab. 15, sl. 6).
Združba *Retiophyllia — Alpinophragmium* (Tab. 10, sl. 1—7; Tab. 11, sl. 1—3, 5; Tab. 16, sl. 4—5).
Združba *Gillastraea delica — Retiophyllia clathrata — Distichophyllia gosaviensis* (Tab. 6, sl. 3—4); Tab. 10, sl. 5).
Združba *Cuifia elliptica* (Tab. 4, sl. 3—4).
Združba *Pachydendron microthallos — Alpinophragmium perforatum* (Tab. 7, sl. 1—2).
Združba *Annaecoelia mirabilis — Battaglia minor — Alpinophragmium perforatum* (Tab. 15, sl. 1, 4).

Kopice

Združba *Elysastraea juliana* (Tab. 5, sl. 1—4; tab. 6, sl. 1—2).

Tominškova pot

Združba *Phacelostylophyllum pygmaeum — Cuifia elliptica — Distichophyllia gosaviensis* (Tab. 9, sl. 1; tab. 14, sl. 4).
Združba *Paradistichophyllum noricum* (Tab. 7, sl. 3—4).
Združba *Cuifia* sp. (Tab. 4, sl. 2).

Kot

Združba *Paradistichophyllum* sp. — *Cuifia elliptica — Cheilosporites tirolensis* (Tab. 7, sl. 5).

Rušnata Mlinarica

Združba *Tropidendron mlinaricensis — Paradeningeria alpina* (Tab. 12, sl. 1—6; tab. 13, sl. 1—5).
Združba *Cyathocoenia juvavica* (Tab. 3, sl. 3—4).
Združba *Paradistichophyllum* sp. — *Vesicocaulis* sp. (Tab. 15, sl. 2).
Združba *Distichophyllia gosaviensis* (Tab. 4, sl. 5).
Združba *Margarosmilia* sp. — *Radiomura cautica* (Tab. 6, sl. 5; tab. 16, sl. 2—3).
Kalcispongijska združba (Tab. 15, sl. 5).
Biocenoza s *Cayeuxia* sp. (Tab. 15, sl. 7).

PALEOEKOLOŠKE ZNAČILNOSTI

V norijski in retijski dobi je bila v severnih Julijskih Alpah sedimentacija na karbonatni platformi. Nastajali so skladnati dachsteinski apnenci, vmes pa so na mnogih mestih rasli grebenski organizmi in sestavljali različne biološke asociacije, ki so gradile večje ali manjše »patch« grebene, iz katerih so nastajali obsežni grebenski kompleksi.

Korale so najvažnejši in prevladujoči grebenski graditelji. Spongije in hidrozoji so podrejeni. Spongiostromatne skorjaste prevleke prispevajo pomemben delež k biolititu. Zanimiva je odsotnost primerov *Tubiphytes* in *Microtubus* kot sekundarnih grebenotvorcev. Dazikladaceje in foraminifere so zelo redke.

Večina najdenih koral v severnih Julijskih Alpah je faceloidnega tipa. Povsod po svetu jih raziskovalci uvrščajo med predstavnike grebenskega okolja z visoko vodno energijo. Prav to dokazuje tudi *Alpinophragmium perforatum*. Hidrozoji, spongije, solenopore ter solitarne in skorjaste korale pa se v literaturi omenjajo tako v centralnih delih grebenov kakor tudi v njihovih obrobjih, zlasti bliže zagrebenu, v bolj zavarovanih delih grebena z nižjo vodno energijo (glej STANTON & FLÜGEL 1987).

V grebenih severnih Julijskih Alp ne opazujemo zoniranja fosilov na grebenske, predgrebenske in zagrebenske enote. Pojavlja pa se velika raznolikost v fosilnih združbah med posameznimi grebeni (glej prejšnje poglavje). Največ 40 % vrst je bilo najdenih v dveh ali več nahajališčih. Več kot polovica ali celo tri četrtine združb pa je takih, ki so vezane na eno samo nahajališče (sl. 5). Te razlike si razlagamo deloma z različno starostjo posameznih grebenskih kom-

pleksov (na primer Rušnata Mlinarica in Šplevta) deloma pa tudi z različnimi lokalnimi ekosistemi, v katerih so uspevali posamezni biotopi, ki so se kljub isti platformi nekoliko razlikovali med seboj zaradi globine, svetlobe, vodnih tokov in drugega (na primer Šplevta in Dovški križ, ali Rušnata Mlinarica in Kot). Znotraj enega takega grebenskega kompleksa so se posamezne združbe omejevale na posamezne kraje in gradile »patch« grebene, ki so bili enote zase. Često en sam rod ali celo ena sama vrsta gradi večji del ogrodja posameznih manjših grebenov. Med posameznimi grebeni pa se je odlagal bioklastični detritični apnenec z odlomki raznih organizmov in drugega detritogenega materiala. Fragmenti so večinoma obdani s spongiostromatnimi skorjami. Ta sedimentacija predstavlja medgrebenski razvoj in je važen sestavni del neskladnatega dachsteinskega apnenca.

Iz vsega povedanega vidimo, da je v času norijske in retijske dobe bila julijska karbonatna platforma stabilna enota z enakomernim pogrezanjem, ki je omogočilo tvorbo do 1000 m debelih grebenskih apnencev. Povezavo z globljim morjem najdemo proti jugu v slovenskem jarku, v katerem je v tem času nastajal baški dolomit. V posameznih intraplatformnih kanalih (na Pokljuki) pa so nastajali apnenci z roženci (BUSER et al. 1982).

REFERENCES — LITERATURA

BEAUVAIS, L., 1972: Deux nouveaux genres de Madréporaires triasiques. Bull. Soc. Géol. Fr. sér. 7., *14*, 310—314, Pl. 6, Paris.

BOIKO, E, V., 1970: Tri novih roda pozdnetriasovih stromatoporoidej Jugo-Vostočnogo Pamira. Paleont. žurnal *1970, 4*, 46—51, Tab. 5—6, Moskva.

BOIKO, E. V., 1979: Pozdnetriasovie Hydrozoa Jugo-Vostočnogo Pamira. Donit, 113 p., Tab. 1—28, Dushanbe.

BUSER, S., RAMOVŠ, A. & TURNŠEK, D., 1982: Triassic Reefs in Slovenia. Facies *6*, 15—24, Erlangen.

CUIF, J. P., 1966: Structure de quelques Polypiers phacéloides triasiques. Bull. Soc. Géol. Fr. sér. 7., *8*, 125—132, Pl. 4, Paris.

CUIF, J. P., 1972: Recherches sur les Madréporaires du Trias. I. Famille des Stylophyllidae. Bull. Mus. nation. Hist. nat. sér. 3., *97*, Sci. Terre *17*, 211—291, Paris.

CUIF, J. P., 1974: Recherches sur les Madréporaires du Trias. II. Astraeoida. Révision des genres *Montlivaltia* et *Thecosmilia*. Étude de quelques types structuraux du Trias de Turquie. Bull. Mus. nation. Hist. nat. sér. 3., *275*, Sci. Terre *40*, 293—400, Paris.

CUIF, J. P., 1975: Recherches sur les Madréporaires du Trias. III. Étude des structures pennulaires chez les Madréporaires triasiques. Bull. Mus. nation. Hist. nat. sér. 3., *310*, Sci. Terre *44*, 45—127, Pl. 1—18, Paris.

CUIF, J. P., 1976: Recherches sur les Madréporaires du Trias. IV. Formes cérioméandroides et thamnastéroides du Trias des Alpes et du Taurus sud-anatolien. Bull. Mus. nation. Hist. nat. sér. 3., *381*, Sci. Terre *53*, 65—195, Pl. 1—17, Paris.

CUIF, J. P., 1977: Arguments pour une relation phylétique entre les Madréporaires paléozoiques et ceux du Trias. Implications systématiques de l'analyse microstructurale des Madréporaires triasiques. Mém. Soc. Géol. Fr. n. s., *56*, 129, 1—54, Pl. 1—13, Paris.

CUIF. J. P., 1980: Microstructure versus morphology in the skeleton of Triassic Scleractinian Corals. Acta Palaeont. Polonica *25*, 361—374, Warszawa.

DIENER, C., 1884: Ein Beitrag zur Geologie des Centralstockes der Julischen Alpen. Jb. Geol. R. A. *34*, 659—705, Wien.

DULLO, W. CH., 1980: Paläontologie, Fazies und Geochemie der Dachstein-Kalke (Ober-Trias) im südwestlichen Gesäuse, Steiermark, Österreich. Facies *2*, 55—122, Taf. 9—13, Erlangen.

FLÜGEL, E., 1960: Solenoporaceen (Algae) aus den Zlambach Schichten (Rhät) der Fischerwiese bei Alt-Aussee, Steiermark. N. Jb. Geol. Paläont., Mh. 1960, *8*, 339—354, Stuttgart.

FLÜGEL, E., 1967: Eine neue Foraminifere aus den Riffkalken der nordalpinen Ober-Trias: *Alpinophragmium perforatum* n. g., n. sp. Senck. Leth. *48*, 381—402, Taf. 1—2, Frankfurt.

FLÜGEL, E., 1972: Mikroproblematika in Dünnschliffen von Trias-Kalken. Mitt. Ges. Geol. Bergbaustud. *21*, 957—988, Taf. 1—5, Innsbruck.

FLÜGEL, E. & RAMOVŠ, A., 1961: Fossilinhalt und Mikrofazies des Dachsteinkalkes (Ober-Trias) im Begunjščica-Gebirge, S-Karawanken (NW-Slovenien, Jugoslavien). N. Jb. Geol. Paläont. 1961, *6*, 287—294, Stuttgart.

FRECH, F., 1890: Die Korallenfauna der Trias. I. Die Korallen der juvavischen Triasprovinz (Zlambachschichten, Hallstätter Kalke, Rhaet). Palaeontographica *37*, 1—116, Taf. 1—21, Stuttgart.

GAŹDZICKI, A., 1974: Rhaetian microfacies, stratigraphy and facial development in the Tatra Mts. Acta Geol. Polonica *24*, 17—96. Pl. 1—52, Warszava.

HAAS, O., 1909: Bericht über neue Aufsammlungen in den Zlambachmergeln der Fischerwiese bei Alt-Aussee. Beitr. Paläont. Österr. Ung. *22*, 143—191, Taf. 5—6, Wien u. Leipzig.

KOLOSVÁRY, G., 1966a: Über Triaskorallenfauna Ungarns. Acta Biol. Szeged. n. s., *12*, 125—137, Szeged.

KOLOSVÁRY, G., 1966b: Angabe zur Kenntnis der Triaskorallen und der begleitenden Fauna der ČSSR. Geol. práce, Zpravy *38*, 179—188, Tab. 7—8, Bratislava.

KRISTAN-TOLLMANN, E., TOLLMANN, A. & HAMEDANI, A., 1980 Beiträge zur Kenntnis der Trias von Persien. II. Zur Rhätfauna von Bagerabad bei Isfahan (Korallen, Ostracoden). Mitt. österr. geol. Ges. *73*, 163—235, Taf. 1—13, Wien

LEMAITRE, D., 1935: Spongiomorphides et Algues. Description des Spongiomorphides et des Algues. Études Paléontologiques sur le Lias du Maroc. Notes Mém. Serv. Mines Maroc 34, 18—58, Pl. 1—12, Rabat.

LEMAITRE, D., 1937: Nouvelles recherches sur les Spongiomorphides et les Algues du Lias et de l'Oolithe inferieure. Notes Mém. Serv. Mines Maroc *43*, 1—25, Pl. 1—4, Rabat.

MATZNER, CH., 1986: Die Zlambach-Schichten (Rhät) in den Nördlichen Kalkalpen: Eine Plattform — Hang — Beckenentwicklung mit allochthoner Karbonatsedimentation. Facies *14*, 1—104, Taf. 1—13, Erlangen.

MELNIKOVA, G. K., 1967: Novie vidi triasovih Skleraktinij Pamira. Paleont. žurnal *1967, 1*, 22—31, Tab. 2, Moskva.

MELNIKOVA, G. K., 1968: O rode Cyathocoenia (Hexacoralla). Paleont. žurnal *1968, 1*, 11—17, Tab. 3, Moskva.

MELNIKOVA, G. K., 1972: K revizii nekotorih pozdnetriasovih i rannejurskih Stylophyllidae. Paleont. žurnal *1972, 2*, 55—63, Tab. 9—10, Moskva.

MELNIKOVA, G. K., 1975: Pozdnetriasovie skleraktinii Jugo-Vostočnogo Pamira. Donit, Akad. nauk Tadž. SSR, Inst. Geol. 236 p., Tab. 1—38, Dushanbe.

MELNIKOVA, G. K., 1983: Novie pozdnetriasovie skleraktinii Pamira. Paleont. žurnal *1983, 1*, 45—53, Tab. 4, Moskva.

OKUDA, H. & YAMAGIWA, N., 1978: Triassic corals from Mt. Daifugen, Nara Prefecture, Southwest Japan. Trans. Proc. Palaeont. Soc. Japan n. s., *110*, 297—305, Pl. 40—41.

PETERS, K., 1856: Bericht über die geologischen Aufnahmen in Kärnten, Krain und dem Görzer Gebiete im Jahre 1855. Jb. Geol. R. A. 7, 629—691, Wien.

RAKOVEC, I., 1933: Geološko-paleontološki oddelek. V. Vodnik po zbirkah narodnega muzeja v Ljubljani. Prirodoslovni del. 119—185, Ljubljana

RAKOVEC, I., 1951: K paleogeografiji Julijskih Alp. Geogr. vestnik *23*, 109—135, Ljubljana.

RAMOVŠ, A., 1985a: Geološke raziskave severnih Julijskih Alp in njihov biostratigrafski razvoj. Jeklo in ljudje. Jeseniški zbornik *5*, 391—428, Jesenice.

RAMOVŠ, A., 1985b: Stratigrafska sestava in tektonski položaj Triglava in okolice. Rudarsko-metalurški zbornik *32*, 163—171, Ljubljana.

RAMOVŠ, A., 1986a: Razvoj zgornjega triasa (norij-retij) v severnih Julijskih Alpah. 11. jugosl. geol. kongres *2*, 99—112, Tara.

RAMOVŠ, A., 1986b: Paläontologisch bewiesene Karn/Nor Grenze in den Julischen Alpen. Newsl. Stratigr. *16*, 133—138, Berlin—Stuttgart.

RAMOVŠ, A. & TURNŠEK, D., 1984: Lower Carnian Reef Buildups in the Northern Julian Alps (Slovenia, NW Yugoslavia). Razprave IV. razr. SAZU *25*, 161—200, Pl. 1—15, Ljubljana.

REUSS, A. E., 1854: Beiträge zur Charakteristik der Kreideschichten in den Ostalpen, besonders im Gosauthale und am Wolfgangsee. Anthozoen. Denkschr. Akad. Wiss. Math. nat. Kl. 7, 1—156, Taf. 1—31, Wien.

RONIEWICZ, E., 1974: Rhaetian corals of the Tatra Mts. Acta Geol. Polonica *24*, 97—116, Pl. 1—10, Warszawa.

SADATI, M., 1981: Die Hohe Wand: Ein obertriadisches Lagunen-Riff am Ostende der Nördlichen Kalkalpen (Niederösterreich). Facies *5*, 191—264, Taf. 54—66, Erlangen.

SCHÄFER, P., 1979: Fazielle Entwicklung und palökologische Zonierung zweier obertriadischer Riffstrukturen in den Nördlichen Kalkalpen (»Oberrhät«-Riff-Kalke, Salzburg). Facies *1*, 1—202, Taf. 1—21, Erlangen.

SCHÄFER, P. & SENOWBARI-DARYAN, B., 1982: The Upper Pantokrator Limestone of Hydra (Greece): An Example of a Prograding Reef Complex. Facies *6*, 147—164, Taf. 19—21, Erlangen.

SEIDL, F., 1929: Zlatenska plošča v Osrednjih Julijskih Alpah. Glasnik Muz. društva Slov. *10, 3—29*, Ljubljana.

SENOWBARI-DARYAN, B., 1980: Fazielle und paläontologische Untersuchungen in oberrhätischen Riffen (Feichtenstein- und Gruberriff bei Hintersee, Salzburg, Nördliche Kalkalpen). Facies *3*, 1—237, Taf. 1—29, Erlangen.

SENOWBARI-DARYAN, B., 1984: Mikroproblematika aus den obertriadischen Riffkalken von Sizilien. Münster Forsch. Geol. Paläont. *61*, 1—81, (Taf. 1—11), Münster.

SENOWBARI-DARYAN, B. & SCHÄFER, P., 1979: Neue Kalkschwämme und ein Problematikum (*Radiomura cautica* n. g., n. sp.) aus Oberrhät-Riffen südlich von Salzburg (Nördliche Kalkalpen). Mitt. österr. geol. Ges. *70* (1977), 17—42, Taf. 1—6, Wien.

SENOWBARI-DARYAN, B. & SCHÄFER, P., 1986: Sphinctozoen (Kalkschwämme) aus den norischen Riffen von Sizilien. Facies *14*, 235—284, Taf. 44—53, Erlangen.

SENOWBARI-DARYAN, B., SCHÄFER, P. & ABATE, B., 1982: Obertriadische Riffe und Rifforganismen in Sizilien (Beiträge zur Paläontologie und Mikrofazies obertriadischer Riffe im alpin-mediterranen Raum, 27). Facies *6*, 165—184, Taf. 22—24, Erlangen.

STANLEY, G. D. Jr., 1979: Paleoecology, Structure, and Distribution of Triassic Coral Buildups in Western North America. Univ. Cansas Paleont. Contrib. *65*, 1—58, Pl. 1—10, Lawrence, Kansas.

STANTON, R. & FLÜGEL, E., 1987: Palecology of Upper Triassic Reefs in the Northern Calcareous Alps: Reef Communities. Facies *16*, 157—186, Erlangen.

STOPPANI, A., 1860—1865: Monographie des fossiles de L'Azzarola. Polypes. Géologie et Paléontologie des Couches a *Avicula contorta* en Lombardie. pp. 100—113. Pl. 21—27, Milan.

TELLER, F., 1910: Geologie des Karawankentunnels. Denkschr. Akad. Wiss. Math. nat. Kl. *82*, 143—250, Wien.

VINASSA de REGNY, P., 1915: Triadische Algen, Spongien, Anthozoen und Bryozoen aus Timor. Paläontologie von Timor. IV. Lief. *8*, 75—118, Taf. 63—72, Stuttgart.

VOLZ, W., 1896: Die Korallenfauna der Trias. II. Die Korallen der Schichten von St. Cassian in Süd-Tirol. Palaeontographica *43*, 1—123, Taf. 1—11, Stuttgart.

WURM, D., 1982: Mikrofazies, Paläontologie und Palökologie der Dachsteinriffkalke (Nor) des Gosaukammes, Österreich. Facies *6*, 203—296, Erlangen.

YAMAGIWA, N., 1963: Some Triassic Corals from Portuguese Timor. Palaeontological Study of Portuguese Timor (II). Memoirs Osaka Univ. *12*, 83—86, Pl. 1. Osaka.

ZANKL, H., 1969: Der Hohe Göll: Aufbau und Lebensbild eines Dachsteinkalk-Riffes in der Obertrias der nördlichen Kalkalpen. Abh. senckenberg. naturf. Ges. *519*, 1—123, Taf. 1—15, Frankfurt.

PLATES – TABLE

EXPLANATION TO PLATES

All the photographs of thin sections except those of microstructure (Pl. 4, Fig. 5; Pl. 5, Fig. 4; Pl. 13, Fig. 4–5) are negatives: thin sections enlarged directly onto the photographic paper.

Photos of all fossil material (surfaces and thin sections, Pl. 3–16) taken by Carmen Narobe, those of landscape (Pl. 1–2) by Anton Ramovš

RAZLAGA K TABLAM

Vse fotografije zbruskov, razen mikrostrukture (Tab. 4, sl. 5; tab. 5, sl. 4; tab. 13, sl. 4–5) so negativni: zbrusek je povečan direktno na fotografski papir.

Vse fotografije fosilnega materiala (površine in zbruske, Tab. 3–16) je izdelala Carmen Narobe, fotografije pokrajine (Tab. 1–2) pa Anton Ramovš

PLATE 1

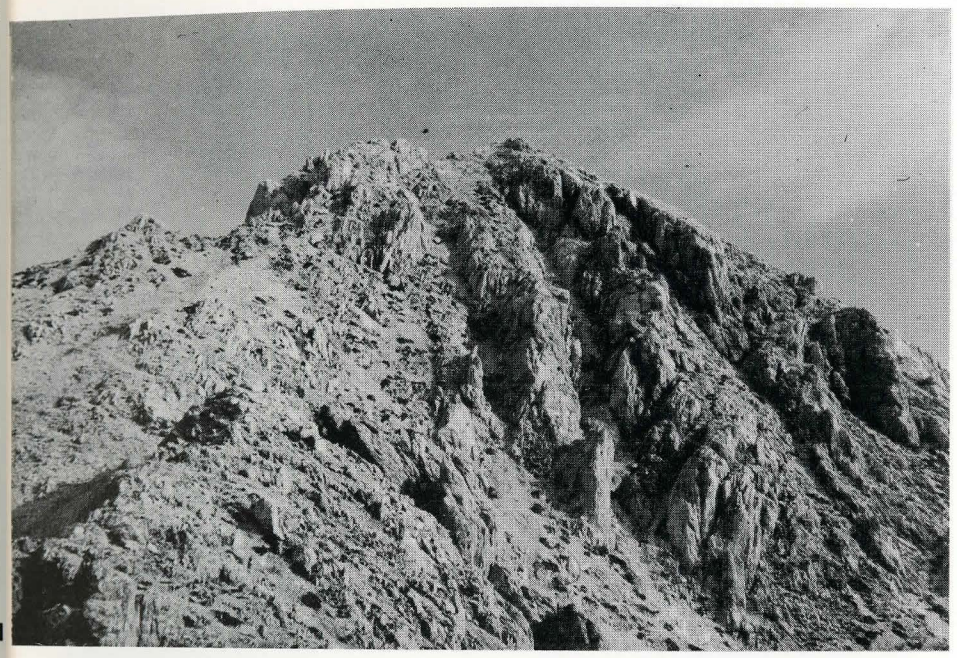
Fig. 1 View to Dovški križ (Peščenik) consisting of very dislocated Norian-Rhaetian ree limestone

Fig. 2 View to Grlo and Oltarji Mountains built of Norian-Rhaetian reef limestone

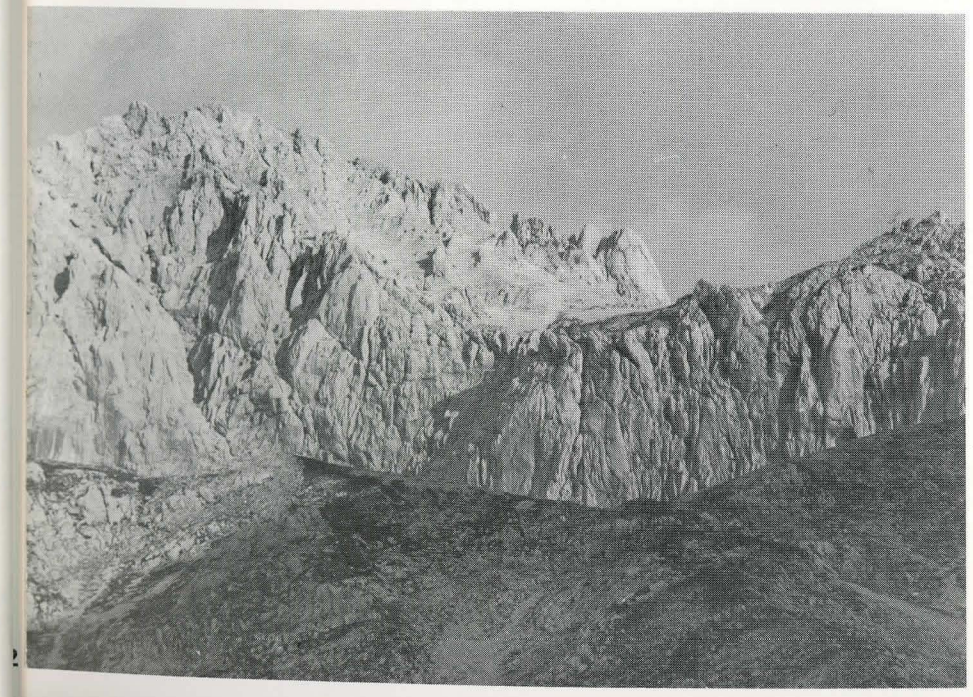
TABLA 1

Sl. 1 Pogled na Dovški križ (Peščenik) z zelo dislociranim norijsko-retijskim grebenskim apnencem

Sl. 2 Pogled na Grlo in Oltarje iz norijsko-retijskega grebenskega apnenca



1



2

PLATE 2

Fig. 1 Eastern slopes of Rušnata Mlinarica with Norian reef Dachstein limestone in the lower part which passes upwards into bedded Dachstein limestone.

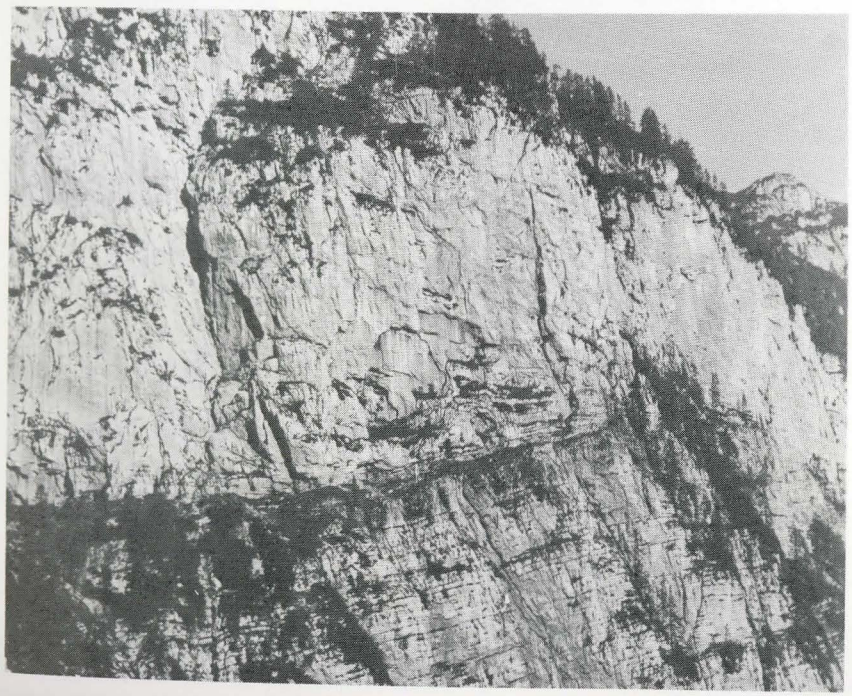
Fig. 2 Eastern slopes of Rušnata Mlinarica consisting in its lower areas of the upper part of Julian-Tuvalian succession, i.e. mostly of brownish micritic limestone with ammonites of Hallstatt type and conodonts. Both indicate uppermost Tuvalian. Upwards follow several layers of bedded light grey Dachstein limestone, which passes vertically into Norian reef limestone. Fig. 1. shows its stratigraphic continuation. In this manner, on Figs. 1. and 2. the stratigraphic succession of the uppermost Tuvalian and a large part of Norian stage are shown.

TABLA 2

Sl. 1 Vzhodno pobočje Rušnate Mlinarice z norijskim grebenskim dachsteinskim apnencem v spodnjem delu, ki navzgor prehaja v skladnati dachsteinski apnenec.

Sl. 2 Vzhodno pobočje Rušnate Mlinarice, ki v spodnjem delu kaže vrhnji del julsko-tuvalske skladovnice, to je predvsem rjavkasti mikritni apnenec z amoniti hallstattskega tipa in konodonti. Oboji dokazujejo najvišji tuval. Navzgor sledi nekaj plasti skladnatega svetlo sivega dachsteinskega apnenca, ta pa navzgor prehaja v norijski grebenski dachsteinski apnenec. Sl. 1 je njegovo stratigrafsko nadaljevanje, tako da sl. 1 in sl. 2 kažeta stratigrafsko zaporedje najvišjega tuvala in precejšnjega dela norijske stopnje.

1



2

PLATE 3

Fig. 1–2 *Astraeomorpha confusa* (Winkler 1861)
1. Radial thin section of colony, 25/85–A4b, x 4.
2. The same thin section, x 8.
Šplevta, Upper Norian – Rhaetian.

Fig. 3–4 *Cyathocoenia juvavica* (Frech 1890)
3. Transverse thin section of colony. 15/82-4, x 4.
4. The same thin section, x 8.
Rušnata Mlinarica, Lower Norian.

Fig. 5–6 *Toechastraea pachyphyllia* Cuif 1976
5. Transverse thin section 59/81-1, x 5.
6. The same thin section, x 8.
Dovški križ, Rhaetian.

TABLA 3

Sl. 1–2 *Astraeomorpha confusa* (Winkler 1861)
1. Radialni presek kolonije. Zbrusek 25/85-A4b, x 4.
2. Isti zbrusek, x 8.
Šplevta, zgornji norij – retij.

Sl. 3–4 *Cyathocoenia juvavica* (Frech 1890)
3. Prečni presek kolonije. Zbrusek 15/82-4, x 4.
4. Isti zbrusek, x 8.
Rušnata Mlinarica, spodnji norij.

Sl. 5–6 *Toechastraea pachyphyllia* Cuif 1976
5. Prečni presek kolonije. Zbrusek 59/81-1, x 5.
6. Isti zbrusek, x 8.
Dovški križ, retij.

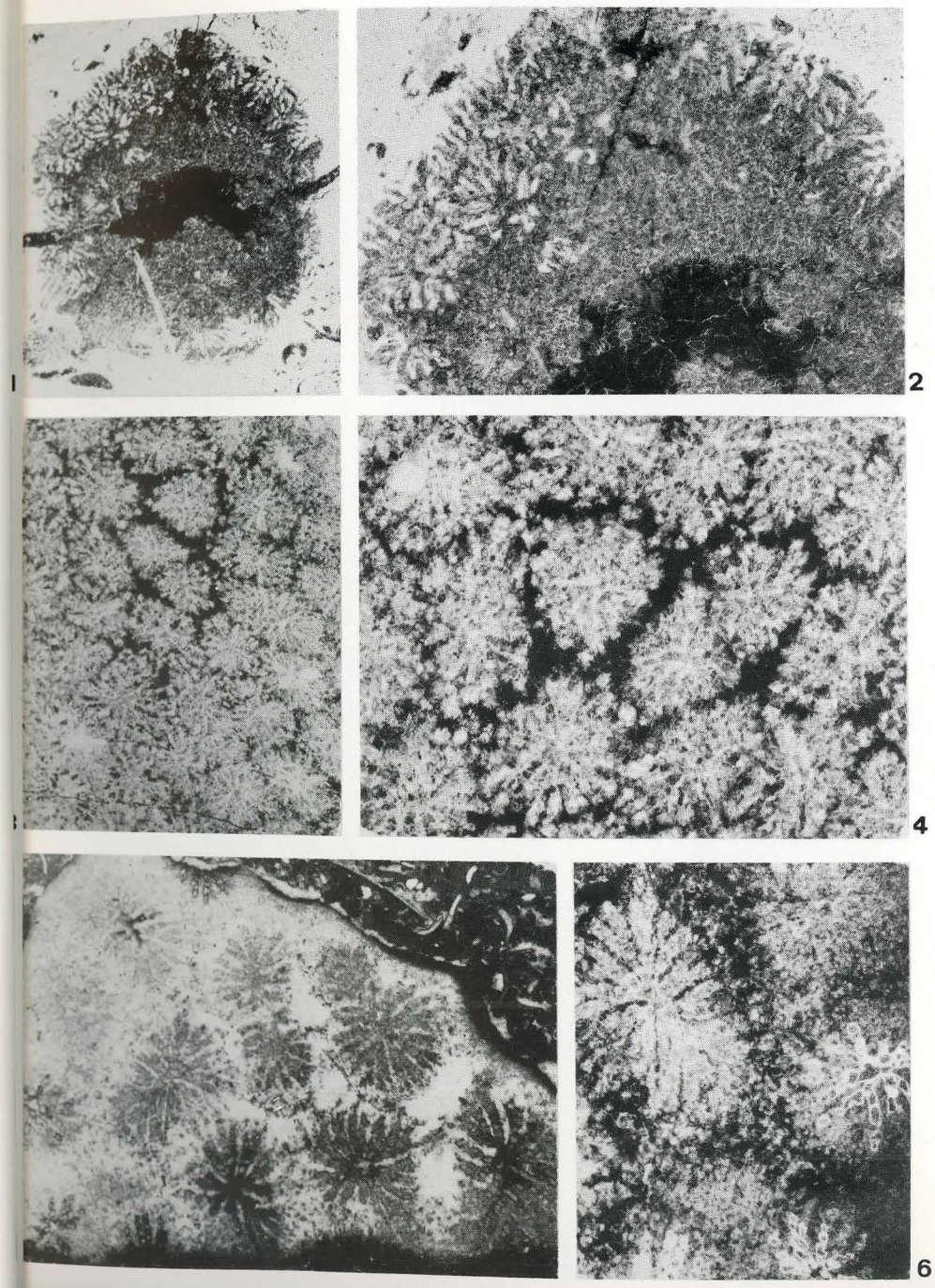


PLATE 4

Fig. 1 *Craspedophyllia* sp.
Transverse section of corallum, note columella.
Thin section 15/82-3, x 4.
Rušnata Mlinarica, Lower Norian.

Fig. 2 *Cuifia* sp.
Transverse thin section 33/82-2, x 4.
Tominškova pot, Lower Norian.

Fig. 3–4 *Cuifia elliptica* Melnikova 1975
3. Transverse surface of corallum. 25/85-A1, x 1.
4. Thin section of corallum, note peripheral dissepiments. 25/85-A1, x 4.
Šplevta, Upper Norian – Rhaetian.

Fig. 5–6 *Distichophyllia gosaviensis* (Frech 1890)
5. Transverse thin section 18/85 c, x 5.
6. The same thin section, axial part, x 8.
Rušnata Mlinarica, Lower Norian.

TABLA 4

Sl. 1 *Craspedophyllia* sp.
Prečni presek koraluma s kolumelo.
Zbrusek 15/82-3, x 4.
Rušnata Mlinarica, spodnji norij.

Sl. 2 *Cuifia* sp.
Prečni presek, zbrusek 33/82-2, x 4.
Tominškova pot, spodnji norij.

Sl. 3–4 *Cuifia elliptica* Melnikova 1975
3. Prečna površina koraluma, vzorec 25/85-A1, x 1.
4. Prečni presek koraluma s perifernimi disepimenti.
Zbrusek 25/85-A1, x 4.
Šplevta, zgornji norij-retij.

Sl. 5–6 *Distichophyllia gosaviensis* (Frech 1890)
5. Prečni presek koraluma, zbrusek 18/85 c, x 5.
6. Isti zbrusek, x 8.
Rušnata Mlinarica, spodnji norij.

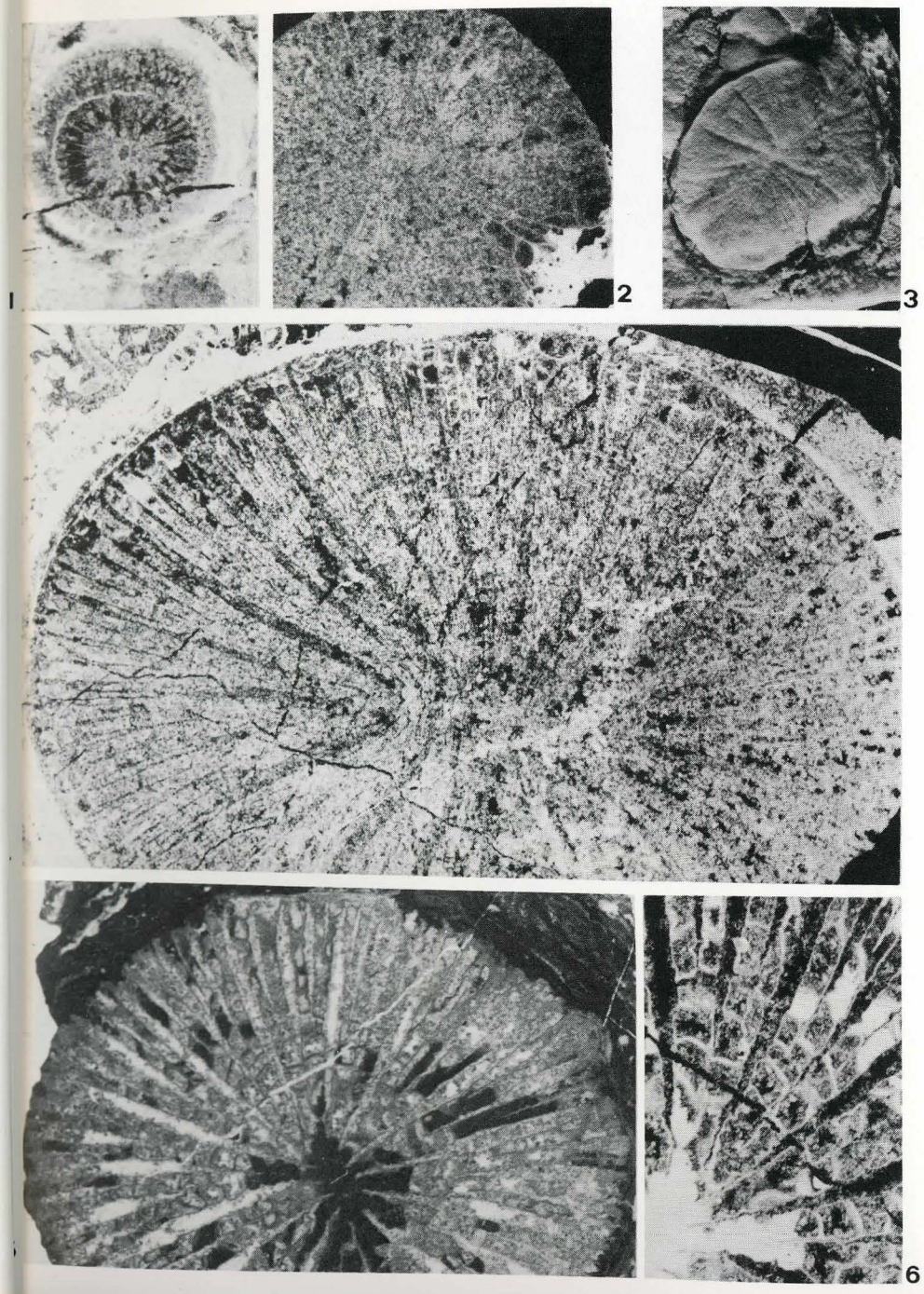


PLATE 5

Fig. 1–4 *Elysastraea juliana* n. sp.
1. Transverse thin section, 61/81-1d, x 4.
2. Transverse thin section, 61/81-1b, x 4.
3. Longitudinal thin section, 61/81-1a, x 4.
4. Detail from fig. 1., microstructure, x 30.
Kopice, Lower Norian All fig. from holotype.

TABLA 5

Sl. 1–4 *Elysastraea juliana* n. sp.
1. Prečni presek kolonije, zbrusek 61/81-1d, x 4.
2. Prečni presek kolonije, zbrusek 61/81-1b, x 4.
3. Podolžni presek koralitov, 61/81-1a, x 4.
4. Detajl s sl. 1, mikrostruktura. x 30.
Kopice, spodnji norij. Vse slike so od holotipa.

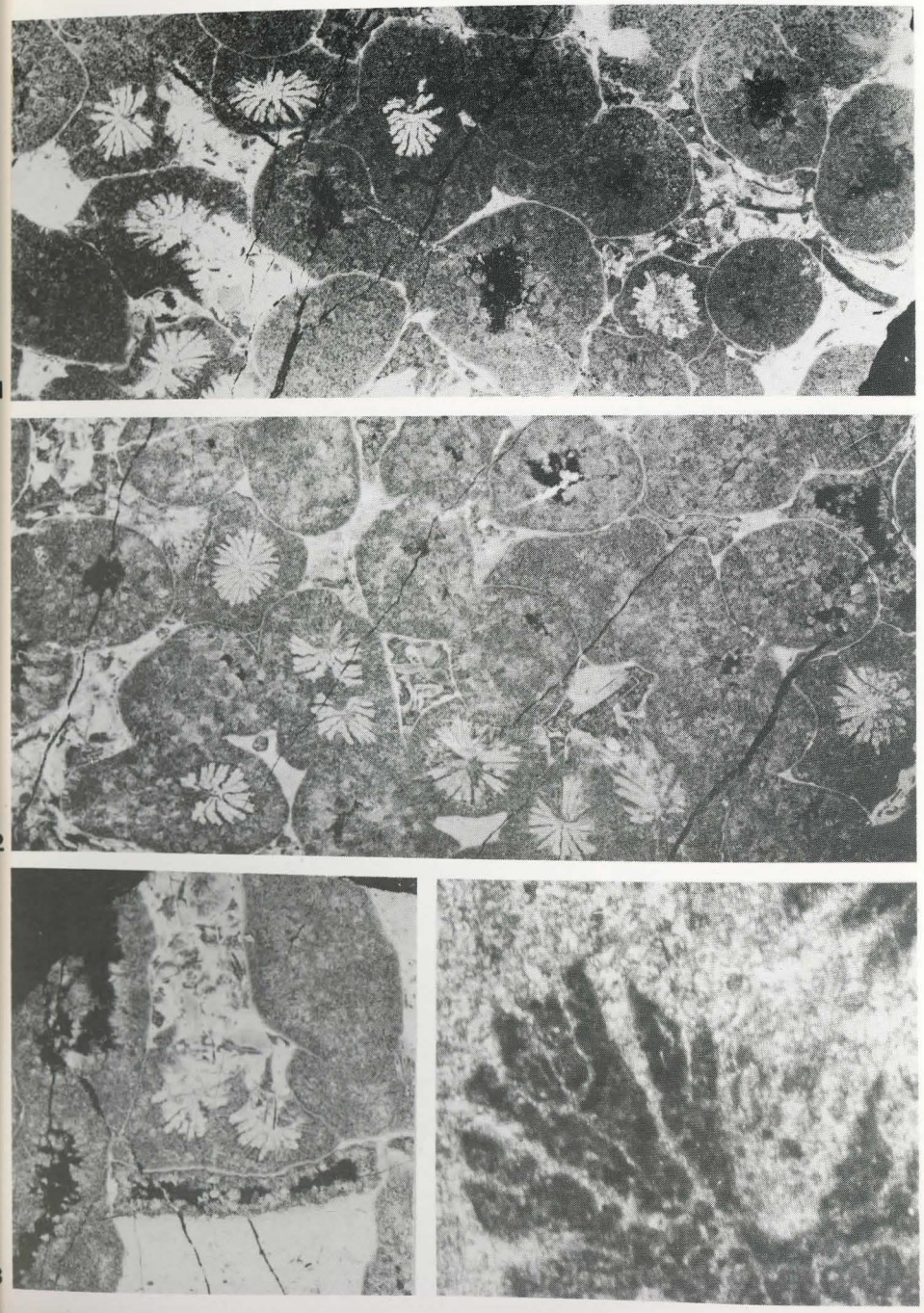


PLATE 6

Fig. 1–2 *Elysastraea juliana* n. sp.
1. Transverse thin section of holotype, 61/81-1b, x 8.
2. Part of longitudinal thin section of holotype, 61/81-1a, x 8.
Kopice, Lower Norian.

Fig. 3–4 *Gillastraea delicata* Melnikova 1983
3. Surface of the colony 25/85, x 1.
4. Transverse thin section 25/85-A3a, x 4.
Šplevta, Upper Norian – Rhaetian

Fig. 5 *?Margarosmilia* sp.
Transverse thin section, 15/85-5, x 4.
Rušnata Mlinarica, Lower Norian.

TABLA 6

Sl. 1–2 *Elysastraea juliana* n. sp.
1. Prečni presek kolonije, Zbrusek 61/81-1b, holotip, x 8.
2. Del podolžnega preseka kolonije. Zbrusek 61/81-1a, x 8.
Kopice, spodnji norij.

Sl. 3–4 *Gillastraea delicata* Melnikova 1983
3. Površina kolonije. Vzorec 25/85, x 1.
4. Prečni presek koralitov. Zbrusek 25/85-A3a, x 4.
Šplevta, zgornji norij – retij.

Sl. 5 *?Margarosmilia* sp.
Prečni presek koralitov. Zbrusek 15/85-5, x 4.
Rušnata Mlinarica, spodnji norij.

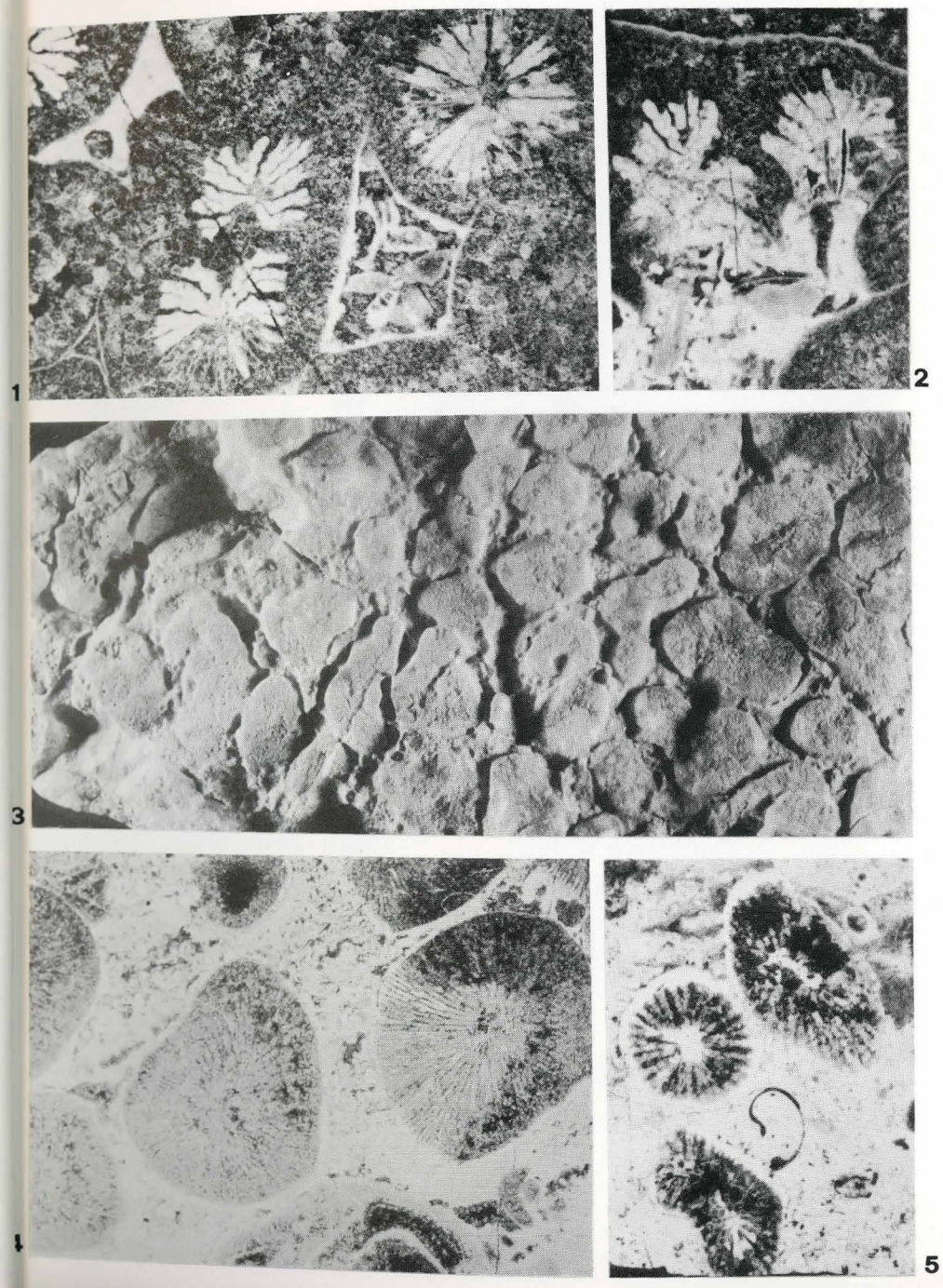


PLATE 7

Fig. 1–2 *Pachydendron microthallos* Cuif 1975
1. Transverse thin section of branched colony, 25/85-5a, x 4.
2. Detail from the same thin section, x 8.
Šplevta, Upper Norian – Rhaetian.

Fig. 3–4 *Paradistichophyllum noricum* (Frech 1890)
3. Surface of the colony. Specimen 14/85, x 1.
4. Transverse thin section of corallites showing abundant peripheral dissepiments, 14/85, x 4.
Tominškova pot, Lower Norian.

Fig. 5 *Paradistichophyllum* sp.
Transverse thin section of corallites overgrown by thick spongiostromate crusts, 26/82-2, x 4.
Kot, Lower Norian.

TABLA 7

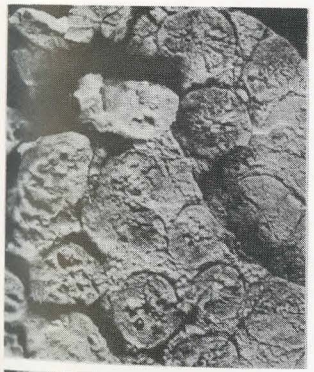
Sl. 1–2 *Pachydendron michrothallos* Cuif 1975
1. Prečni presek vejnate kolonije. Zbrusek 25/85-5a, x 4.
2. Detajl s sl. 1, x 8.
Šplevta, zgornji norij – retij.

Sl. 3–4 *Paradistichophyllum noricum* (Frech 1890)
3. Površina kolonije, vzorec 14/85, x 1.
4. Prečni presek koralitov z bogatimi perifernimi dissepimenti. Zbrusek 14/85, x 4.
Tominškova pot, spodnji norij.

Sl. 5 *Paradistichophyllum* sp.
Prečni presek koralitov, ki so prerasli z debelimi spongiostromatnimi skorjami. Zbrusek 26/82-2, x 4.
Kot, spodnji norij.


1


2


3


4

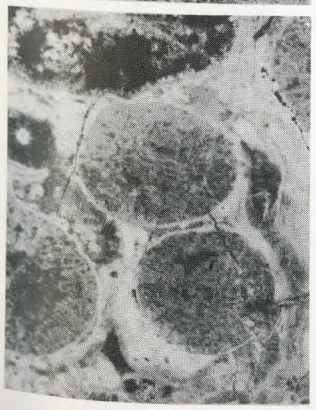

5

PLATE 8

Fig. 1–2 *Parathecosmilia langobardica* (Stoppani 1857)
1. Transverse thin section, 59/81-3a, x 4.
2. Detail from fig. 1., x 8.
Dovški križ, Rhaetian.

Fig. 3–5 *Parathecosmilia sellae* (Stoppani 1862)
3. Transverse thin section of two corallites, 25/85-A2a, x 8.
4. Surface of the colony, specimen 25/85-A2, x 1.5.
5. Transverse thin section, 25/85-A2a, x 4.
Šplevta, Upper Norian – Rhaetian.

TABLA 8

Sl. 1–2 *Parathecosmilia langobardica* (Stoppani 1857)
1. Prečni presek kolonije. Zbrusek 59/81-3a, x 4.
2. Detajl z istega zbruska, x 8.
Dovški križ, retij.

Sl. 3–5 *Parathecosmilia sellae* (Stoppani 1862)
3. Prečni presek dveh koralitov. Zbrusek 25/85-A2a, x 8.
4. Površina kolonije. Vzorec 25/85-A2, x 1,5.
5. Prečni presek kolonije. Zbrusek 25/85-A2a, x 4.
Šplevta, zgornji norij – retij.

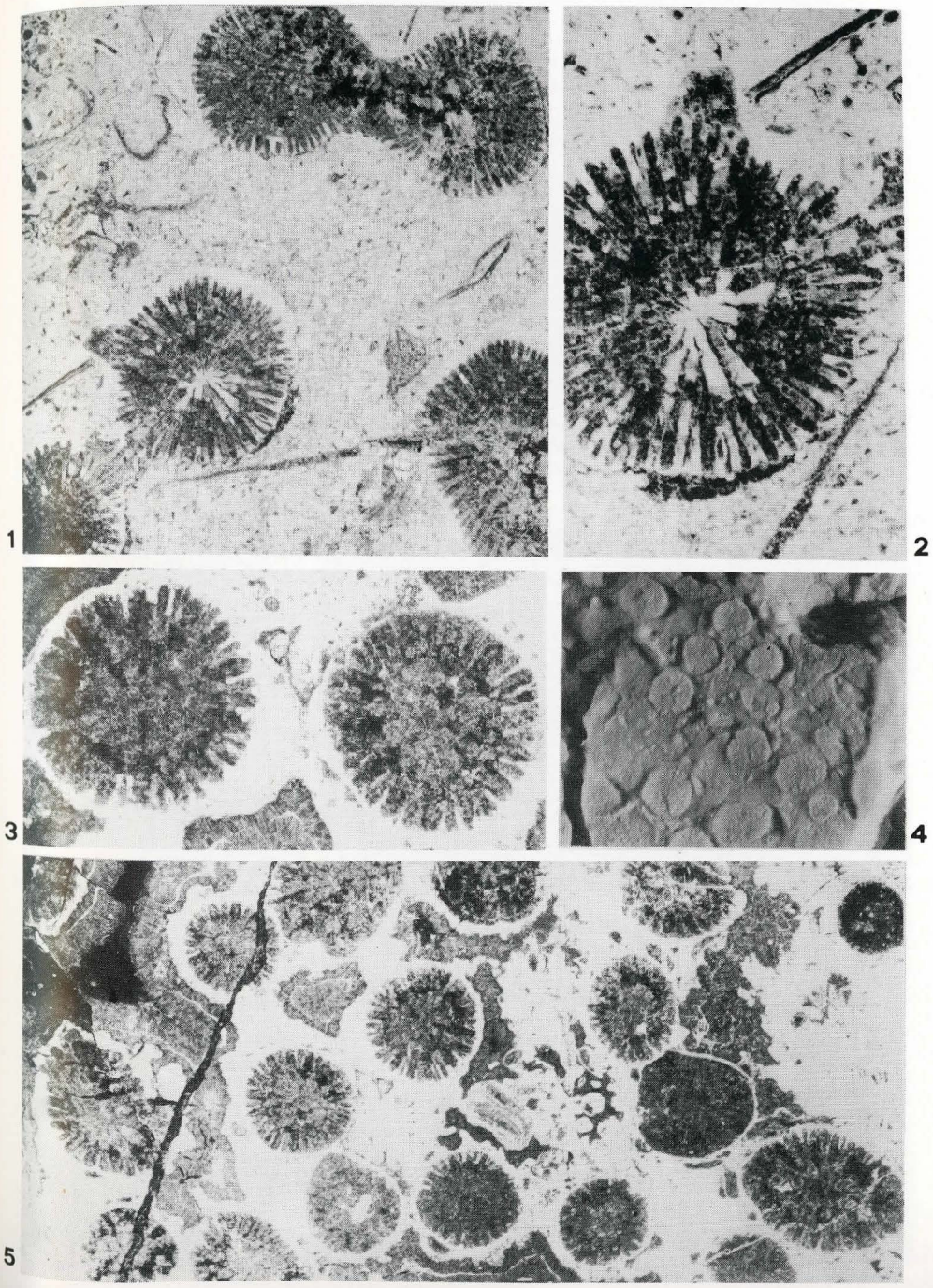


PLATE 9

Fig. 1 *Phacelostylophyllum pygmaeum* (Frech 1890)
1. Transverse and partly oblique thin section of corallites, 5/85e, x 4.
Tominškova pot, Lower Carnian.

Fig. 2–3 *Phacelostylophyllum* cf. *medium* Roniewicz 1974
2. Transverse thin-section of one corallite, 15/82-2a, x 4.
3. The same thin section, x 8.
Rušnata Mlinarica, Lower Norian.

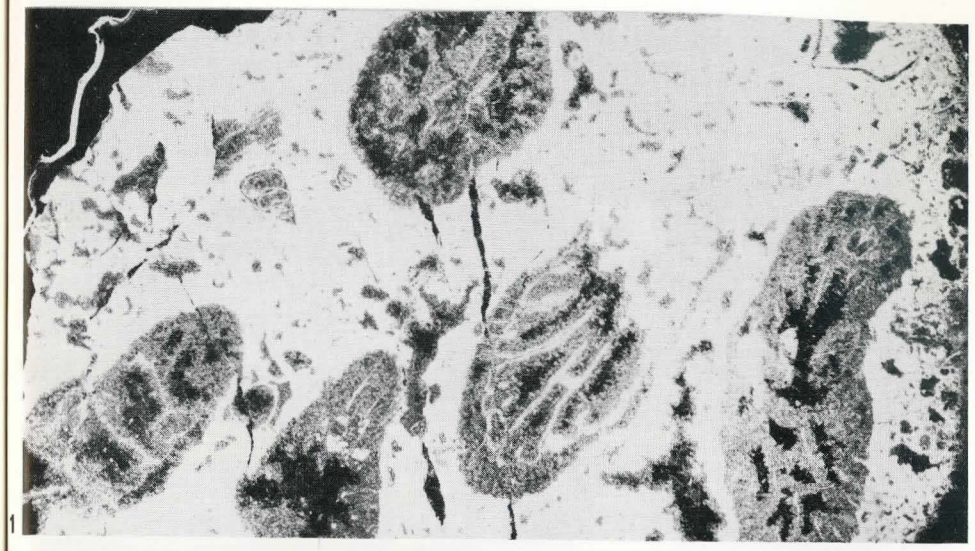
Fig. 4–5 *Procyclolites triadicus* Frech 1890
4. Part of transverse section of corallum. Thin section 59/81-1a, x 4.
5. Detail from the same thin section, x 8.
Dovški križ, Rhaetian.

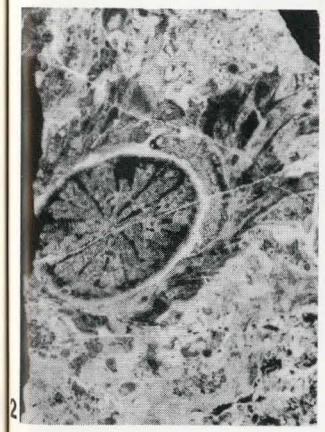
TABLA 9

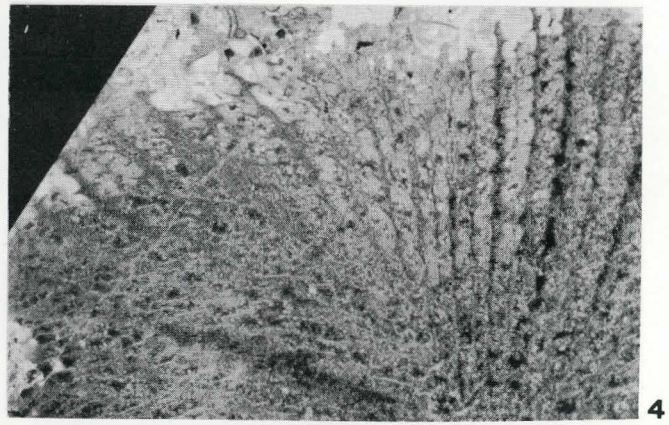
Sl. 1. *Phacelostylophyllum pygmaeum* (Frech 1890)
1. Prečni in deloma poševni presek koralitov. Zbrusek 5/85e, x 4.
Tominškova pot, spodnji norij.

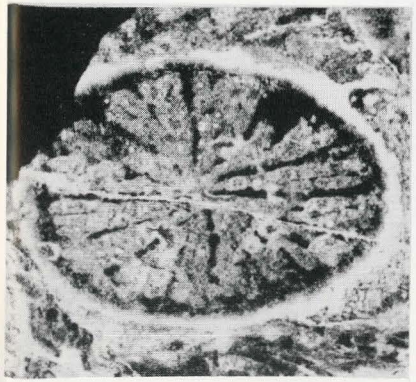
Sl. 2–3 *Phacelostylophyllum* cf. *medium* Roniewicz 1974
2. Prečni presek enega koralita. Zbrusek 15/82-2a, x 4.
3. Presek istega koralita, x 8.
Rušnata Mlinarica, spodnji norij.

Sl. 4–5 *Procyclolites triadicus* Frech 1890
4. Del prečnega preseka koraluma. Zbrusek 59/81-1a, x 4.
5. Detajl z istega zbruska, x 8.
Dovški križ, retij.


1


2


4


3

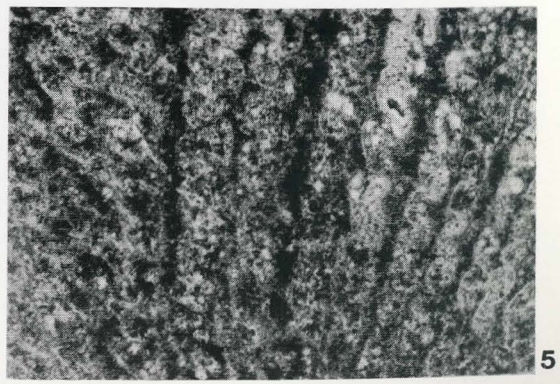

5

PLATE 10

Fig. 1–5 *Retiophyllia clathrata* (Emmrich 1853)
1. Surface of the colony from above. Specimen 25/85-8, x 1.
2. Transverse thin section, 25/85-8a, x 4.
3. Longitudinal thin section of one corallite, 64/81-1a, x 4.
4. Surface of the colony from side. Specimen 25/85-A3, x 1.
5. Transverse thin section of corallites, 25/85-A3b, x 4.
Šplevta, Upper Norian – Rhaetian.

Fig. 6–7 *Retiophyllia paraclathrata* Roniewicz 1974
6. Surface of the colony from above. Specimen 25/85-3, x 1
7. Transverse thin section of the same colony, 25/85-3a, x 4.
Šplevta, Upper Norian – Rhaetian.

TABLA 10

Sl. 1–5 *Retiophyllia clathrata* (Emmrich 1853)
1. Površina kolonije od zgoraj. Vzorec 25/85-8, x 1.
2. Prečni presek kolonije. Zbrusek 25/85-8a, x 4.
3. Podolžni presek enega koralita. Zbrusek 64/81-1a, x 4.
4. Površina kolonije od strani. Vzorec 25/85-A3, x 1.
5. Prečni presek koralitov. Zbrusek 25/85-A3b, x 4.
Šplevta, zgornji norij – retij.

Sl. 6–7 *Retiophyllia paraclathrata* Roniewicz 1974
6. Površina kolonije od zgoraj. Vzorec 25/85-3, x 1.
7. Prečni presek iste kolonije. Zbrusek 25/85-3a, x 4.
Šplevta, zgornji norij – retij.

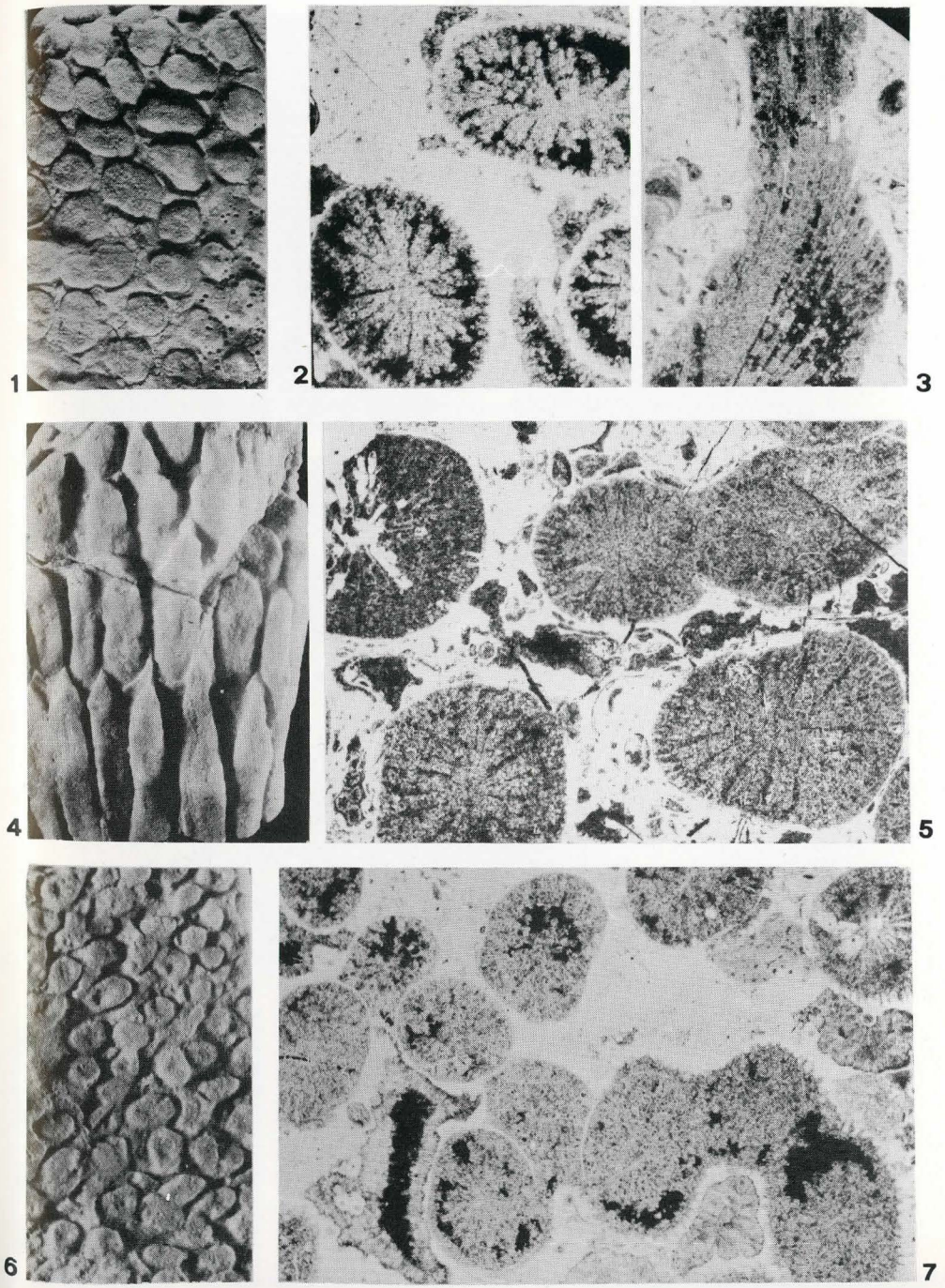


PLATE 11

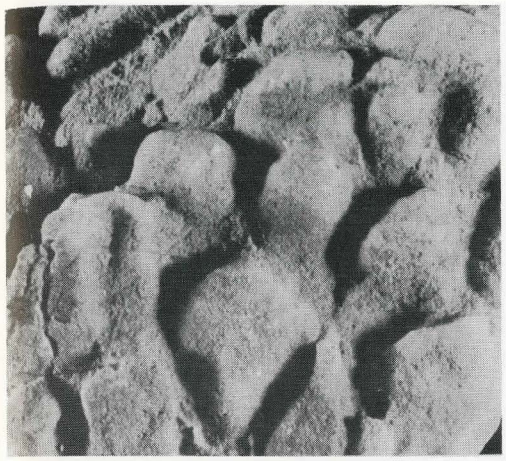
Fig. 1–3 *Retiophyllia defilippi* (Stoppani 1865)
1. Surface of the colony from above, showing irregular branching of corallites. Specimen 25/85-A5, x 1.5.
2. Transverse thin section of two corallites, 25/85-5d, x 4.
3. Transverse thin section of corallites, 25/85-A5a, x 4.
Šplevta, Upper Norian – Rhaetian.

Fig. 4–5 *Retiophyllia fenestrata* (Reuss 1854)
4. Transverse thin section of one corallite, 33/82-2c, x 4.
Tominškova pot, Lower Norian.
5. Transverse thin section of two corallites, 25/85-1d, x 4.
Šplevta, Upper Norian – Rhaetian.

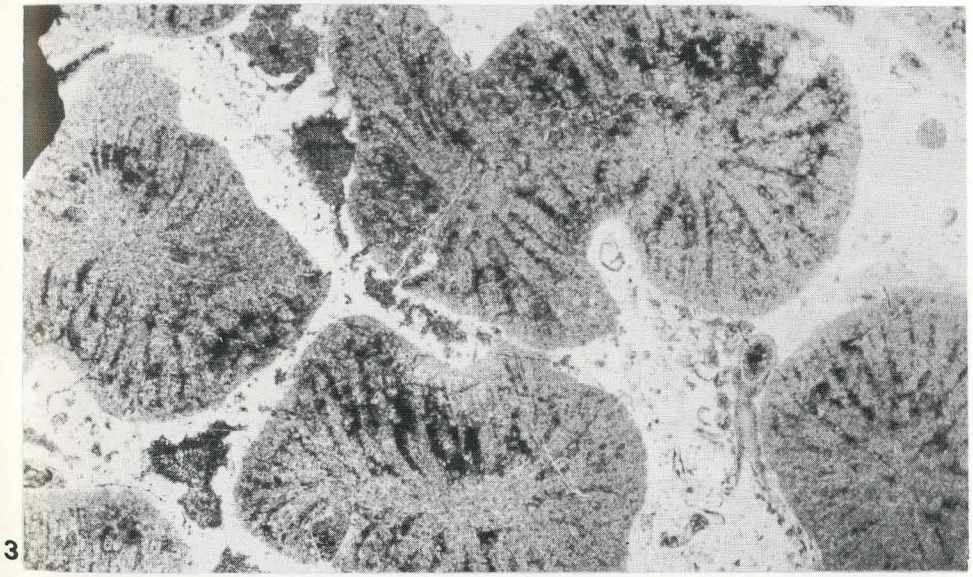
TABLA 11

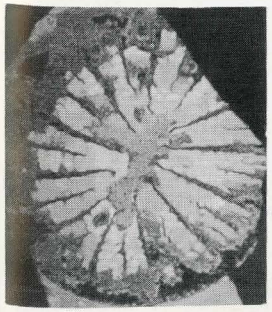
Sl. 1–3 *Retiophyllia defilippi* (Stoppani 1865)
1. Površina kolonije od zgoraj, kaže nepravilno razraščene koralite. Vzorec 25/85-A5, x 1,5.
2. Prečni presek dveh koralitov. Zbrusek 25/85-5d, x 4.
3. Prečni presek koralitov. Zbrusek 25/85-A5a, x 4.
Šplevta, zgornji norij – retij.

Sl. 4–5 *Retiophyllia fenestrata* (Reuss 1854)
4. Prečni presek enega koralita. Zbrusek 33/82-2c, x 4.
Tominškova pot, spodnji norij.
5. Prečni presek dveh koralitov, Zbrusek 25/85-1d, x 4.
Šplevta, zgornji norij – retij.


1


2


3


4

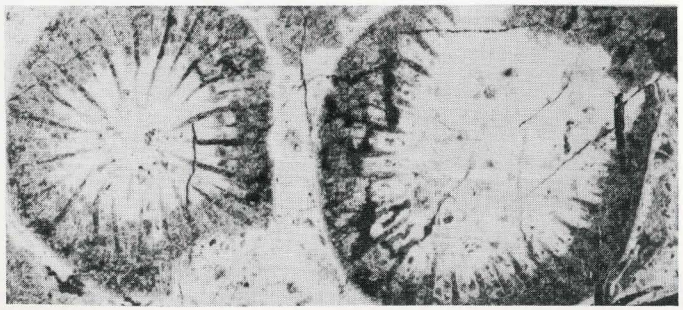
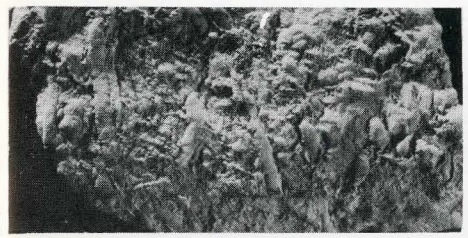

5

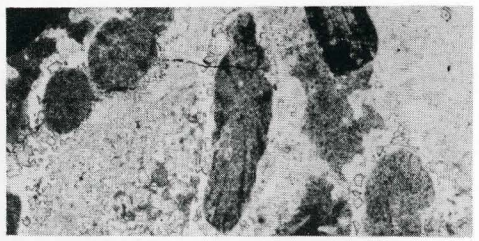
PLATE 12

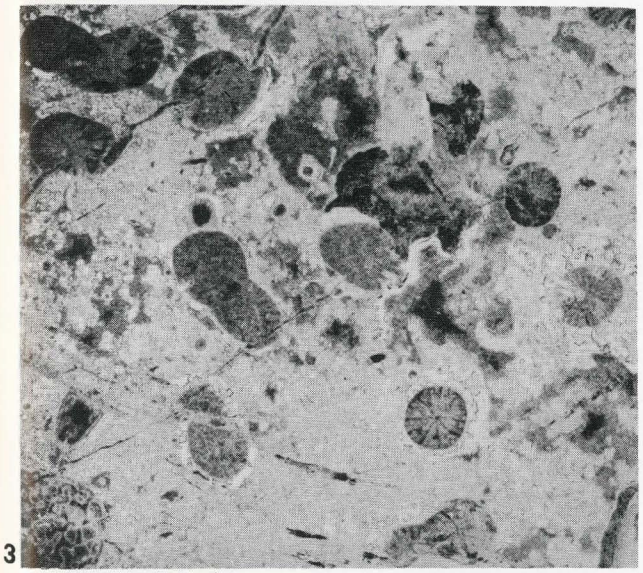
Fig. 1–6 *Tropidendron mlinaricensis* n. sp.
1. Surface of the colony from side. Specimen 15/82-6, x 1.
2. Transverse and oblique thin section of corallites, 15/82-6b, x 4.
3. Transverse thin section of several corallites, 15/82-6a, x 4.
4. Transverse thin section of another part of colony, some corallites are poorly preserved, 15/82-6d, x 4.
5. Transverse thin section of one corallite, note columella, 15/82-6a, x 8.
6. Longitudinal thin section of one corallite, 15/82-6e, x 8.
All figures are of holotype.
Rušnata Mlinarica, Lower Norian.

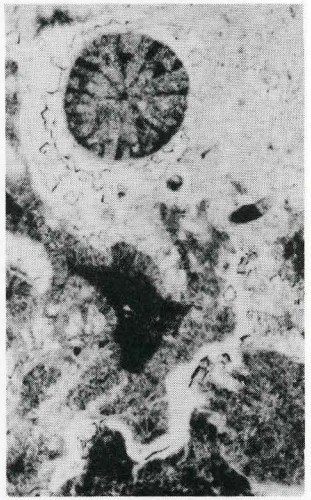
TABLA 12

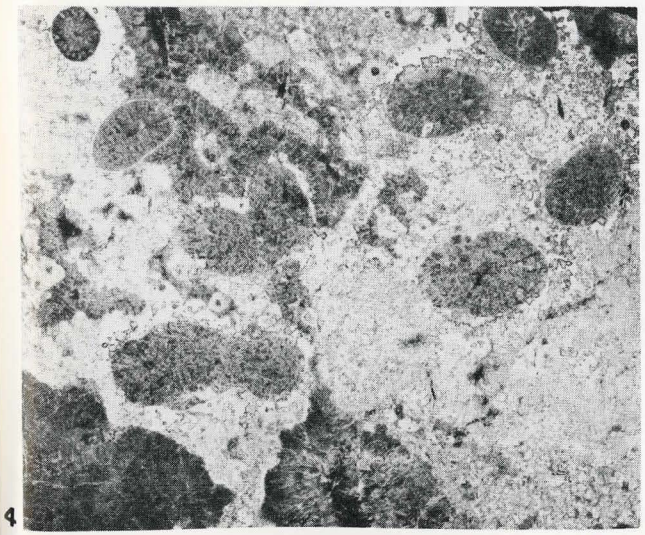
Sl. 1–6 *Tropidendron mlinaricensis* n. sp.
1. Površina kolonije od strani. Vzorec 15/82-6, holotip, x 1.
2. Prečni presek in poševni presek koralitov. Zbrusek 15/82-6b, x 4.
3. Prečni presek različnih koralitov. Zbrusek 15/82-6a, x 4.
4. Prečni presek drugih koralitov iz iste kolonije, nekateri so slabše ohranjeni. Zbrusek 15/82-6d, x 4.
5. Prečni presek enega koralita s sl. 3. Dobro ohranjena kolumela. Zbrusek 15/82-6a, x 8.
6. Podolžni presek enega koralita. Zbrusek 15/82-6e, x 8.
Vse slike so zbruski holotipa.
Rušnata Mlinarica, spodnji norij.


1


2


3


5


4

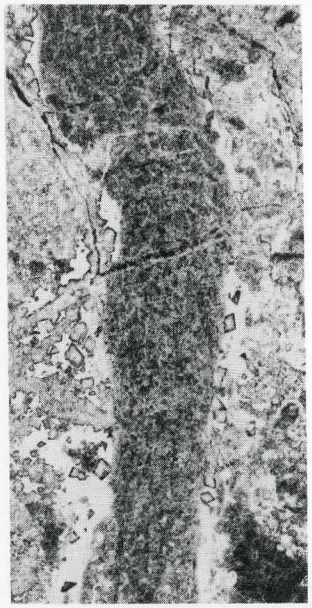

6

PLATE 13

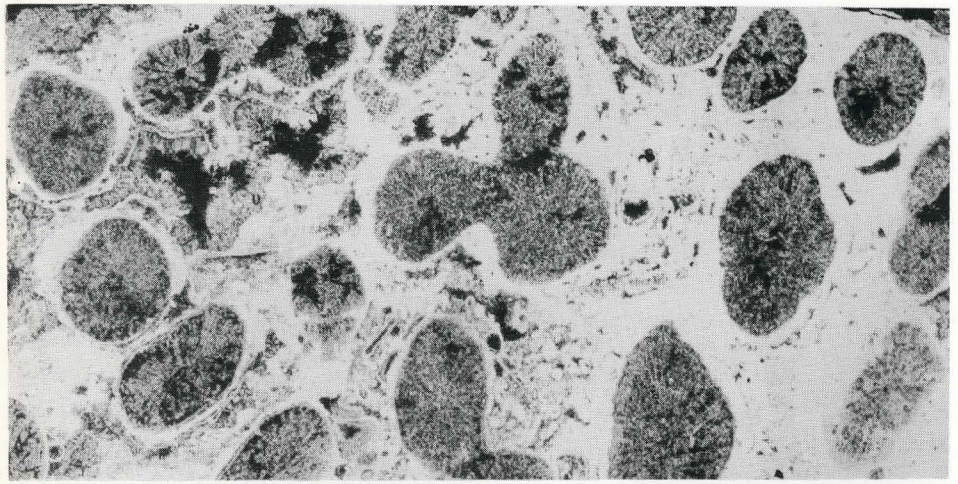
Fig. 1–5 *Tropidendron mlinaricensis* n. sp.
1. Transverse thin section of colony, 17/85, x 4.
2. Detail from the same thin section, x 8.
3. Transverse thin section of another colony, 16/85c, x 4.
4. Transverse thin section of one corallite from holotype, showing microstructure, 15/82-6a, x 30.
5. Transverse thin section of another corallite, showing microstructure and columella, poorly preserved, 17/85, x 30.

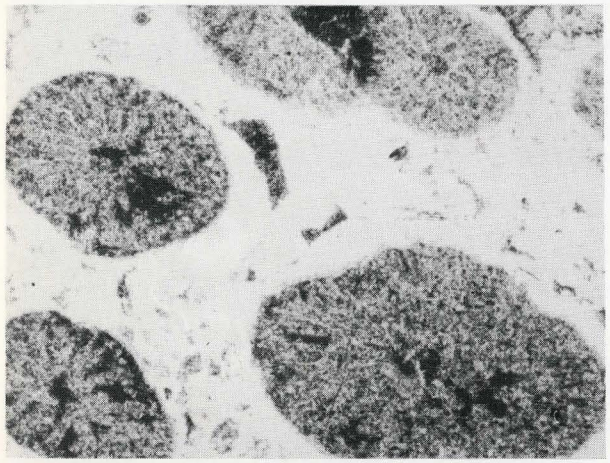
Rušnata Mlinarica, Lower Norian.

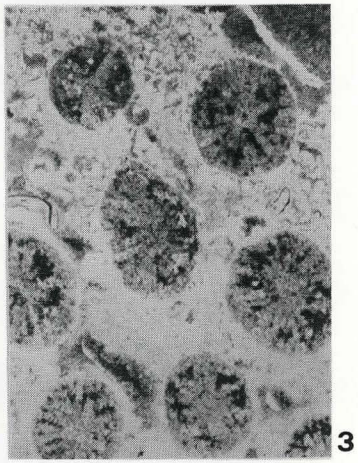
TABLA 13

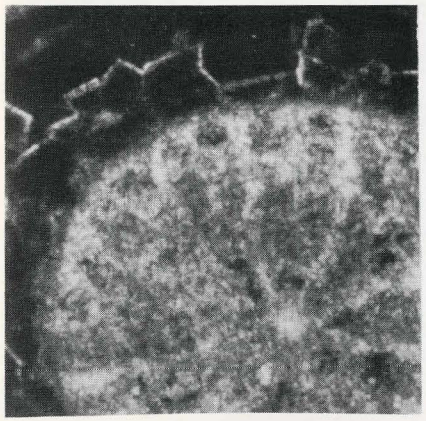
Sl. 1–5 *Tropidendron mlinaricensis* n. sp.
1. Prečni presek kolonije. Zbrusek 17/85, x 4.
2. Detajl z istega zbruska, x 8.
3. Prečni presek druge kolonije. Zbrusek 16/85c, x 4.
4. Prečni presek enega koralita iz holotipa z mikrostrukturo. Zbrusek 15/82-6a, x 30.
5. Prečni presek drugega koralita, kaže mikrostrukturo in kolumelo, slabo ohranjeno. Zbrusek 17/85, x 30.

Rušnata Mlinarica, spodnji norij.


1


2


3


4

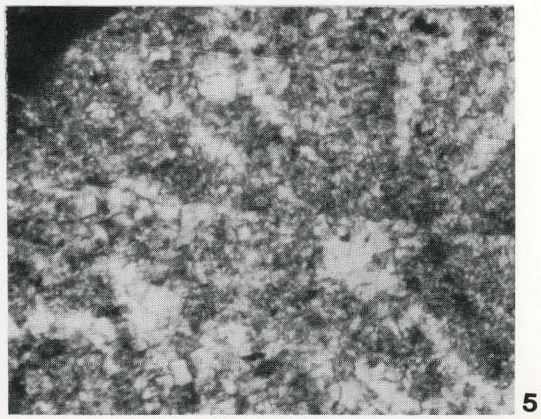

5

PLATE 14

Fig. 1 *Cylicopsis* sp.
Transverse and oblique thin section of coenosteum showing vermiculate skeleton and astrorhizae, 15/82-7, x 4.
Rušnata Mlinarica, Lower Norian

Fig. 2–3 *Spongiomorpha acyclica* Frech 1890
2. Longitudinal thin section, 25/85-5b, x 4.
3. Transverse thin section, 25/85-5f, x 4.
Šplevta, Upper Norian – Rhaetian.

Fig. 4 *Pamirostroma* cf. *astrorizoides* Boiko 1970
Longitudinal thin section of coenosteum with astrosystem, 5/85, x 4.
Tominškova pot, Lower Norian.

Fig. 5 *Pseudoseptifer aktashi* Boiko 1979
Transverse thin section of tubular coenosteum, 25/85-1b, x 4.
Šplevta, Upper Norian – Rhaetian.

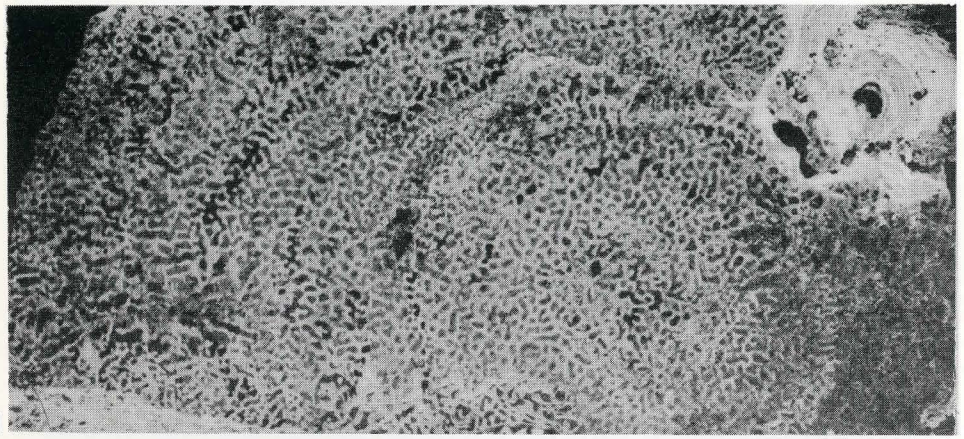
TABLA 14

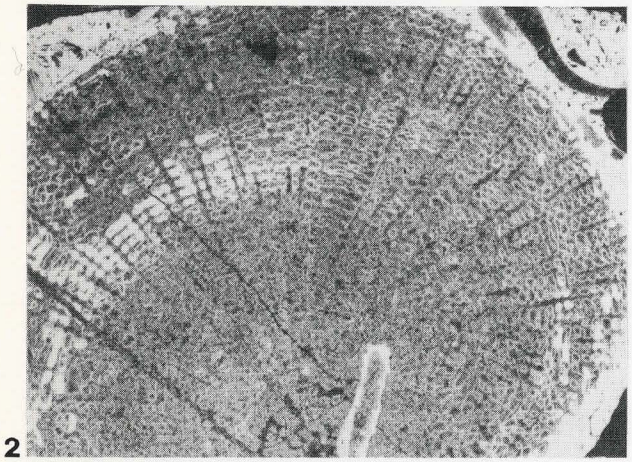
Sl. 1 *Cylicopsis* sp.
Prečni in deloma poševni presek cenosteja, ki kaže črvasti skelet in astrorize. Zbrusek 15/82-7, x 4.
Rušnata Mlinarica, spodnji norij.

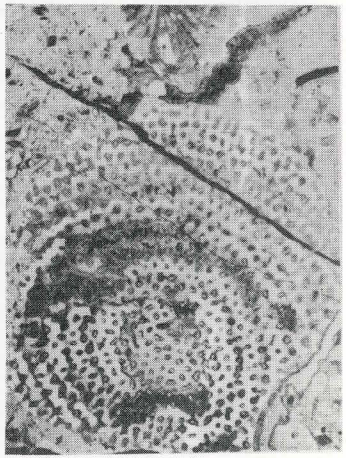
Sl. 2–3 *Spongiomorpha acyclica* Frech 1890
2. Podolžni presek. Zbrusek 25/85-5b, x 4.
3. Prečni presek. Zbrusek 25/85-5f, x 4.
Šplevta, zgornji norij – retij.

Sl. 4 *Pamirostroma* cf. *astrorizoides* Boiko 1970
Podolžni presek cenosteja z astroriznim sistemom. Zbrusek 5/85, x 4.
Tominškova pot, spodnji norij.

Sl. 5 *Pseudoseptifer aktashi* Boiko 1979
Prečni presek cevastega cenosteja. Zbrusek 25/85-1b, x 4.
Šplevta, zgornji norij – retij.


1


2


3


4

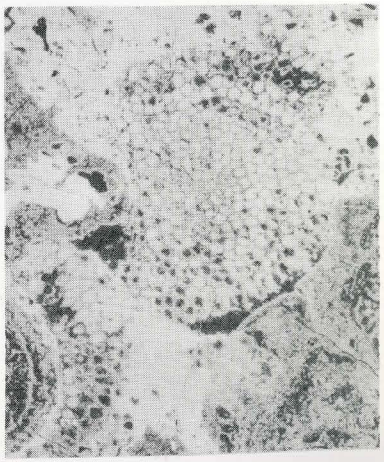

5

PLATE 15

Fig. 1 *Battaglia minor* Senowbari-Daryan & Schäfer 1986
Thin section 25/85-A3a, x 8. Šplevta, Upper Norian – Rhaetian.

Fig. 2 *Vesicocaulis* sp.
with fragment of *Paradistichophyllum* sp. (right above).
Thin section 16/85-2b, x 4. Rušnata Mlinarica, Lower Norian.

Fig. 3 *Cryptocoelia crassiparietalis* Senowbari-Daryan & Schäfer 1986
Thin section 59/81-1c, x 4, Dovški križ, Rhaetian.

Fig. 4 *Annaecoelia mirabilis* Senowbari-Daryan & Schäfer 1979
overgrown by *Battaglia minor*. Thin section 25/85-A4a, x 4.
Šplevta, Upper Norian – Rhaetian.

Fig. 5 *Paradeningeria alpina* Senowbari-Daryan & Schäfer 1979
in community with *Cryptocoelia crassiparietalis* (left) and tubelike forms (right above). Thin section 19/85b, x 4.
Rušnata Mlinarica, Lower Norian.

Fig. 6 *Solenopora styriaca* Flügel 1960
Thin section 25/85-A4b, x 4, Šplevta, Upper Norian-Rhaetian.

Fig. 7 *Cayeuxia* sp.
Thin section 15/82-8, x 4. Rušnata Mlinarica, Lower Norian.

TABLA 15

Sl. 1 *Battaglia minor* Senowbari-Daryan & Schäfer 1986
Zbrusek 25/85-A3a, x 8. Šplevta, zgornji norij – retij.

Sl. 2 *Vesicocaulis* sp.
z odlomkom *Paradistichophyllum* sp. (desno zgoraj).
Zbrusek 16/85-2b, x 4. Rušnata Mlinarica, spodnji norij.

Sl. 3 *Cryptocoelia crassiparietalis* Senowbari-Daryan & Schäfer 1986
Zbrusek 59/81-1c, x 4. Dovški križ, retij.

Sl. 4 *Annaecoelia mirabilis* Senowbari-Daryan & Schäfer 1979
prerasla z *Battaglia minor*.
Zbrusek 25/85-A4a, x 4. Šplevta, zgornji norij – retij.

Sl. 5 *Paradeningeria alpina* Senowbari-Daryan & Schäfer 1979
v združbi s *Cryptocoelia crassiparietalis* (levo) in cevastimi oblikami (desno zgoraj).
Zbrusek 19/85b, x 4. Rušnata Mlinarica, spodnji norij.

Sl. 6 *Solenopora styriaca* Flügel 1960
Zbrusek 25/85-A4b, x 4. Šplevta, zgornji norij – retij.

Sl. 7 *Cayeuxia* sp.
Zbrusek 15/82-8, x 4. Rušnata Mlinarica, spodnji norij

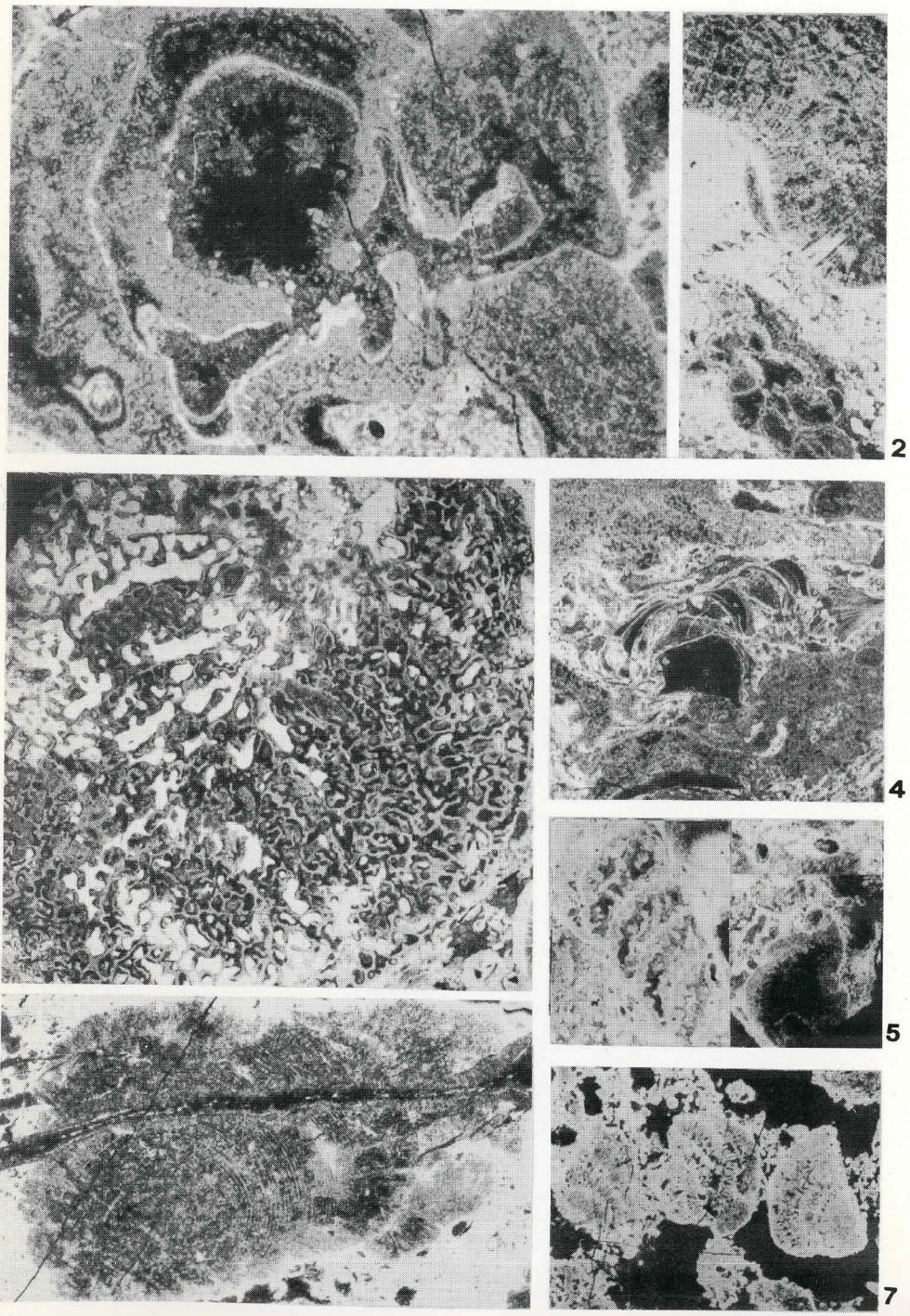


PLATE 16

Fig. 1 *Pycnoporidium eomesozoicum* Flügel 1972
Thin section 15/82-1, x 25. Rušnata Mlinarica, Lower Norian.

Fig. 2–3 *Radiomura cautica* Senowbari-Daryan & Schäfer 1979
2. Thin section 15/82-5c, x 4.
3. The same thin section, x 25.
Rušnata Mlinarica, Lower Norian.

Fig. 4–5 *Alpinophragmium perforatum* Flügel 1967
4. Thin section 25/85-8, x 25.
5. Thin section 25/85-3c, x 25.
Šplevta, Upper Norian – Rhaetian.

Fig. 6 Several foraminifers.
Thin section 63/81, x 25. Šplevta, Upper Norian – Rhaetian.

Fig. 7 Juvenile amonite
Thin section 59/81-1d, x 25. Dovški križ, Rhaetian.

Fig. 8 Several gastropods
Thin section 59/81-1e, x 25. Dovški križ, Rhaetian.

Fig. 9 Dasycladacean algae
Thin section 25/85-A2a, x 25. Šplevta, Upper Norian – Rhaetian.

Fig. 10 Bioclastic detrital limestone with solitary corals, inozoans, brocken fragments of lamellibrachs, gastropods, echinoderms, solenoporaceans, and other detritogenous material. Fragments are mostly encrusted by spongiostromate crusts. Interpatch-reef development.
Thin section 59/81-1e, x 4. Dovški križ, Rhaetian.

Fig. 11 Oncolitic grainstone with crinoids and other organisms.
Thin section 3/85, x 4. Tominškova pot, Lower Norian.

TABLA 16

Sl. 1 *Pycnoporidium eomesozoicum* Flügel 1972
Zbrusek 15/82-1, x 25. Rušnata Mlinarica, spodnji norij.

Sl. 2–3 *Radiomura cautica* Senowbari-Daryan & Schäfer 1979
2. Zbrusek 15/82-5c, x 4.
3. Isti zbrusek, x 25.
Rušnata Mlinarica, spodnji norij.

Sl. 4–5 *Alpinophragmium perforatum* Flügel 1967
4. Zbrusek 25/85-8, x 25.
5. Zbrusek 25/85-3c, x 25.
Šplevta, zgornji norij – retij.

Sl. 6 Razne foraminifere
Zbrusek 63/81, x 25. Šplevta, zgornji norij – retij.

Sl. 7 Juvenilni amonit
Zbrusek 59/81-1d, x 25. Dovški križ, retij.

Sl. 8 Razni polži
Zbrusek 59/81-1e, x 25. Dovški križ, retij.

Sl. 9 Dazikladacejske alge
Zbrusek 25/85-A2a, x 25. Šplevta, zgornji norij – retij.

Sl. 10 Bioklastični detritični apnenec s solitarnimi koralami, spongijami, odlomki školjk, polžev, ehinodermov, solenopor in drugega detritogenega materiala. Odlomki so v glavnem obrasli s spongiostromatnimi prevlekami. Medgrebenski razvoj.
Zbrusek 59/81-1e, x 4. Dovški križ, retij.

Sl. 11 Onkolitni »grainstone« s krinoidi in drugimi organizmi.
Zbrusek 3/85, x 4. Tominškova pot, spodnji norij.