

THE LOWER NORIAN (LATIAN) DEVELOPMENT WITH CORAL FAUNA ON RAZOR AND PLANJA IN THE NORTHERN JULIAN ALPS (SLOVENIA)

SPODNJENORIJSKI (LAC) RAZVOJ
S KORALNO FAVNO NA RAZORJU IN
PLANJI V SEVERNIM JULIJSKIM ALPAH

ANTON RAMOVŠ IN DRAGICA TURNŠEK

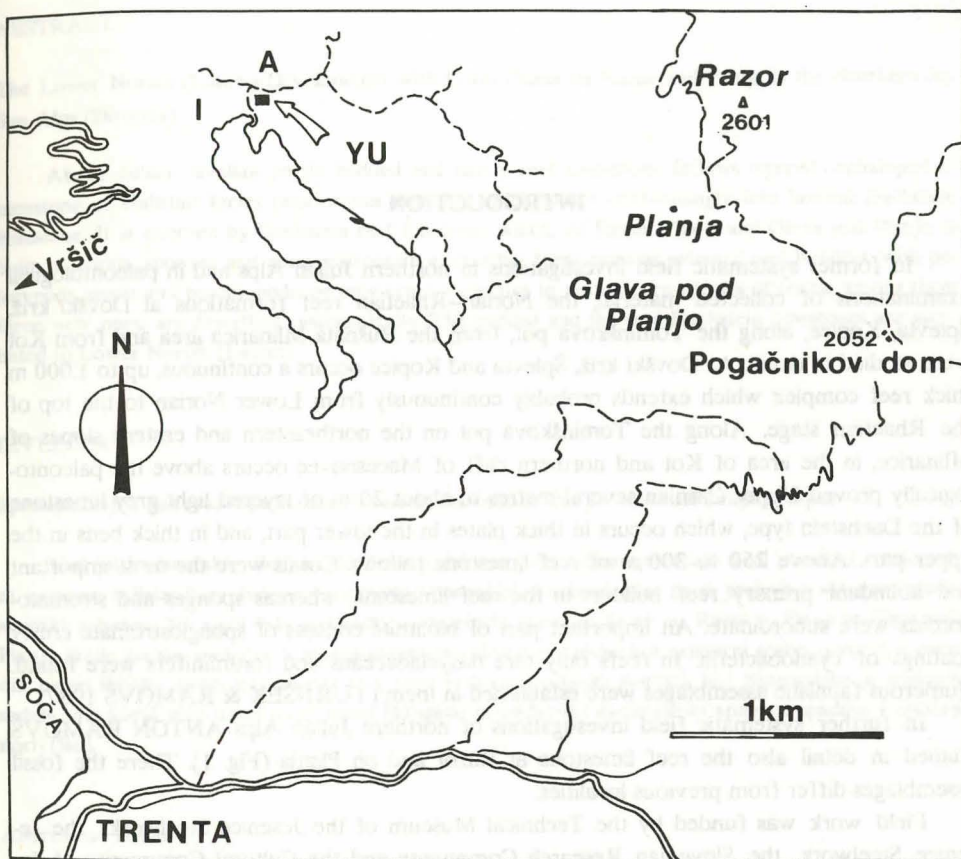


Fig. 1. Situation sketch of Lower Norian reef limestones on Razor and Planja.

Sl. 1. Položajna skica spodnjenorijskih grebenskih apnencev na Razorju in Planji.

part. The upper stratum passes upwards into nonbedded reef limestone which reaches up to the 2601 m high peak of Razor. In the lower bedded part no macrofossils were found. In the lower part of the reef limestone, at the point where the path starts rising very steeply towards the peak, appears sponge–coral limestone with prevailing small corallites. Within the sponge–coral limestone occur pelecypod lumachelles in small lenses. The sponge–coral reef is several metres thick, and above it in the limestone no corals or other reefbuilding organisms were found. About 30 m higher in the summit part of the southern part of the reef, at 2580 m elevation, the central part of the reef is exposed. The biolithite consists here of smaller coral species, among which occur individual larger corallites of genus *Coryphyllia*; abundant are also nonsegmented sponges. In smaller lenses within the sponge–coral biolithite appear

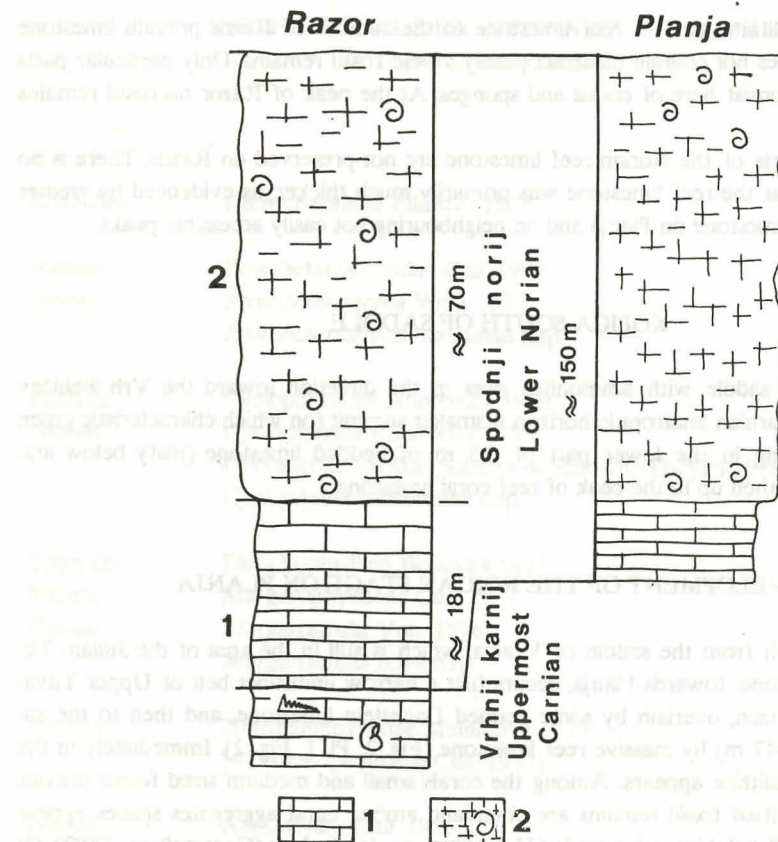


Fig. 2. Stratigraphic column of Lower Norian bedded and reef limestone on Razor and Planja.

1. Bedded Dachstein limestone.

2. Reef Dachstein limestone.

Sl. 2. Stratigrafska lestvica skladnatega in grebenskega spodnjenorijskega apnenca na Razorju in Planji.

1. Skladnati dachsteinski apnenec.

2. Grebenski dachsteinski apnenec.

small pelecypod lumachelles. Other, similarly small lenses in the sponge–coral biolithite are filled with pelecypods and snails with thick valves. Still other lenses consist entirely of various brachiopod valves. Beside these lenses appear in the biolithite individual larger spaces filled with joints of crinoid stems and their shorter stems, up to half a centimetre thick.

From this biolithitic part of reef limestone to the summit of Razor prevails limestone which in general does not contain macroscopically visible fossil remains. Only particular parts of this limestone consist here of corals and sponges. At the peak of Razor no fossil remains were found.

The upper parts of the Norian reef limestone are not preserved on Razor. There is no doubt, however, that the reef limestone was primarily much thicker, as evidenced by greater thicknesses of this limestone on Planja and on neighbouring not easily accessible peaks.

KOPICA SOUTH OF SADDLE

South of the saddle with ammonites rises in the direction toward the Vrh žlebičev above the Upper Carnian anaprotic horizon a smaller summit (on which characteristic green sills occur) consisting in the lower part of 2.5 m of bedded limestone (platy below and bedded at top), and then up to the peak of reef coral limestone.

DEVELOPMENT OF THE NORIAN STAGE ON PLANJA

Along the path from the saddle of Vratca, which is still in the area of the Julian-Tuvalian Razor limestone, towards Planja, occurs first a narrow undistinct belt of Upper Tuvalian anaprotic horizon, overlain by some bedded Dachstein limestone, and then to the summit of Planja (2447 m) by massive reef limestone (Fig. 2; Pl. 1, Fig. 2). Immediately in the lower part coral biolithite appears. Among the corals small and medium sized forms prevail. In places tiny, ramified fossil remains are abundant. among coral aggregates spaces appear with abundant small halobiid pelecypods (*Halobia* ex. gr. *lenticularis* (Gemmellaro, 1882)). (It was determined by B. JURKOVŠEK, to whom thanks are extended for this) (Pl. 8, Fig. 4-5). Valves are for the most part distinctly oriented one above other. Corallites are overgrown by thinner or thicker stromatolitic crusts. The coral biolithite reaches with smaller or larger interruptions to the summit of Planja. On the peak well preserved thinly ramified corals of species *Margarophyllia nova* were found.

On Planja the reef limestone is about 150 m thick; its thickness increases towards Glava below Planja where observations were not performed owing to the inaccessible terrain. Also the westerly located Kanceljini (2131 m) and Goličica (2102 m), which is already in the area of the Trenta valley, were not investigated. Both consist of Upper Triassic reef limestone which, however, was not dated into more detail yet.

SYSTEMATICAL DESCRIPTION OF CORAL FAUNA

(by Dragica Turnšek)

Anthozoa

Suborder: Pachytherecallina Eliašova 1976

Familia: Protoheterastraeidae Cuif 1977

Genus: *Protoheterastraea* Wells 1937
Protoheterastraea razorensis n.sp.

Familia: Cyclophylliidae Roniewicz 1989

Genus: *Cyclophyllia* Roniewicz 1989
Cyclophyllia cyclica (Schäfer & Senowb.-Daryan 1978)
Cyclophyllia raricorallita n.sp.

Suborder: Distichophylliina Beauvais 1981

Familia: Margarophylliidae Cuif 1977

Genus: *Margarosmia* Volz 1896
Margarosmia nova n.sp.

Familia: ?Reimaniphylliidae Melnikova 1975
(=Distichophylliidae Cuif 1977)

Genus: *Retiophyllia* Cuif 1966
Retiophyllia sp. (Cuif 1974, type III)

Genus: *Pokljukosmia* Turnšek 1989
Pokljukosmia tuvalica Turnšek 1989

Suborder: Fungiina Verrill 1865

Familia: Conophylliidae Alloiteau 1952

Genus: *Rhopalodendron* Turnšek 1989
Rhopalodendron juliensis Turnšek 1989

Suborder: Pachythecalina Eliasova 1976

Familia: Protoheterastraeidae Cuif 1977

Genus: *Protoheterastraea* Wells 1937

Protoheterastraea razorensis n.sp.

Pl. 2, Fig. 1–3; Pl. 3, Fig. 1–2

Name: After the Razor Mountain where it was found.

Holotypus: Specimen P–899

Locus typicus: Razor Mountain

Age: Lowermost Norian

Material: Two colonies with four thin sections.

Diagnosis: *Protoheterastraea* with hexagonal system of septa in three cycles, budding along septa and axial dissepiments. Dimensions: D = 3–4 mm, d = 2–2.7 mm, wall = 0.4–0.8 mm thick, s = 20–24.

Description: Phaceloid colony has roundish to irregular corallites. Septa are in hexameral system, in 3 cycles, the third being incomplete. Weak main septum. Multiplication along the main septa or along axial dissepiments. The phase of dividing causes irregular form of corallites. The wall is thick "fibrous" epitheca or eutheca. Somewhere it looks homogenous and thick like epitheca, in other places it contains beginnings of third cycle septa and looks like eutheca. There is no columella, but the axial ends of septa are joined with several "traverses" and form some kind of fossula. Endotheca is of vesicular and tabulate dissepiments arranged in levels. Microstructure in walls is recrystallized, in septa it looks trabecular with central line and orthogonal fibres.

Comparison: In structure of septa and wall our species is closest to *P. hudajuznensis* (TURNŠEK & al. 1982: 71–72, Pl. 5–6). but differs in smaller dimensions and in more regular hexagonal arrangement of septa.

Systematics: Because of thick wall and fibrous microstructure the genus *Protoheterastraea* is attributed to suborder Pachythecalina (see RONIEWICZ 1989: 25). Its septal irregularities show similarity to suborder Amphistraeina.

Distribution: All so far known species are of Carnian age.

Familia: Cyclophylliidae Roniewicz 1989

Genus: *Cyclophyllia* Roniewicz 1989

Cyclophyllia cyclica (Schäfer & Senowbari–Daryan 1978)

Pl. 5, Fig. 3–4

1978 *Thecosmilia cyclica* n.sp. SCHÄFER & SENOWBARI–DARYAN: 125–128, Pl. 3, Fig. 4–5.

1989 *Cyclophyllia cyclica* (Schäfer & S.D.). RONIEWICZ: 27–28, Pl. 1, Fig. 1, 4–6; Pl. 2, Fig. 1.

Description: Our specimens are very recrystallized. We can recognize phaceloid colony with dense roundish corallites budding marginally. Septa in 3–4 cycles, numerous dissepiments, in some places epitheca.

Dimensions: d = 5–9 mm.

Comparison: In dimensions, type of corallites, budding, endotheca and wall our specimens fit in with *C. cyclica*. Therefore in spite of recrystallization I attribute our specimens to this species.

Distribution: Rhaetian of Northern Calcareous Alps (Zlambach beds, Rotelwand and others) (SCHÄFER & SENOWBARI–DARYAN 1978).

Material: Razor (Thin sections 977a,b,c,d).

Cyclophyllia raricorallita n.sp.

Pl. 4, Fig. 1–4; Pl. 5, Fig. 1–2

Name: It has rare corallites.

Holotypus: Specimen 27/85–2.

Locus typicus: Razor

Age: Lowermost Norian

Material: Six colonies and 9 thin sections.

Diagnosis: *Cyclophyllia* with rare corallites and dimensions of d = 5–8 mm, c–c = 7–12 mm, s = 35–60.

Description: Phaceloid colony has rare corallites which bud marginally. Septa are radially arranged in 4 cycles and the beginnings of fifth cycle in the wall. They bear lateral teeth and axial trabecular prolongations. Endotheca is of numerous vesicular and bent dissepiments which interlace axial parts of corallites. The wall complex (RONIEWICZ 1989) is composed of primary fibrous wall, septa, and of interseptal peripheral stereozom. In our specimens, it is thin. Microstructure not well preserved, it looks being trabecular (of more centres of calcification).

Comparison: In dimensions this species is close to *C. cyclica* differing in rarer corallites and thinner epitheca. The species *C. major* is larger (RONIEWICZ 1989).

Material: Razor 27/85–1,2,4,5; Planja 10/86–34; 12/86–37.

Suborder: Distichophylliina Beauvais 1981

Familia: Margarophylliidae Cuif 1977

The family Margarophylliidae was attributed by RONIEWICZ 1989 into the suborder Caryophylliina because of the similarity in trabecular microstructure. BEAUVAIS (1981) put it into her new suborder Distichophylliina, characterized by nontrabecular microstructure. In our material microstructure is not well preserved. But the presence of endotheca and ornamented septa distinguish it from Caryophylliina. So, for the moment, I follow the system of BEAUVAIS 1981.

Genus: *Margarosmilia* Volz 1896

Margarosmilia nova n.sp.

Pl. 6, Fig. 1–3

Name: It is new

Holotypus: Specimen 624/82

Locus typicus: Planja

Age: Lowermost Norian

Material: Two colonies, 5 thin sections

Diagnosis: *Margarosmilia* with smooth septa of older cycles, and dimensions of $d = 16\text{--}22$ mm, $s = 85\text{--}96$

Description: Colony is phaceloid with straight rare corallites. Septa are regularly radially arranged in 4–5 cycles. The first three are equally thick from periphery to the centre of the corallite where they end freely. The fourth cycle is thinner and shorter, the fifth very thin and almost completely developed. Laterally they are smooth, teeth appear on younger cycles, especially in axial parts. Microstructure is not well preserved, it seems like very thin uneven lines of centres of calcification. Endotheca is of many tabulate and bent dissepiments.

Comparison: New species is similar to *M. zietenii* (VOLZ 1896) but it differs in larger dimensions and in smoother septa which have equal thickness.

Material: Planja 624/82 and 625/82.

Familia: ?Reimaniphylliidae Melnikova 1975

(=Distichophylliidae Cuif 1977)

Explanation of family name is given in RONIEWICZ 1989, 35.

Genus: *Retiophyllia* Cuif 1966

Retiophyllia sp. (Cuif 1974, type III)

Pl. 7, Fig. 1–2

1974 *Retiophyllia* sp. type III. CUIF: 388–390, Fig. 41, 42a.

Description: Our specimens fit with the *Retiophyllia* sp. described by Cuif 1974, 388. Septothecal region is very massive, septa ornamented with teeth, dimensions: $d = 4$, $s = ca\ 48$. Microstructure in our case is poorly preserved.

Remarks: I have only one not well preserved specimen, so I could not describe the new species.

Distribution: Alakir Cay in Taurus, Turkey, put into Carnian and Lower Norian (Cuif 1974, 388, 1976, 160).

Material: Razor 27/85–3. Lowermost Norian.

Genus: *Pokljukosmilia* Turnšek 1989

Pokljukosmilia tuvalica Turnšek 1989

Pl. 7, Fig. 3–4

1989 *Pokljukosmilia tuvalica* n.sp. TURNŠEK & BUSER: 85–86, Pl.5–6.

Description: New specimens fit completely with those from Tuvallian on Pokljuka. Dimensions: $d = 5\text{--}7(10)$ mm, $s = ca\ 46\text{--}60$.

Material: Planja 11/86–36. Lowermost Norian.

Suborder: Fungiina Verrill 1865
 Familia: Conophylliidae Alloiteau 1952
 Genus: *Rhopalodendron* Turnšek 1989

Rhopalodendron juliensis Turnšek 1989
 Pl. 8, Fig. 1–3

1989 *Rhopalodendron juliensis* n.sp. TURNŠEK & BUSER: 87–88, Pl.8, Fig.1–6.

Description: Some of our corallites are a little smaller than those of the first description: $d = 2-3$ mm (2.5–4 mm), $s = 30-48$ (40–50).

Systematic remarks: At first description this species was included into the subordo Fungiina, next to the genera *Rhopalophyllia* Cuif 1975 and *Omphalophyllia* Laube 1865, as well as *Tropidendron* Cuif 1975. CUIF (1977) systematized these genera into family Conophylliidae, at which he explained ornamentations as "subpennular" (cf. CUIF 1977: 42, Pl.7).

By BEAUVAIS (1981:355) the above mentioned genera were attributed into her new family Tropiphyllidae within the suborder Archaeocoeniina, characterized by granular ornamentation of septa.

Our specimens show that ornamentations of septa are really nearer to "subpennular" structure than to granulae. Younger septa have rare pores. They also have synapticulae. So I still attribute *Rhopalodendron* into the family Conophylliidae, and after ALLOITEAU 1952 into suborder Fungiina.

Distribution: Tuvanian of Pokljuka (TURNŠEK & BUSER 1989).

Material: Planja 10/86–35. Lower Norian.

Stratigraphical comparison of coral fauna

Description of 7 species of corals is given, among which two were known from Tuvanian of Pokljuka (TURNŠEK & BUSER 1989), two from Norian–Rhaetian beds of the Northern Calcareous Alps and from the Tatra Mountains (RONIEWICZ 1974, 1989), whereas three species are new.

On Razor four coral species were established, among which two are Norian–Rhaetian, while two are new. On Planja four species were found, among which two are Tuvanian, and two are new.

Consequently, the coral species from Planja and Razor can be compared with the Tuvanian and Norian species. According to their field relations, the localities have been attributed to Lower Norian, and this attribution is entirely supported by coral fauna.

Once again the confirmation of the hypothesis of continuation of coral fauna from Tuvanian into Lower Norian was obtained, as well as of the presence of Carnian and Norian

faunistic elements in the Lower Norian coral assemblage (TURNŠEK et al. 1987). Pure Norian–Rhaetian elements start to prevail in the Upper Norian only. Mixed Upper Carnian and Lower Norian faunistic elements have been detected in the Nezsza and Aggtelek regions in north Hungary, and elsewhere (RIEDEL 1990).

Species	Localities investigated		Previous localit.	Previous stratigr.	
	Razor (Lower Norian)	Planja	Slovenia	Tu	No
<i>Cyclophyllia cyclica</i>	+	–	–		x
<i>Cyclophyllia raricorallita</i> n.sp.	+	+	–		
<i>Margarosmia nova</i> n.sp.	–	+	–		
<i>Pokljukosmia tuvalica</i>	–	+	Pokljuka	x	
<i>Protoheterastraea razorensis</i> n.sp.	+	–	–		
<i>Retiophyllia</i> sp.	+	–	–	x	x
<i>Rhopalodendron juliensis</i>	–	+	Pokljuka	x	

Fig. 3. List of coral species with their distribution in Slovenia and stratigraphic comparison in the world.

Sl. 3. Seznam koralnih vrst z geografsko razširjenostjo v Sloveniji in stratigrafsko primerjavo v svetu.

FAUNISTIC ASSEMBLAGES ON RAZOR AND PLANJA

1. Razor

In the lowermost part of the Razor limestone coral assemblages *Retiophyllia* sp. – *Cyclophyllia raricorallita* with prevalence of *C. raricorallita* occur. Individually non-segmented sponges can be found. Corallites and sponges are overgrown by spongiostromate crusts with sessile foraminifers. In smaller lenses pelecypod lumachells with species *Halobia* ex gr. *lenticularis* occur.

A part of reef was colonized by *Cyclophyllia cyclica*, overgrown with spongiostromate crusts as well, and accompanied by individual nonsegmented sponges. Problematicum *Tubiphytes* occurs sporadically only.

In the higher part of the Razor traverse the rock-building coral *Protoheterastraea razorensis* is found, accompanied by individual larger corals of genus *Coryphyllia*. Numerous

are nonsegmented sponges *Cryptocoelia* and stromatoporoids of type *Cylicopsis*. Smaller lenses are filled with pelecypod valves and thick-walled snail tests, while in others numerous terebratulid brachiopods occur. The primary reef-builders are encrusted by spongiostromate crusts with individual sessile foraminifers and problematica on them. On the ridge in smaller spaces within the coral reef numerous remains of crinoids occur which were washed from the front part of the reef to more sheltered areas.

2. Planja

On Planja two coral assemblages are distinguished. In the lowermost part the patch reef is built of corals of species *Pokljukosmia tuvalica* and *Rhopalodendron juliensis* which are accompanied by solenoporaceans of type "*Cayeuxia*". In intermediate space numerous pelecypods *Halobia* ex gr. *lenticularis* and rare small snail tests occur. In this assemblage almost no spongiostromate crusts on corallites can be seen. Sponges also seem to be absent.

In the second assemblage of the same reef body the species *Cyclophyllia raricorallita* was determined. It seems to be the most abundant coral in the lower part of the reef limestone of Planja.

On the top of Planja next to smaller corallites the large thinly rymified coral of the new species *Margarosmia nova* appears which forms a distinct monolithic assemblage. Corals are thickly overgrown with spongiostromate crusts. Sessile foraminifer *Alpinophragmium* and problematicum *Tubiphytes* appear individually. Among other primary reef-builders there occur also nonsegmented sponges and soleporaceans.

AGE OF THE REEF LIMESTONE ON RAZOR AND PLANJA

The Lower Norian age of the reef limestone on Razor and Planja is proved by its position above the Upper Carnian cephalopod limestone of Hallstatt development, the anatroites horizon. Lower Norian age is supported also by massive appearance of pelecypod *Halobia* ex gr. *lenticularis* which occurs in the time Tuvalian 2 – Latian 1. The oldest Norian reef limestone in northern Julian Alps is indicated also by coral fauna which differs from fauna in a somewhat younger Norian reef limestone, and shows a high degree of relationship with the Tuvalian coral fauna of Pokljuka (see chapter of Stratigraphical comparison of coral fauna). The reef limestone on Razor and Planja is therefore attributed to Latian (Lower Norian), more precisely to its lower part.

RELATIONSHIP BETWEEN LOWER NORIAN REEF LIMESTONE ON RAZOR AND PLANJA AND NORIAN–RHAETIAN REEF LIMESTONES ELSEWHERE IN THE NORTHERN JULIAN ALPS

Paleontological studies indicated differences between fossils of lowermost Norian reef limestone on Razor and Planja and those on Dovški Križ, Šplevta, Kopice, in slopes of Mlinarice between Vrata and Kot, in Kot itself and below the Macenovce peak (TURNŠEK & RAMOVŠ, 1987).

On Razor corals *Protoheterastraea razorensis*, *Cyclophyllia raricorallita*, *C. cyclica* and *Retiophyllia paraclathrata* were determined. Two species are new, *C. cyclica* was not found in Norian–Rhaetian reef limestone of mentioned localities. Only *R. paraclathrata* was established on Šplevta.

On Planja, in the lowermost part of reef limestone the species *Pokljukosmia tuvalica*, *Rhopalodendron juliensis* and *Cyclophyllia raricorallita* occur, and on the top of Planja *Margarosmia nova* is characteristic. According to previous investigations on Razor and Planja, the only species *Cyclophyllia raricorallita* is common; it occurs together with species *Pokljukosmia tuvalica* and *Rhopalodendron juliensis* in the lowermost part of reef limestone on Planja, and in the lowermost part also on Razor. Neither on Planja nor on Razor, no species that were established in reef limestone of Dovški Križ and surroundings, as well as in the territory south of it, can be found.

Identical with the Tuvalian fauna in the Julian Alps are species *Pokljukosmia tuvalica* and *Rhopalodendron juliensis* which were described in Tuvalian limestone on Pokljuka (TURNŠEK & BUSER 1989).

Coral fauna of Razor and Planja shows more similarity with fauna of the Julian–Tuvalian Razor limestone (RAMOVŠ 1988) than with fauna of the Norian–Rhaetian reef limestones in the surroundings of Dovški Križ, Mlinarice and Kot, as well as in the northern walls of Macenovce. The reason for similarity of the Lower Norian fauna of Razor and Planja with fauna of the reef limestone in the Razor mostly bedded limestone, and the reason for differences of examined fauna on Razor and Planja with faunas of the Norian–Rhaetian reef limestones in the northern Julian Alps can be explained in the following.

Fossils on Dovški Križ and surroundings belong already to a higher part of the Norian reef limestone. In the same way most of fossils from the Tominškova pot do not come from the lowermost part of the reef limestone. In slopes of Mlinarice, however, fossils were found on secondary places, since primarily located fossils could not be collected in steep and vertical walls. These fossils come therefore mostly from the upper parts of the 250 to 300 m thick reef limestone. From this aspect the localities of Razor and Planja are even more important, as they indicate the narrow relationship between the Upper Tuvalian reef fauna of the Razor limestone and the lowermost Norian reef fauna. Between both faunas in this region of the northern Julian alps only a short interruption in the growth of reef fauna occurred when the part of the Julian carbonate platform deepened, and when the deeper furrow was colonized

by deeper marine cephalopod fauna of the Hallstatt type. It appears, however, that somewhere in the surroundings an environment existed in which the reef development subsisted continuously from Tuvanian times into the Norian time.

POVZETEK

SPODNJENORIJSKI (LAC) RAZVOJ S KORALNO FAVNO NA RAZORJU IN PLANJI V SEVERNIH JULIJSKIH ALPAH

Uvod

Pri dosedanjih sistematičnih terenskih raziskovanjih v severnih Julijskih Alpah in paleontoloških obdelavah zbranega materiala so bile podrobno obdelane norijsko–retijske grebenske tvorbe na Dovškem križu, Šplevti, Kopicah, ob Tominškovi poti iz Vrat na Kredarico, s področja Rušnate Mlinarice in iz Kota. Na Dovškem križu, Šplevti in Kopicah je strnjen grebenski kompleks, debel do 1000 m, segajoč najbrž neprekinjeno od spodnjega norija do vrha retijske stopnje. Ob Tominškovi poti, na severnovzhodnem in vzhodnem pobočju Mlinaric, na območju Kota in severne stene Macenovca pa leži nad paleontološko dokazanim vrhnjim karnijem nekaj metrov do približno 20 m plastnatega svetlo sivega apnenca dachsteinskega tipa, spodaj debeloploščastega, više pa debeloskladnatega, nad njim pa od 250 do 300 m grebenskega apnenca. Korale so bile v grebenskem apnencu najpomembnejši in najštevilnejši primarni grebenski graditelji, spongije in stromatopori so bili podrejeni. Pomemben delež biolitita so imele spongiostromatne skorjaste prevleke cianobakterij. V grebenih so bile najdene le redke dazikladaceje in foraminifere. Ugotovljene so bile številne favnistične združbe (TURNŠEK & RAMOVŠ 1987).

Pri sistematičnih terenskih raziskovanjih v severnih Julijskih Alpah je ANTON RAMOVŠ podrobno raziskal tudi grebenski apnenec na razorju in Planji (Sl. 1). Tam se fosilne združbe ločijo od tistih v okolici Dovškega križa in v grebenskem apnencu med Vrat, pobočju Mlinaric, Kotom in Macenovcem.

Terenske raziskave so omogočili Tehniški muzej Železarne Jesenice, Železarna Jesenice, Republiška raziskovalna skupnost in Kulturna skupnost občine Jesenice. Vsem lepa hvala. Avtorja se zahvalujeta tudi KATI CVETKO, IZTOKU SAJKU, MARJANU GRMU in CARMEN NAROBÉ za izdelavo mikroskopskih zbruskov, grafičnih prilog in fotografij. Tekst je v angleščino prevedel SIMON PIRC.

Razvoj norijske stopnje na Razorju

Paleontološko ugotovljeni najvišji ploščasti in drobnoplastnati karnijski apnenec v hallstattskem cefalopodnem razvoju anatropitnega področja (RAMOVŠ 1986, 134–135) konkordantno prehaja navzgor v svetlo sivi mikritni apnenec dachsteinskega tipa in sestavlja najnižji del norijske stopnje. Pod samim vrhom Razorja je debel okoli 18 m, in ima zelo položno lego (sl. 2; Tab. 1, sl. 1.). V spodnjem delu je še drobno plastnat, navzgor pa postajajo skladi vedno debelejši in v vrhnjem delu je že nekaj debelih metrskih skladov. Vrhnji sklad prehaja navzgor v neplastnati grebenski apnenec in takšen sega do 2601 m visokega vrha Razorja. V spodnjem plastnatem delu niso bili najdeni nobeni makrofosili. V spodnjem delu grebenskega apnenca, tam kjer se steza začne zelo strmo vzpenjati proti vrhu, je spongijsko–koralni apnenec s prevladujočimi majhnimi koraliti. V majhnih lečah so med spongijsko–koralnim apnencem školjčne lumakele. Spongijsko–koralni greben je debel nekaj metrov, nad njim pa v apnencu niso bile najdene korale in drugi grebenotvorni organizmi. Okoli 30 m više je že v vrhnjem delu južnega konca grebena v višini 2580 m razgaljen osrednji del grebena. Biolitit sestavljajo tu manjše koralne vrste in med njimi so posamični večji koralumi rodu *Coryphyllia*, veliko je tudi nečlenkastih morskih gob. V manjših lečah so med spongijsko–koralnim biolititom majhne školjčne lumakele. Druge, prav tako majhne leče v biolititu zapolnjujejo školjke in polži z debelimi hišicami. Spet druge leče sestojijo iz samih različnih lupin ramenonožcev. Razen teh leč so v biolititu posamezni večji prostori, napolnjeni s členki pecljev morskih lili in njihovimi krajšimi peclji, debelimi dobrega pol centrimetra.

Od tega biolititnega dela grebenskega apnenca do samega vrha Razorja prevladuje apnenec večinoma brez makroskopsko vidnih fosilnih ostankov. Samo posamični deli apnenca so tu zgrajeni iz koral in spongij, na samem vrhu pa niso bili najdeni fosilni ostanki.

Višji deli norijskega grebenskega apnenca na Razorju niso ohranjeni, ni pa dvoma, da je bil tam prvotno grebenski apnenec precej debelejši, o čemer priča že večja debelina grebenskega apnenca na Planji in sosednjih zelo težko dostopnih vrhovih.

Kopica južno od prevala

Južno od prevala z amoniti se v smeri proti Vrhju žlebičev vzdiguje iznad vrhnjekarnijskega anatropitnega horizonta (na njem so značilne zelene police ali gredine) nižja kopica, ki sestoji v spodnjem delu iz 2.5 m plastnatega apnenca (spodaj je ploščast, na vrhu pa skladnat), nato pa je do vrha grebenski koralni apnenec.

Razvoj norijske stopnje na Planji

Na stezi s prevala Vratca, ki je še v območju julsko-tuvalskega razorskega apnenca, proti Planji je najprej ozek slabše razločen pas zgornjetuvalskega anatropitnega horizonta, nad njim pa nekaj plastnatega dachsteinskega apnenca in nato do vrha Planje (2447 m) masivni grebenški apnenec (Sl. 2; Tab. 1. sl. 2). Že takoj v spodnjem delu je koralni biolitit. Med koralami prevladujejo majhne in srednje velike oblike. Ponekod je vse polno drobcebnih viličasto razvejanih fosilnih ostankov. Med koralnimi gruči so prostori s samimi majhnimi halobiidnimi školjkami (*Halobia ex gr. lenticularis* (Gemmellaro, 1882). (Določil jo je B. JURKOVŠEK, lepa hvala) (Tab. 8, sl. 4–5). Razločno so lupine večidel orientirane druga na drugi. Koralite obdajajo debelejšje ali tanjše stromatolitne skorje. Koralni biolitit sega z večjimi in manjšimi presledki do vrha Planje. Na njenem vrhu so lepo ohranjene redko vejnate korale vrste *Margarosmilia nova*.

Na Planji je grebenški apnenec debel okoli 150 m; njegova debelina se povečuje proti Glavi pod Planjo, kjer pa zaradi nedostopnosti ozemlja ni bilo raziskav. Tudi zahodno od tam ležeči Kanceljni (2131 m) in Goličica (2102 m), ki teže že na trentarsko stran, niso bili raziskovani. Oboji sestoje iz zgornjetriasnega grebenskega apnenca, ki pa starostno še ni natančneje določen.

Koralna favna

Determiniranih in opisanih je 7 vrst koral, ki so uvrščene v 6 rodov, 5 družin in 3 podredove. Upoštevana je sodobna sistematika koral, kakršno uporabljajo MELNIKOVA 1975, ELIAŠOVA (1976), CUIF (1977), BEAUVAIS (1981), RONIEWICZ (1989), TURNŠEK (1989).

Opisane so naslednje koralne vrste:

<i>Protoheterastraea razorensis</i> n. sp.	Tab.2–3
<i>Cyclophyllia cyclica</i> (Schäfer & S. D. 1978)	Tab.5, sl.3–4
<i>Cyclophyllia raricorallita</i> n.sp.	Tab.4, Tab.5, sl.1–2
<i>Margarosmilia nova</i> n.sp.	Tab.6
<i>Retiophyllia</i> sp. (Cuif 1974 type III)	Tab.7, sl.1–2
<i>Pokljukosmilia tuvalica</i> Turnšek 1989	Tab.7, sl.3–4
<i>Rhopalodendron juliensis</i> Turnšek 1989	Tab.8, sl.1–3

Stratigrafska primerjava koral kaže, da so tri doslej znane iz tuvala Pokljuke (TURNŠEK & BUSER 1989), ena iz norijsko–retijskih skladov Severnih Apneniških Alp (RONIEWICZ 1989), tri pa so nove.

Ker so po legi nahajališča uvrščena v spodnji norij, koralna favna pa kaže večje podobnosti s tuvalskimi vrstami, se ponovno potrjuje ugotovitev, da se koralna favna iz tuvalija nadaljuje še v spodnji norij, ter da spodnjenorijska nahajališča vsebujejo karnijske in norijske fosilne elemente (TURNŠEK et al. 1987). Čisti norijsko–retijski koralni elementi prevladajo šele v zgornjem noriju. Pomešane zgornjekarnijske in spodnjenorijske favnistične elemente ugotavljajo tudi na Madžarskem in drugje (RIEDEL 1990).

Favnistične združbe na Razorju in Planji

1. Razor

V najnižjem delu razorskega apnenca se pojavlja koralna združba *Retiophyllia* sp. – *Cyclophyllia raricorallita*, pri čemer je *C. raricorallita* najštevilnejša. Posamične so nečlenkaste spongije. Koralite in spongije obraščajo spongiostromatne skorje s sesilnimi foraminiferami. V manjših lečah je školjna lumakela z vrsto *Halobia ex gr. lenticularis*.

Del grebena je poseljevala *Cyclophyllia cyclica*, prav tako obraščena s spongiostromatnimi skorjami, spremljale so jo posamične nečlenkaste spongije. Problematikum *Tubiphytes* je samo sporadičen.

V višjem delu razorskega profila je kamnotvorna koralna *Protoheterastraea razorensis*, ki jo spremljajo posamični večji koraliti rodu *Coryphyllia*. Pogostne so nečlenkaste apnenčeve spongije tipa *Cryptocoelia* in stromatopore tipa *Cylicopsis*. Manjše leče zapolnjujejo školjne lupine in polžje hišice z debelimi lupinami, v drugih lečah pa so številni terebratulidni brachipodi. Primarne tvorce grebenov obraščajo spongiostromatne skorje, na njih so še posamične sesilne foraminifere in problematika. Na grebenu so še v manjših prostorih med koralnim grebenom številni ostanki morskih lilij, naplavljeni s čelnega dela grebena v bolj zatišne prostore.

2. Planja

Na Planji izstopata dve koralni združbi. V najnižjem delu sestavljajo patch reef korale vrst *Pokljukosmilia tuvalica* in *Rhopalodendron juliensis*, ki jih spremljajo solenoporaceje tipa "Cayeuxia". V vmesnih prostorih so številne školjke *Halobia ex gr. lenticularis* in redke majhne polžje hišice. V tej združbi skoraj ni spongiostromatnih skorij okoli koralitov. Tudi spongije, kot kaže, manjkajo.

V drugi združbi istega grebenskega telesa je bila ugotovljena vrsta *Cyclophyllia raricorallita*, ki je najbolj pogostna koralna v spodnjem delu grebenskega apnenca Planje.

Na vrhu Planje se poleg manjših koralitov pojavlja velika redko vejnata koralna nove vrste *Margarosmilia nova*, ki tvori posebno monolitno združbo. Korale so na debelo porasle s spongiostromatnimi skorjami, posamične so sesilne foraminifere (*Alpinophragmium*)

in problematiku (*Tubiphytes*). Primarni tvorci grebena so tam še nečlenkaste spongije in solenoporaceje.

Starost grebenskega apnenca na Razorju in Planji

Spodnjenorijsko starost grebenskega apnenca na Razorju in Planji dokazuje njegov položaj nad vrhnjekarnijskim cefalopodnim apnencem hallstattskega razvoja, anatropitnega horizonta. Spodnjenorijsko starost potrjuje tudi množično nastopajoča školjka *Halobia ex gr. lenticularis*, ki se pojavlja v času tuval 2 – lac 1. Najstarejši norijski grebenski apnenec v severnih Julijskih Alpah dokazuje tudi koralna favna, ki se loči od tiste v nekoliko mlažšem grebenskem apnencu in ima še veliko sorodnost s tuvalsko koralno favno (glej poglavje o koralni favni). Grebenski apnenec na Razorju in Planji uvršča zato v lac (spodnji norij) in sicer v njegov nižji del.

Odnos med spodnjenorijskimi grebenskimi apnenci na Razorju in Planji in med norijsko–retijskimi grebenskimi apnenci druge v severnih Julijskih Alpah

Paleontološke raziskave so pokazale, da se fosili najnižjega norijskega grebenskega apnenca na Razorju in Planji ločijo od fosilov na Dovškem Križu, Šplevti, Kopicah, po pobočjih Mlinaric med Vrati in Kotom, v samem Kotu in pod vrhom Macesnovca (TURNŠEK & RAMOVŠ 1987).

Na Razorju so bile določene koralne *Protoheterastraea razorensis*, *Cyclophyllia raricorallita*, *C. cyclica* in *Retiophyllia* sp. Dve vrsti sta novi, ostali dve pa še nista bili najdeni v norijsko–retijskem grebenskem apnencu omenjenih nahajališč.

Na Planji so v najnižjem delu grebenskega apnenca vrste *Pokljukosmilina tuvalica*, *Rhopalodendron juliensis* ter *Cyclophyllia raricorallita*, na vrhu Planje pa je značilna *Margarosmilina nova*. Na Razorju in Planji je po dosedanjih raziskavah skupna samo vrsta *Cyclophyllia raricorallita*, ki se pojavlja skupaj z vrstama *Pokljukosmilina tuvalica* in *Rhopalodendron juliensis* v najnižjem delu grebenskega apnenca na Planji, na Razorju pa je prav tako v najnižjem delu. Ne na Planji in ne na Razorju ni nobene vrste, ugotovljene v grebenskem apnencu Dovškega Križa in okolice in na ozemlju južnovzhodno od tam.

S tuvalsko favno v Julijskih Alpah sta identični vrsti *Pokljukosmilina tuvalica* in *Rhopalodendron juliensis*, ki sta bili opisani v tuvalskem apnencu na Pokljuki (TURNŠEK & BUSER 1989).

Koralna favna Razorja in Planje ima večje podobnosti s favno julske–tuvalskega razorskega apnenca (RAMOVŠ, 1988) kot s favno norijsko–retijskih grebenskih apnencev v okolici Dovškega Križa, po pobočjih Mlinaric in v Kotu ter na severnem ostenju Macesnovca. Vzrok v podobnosti spodnjenorijske favne Razorja in Planje s favno grebenskih apnencev v

razorskem pretežno skladnatem apnencu in vzrok v razlikah med obdelovano favno na Razorju in Planji in favnami norijsko–retijskih grebenskih apnencev v severnih Julijskih Alpah moremo iskati v naslednjem.

Fosili na Dovškem Križu in v okolici so že iz višjega dela norijskega grebenskega apnenca. Prav tako večina fosilov na Tominškovi poti ni v najnižjem delu grebenskih apnencev, na pobočjih Mlinaric pa so najdeni fosili na sekundarnih mestih, kajti primarno ležečih fosilov ni bilo mogoče nabirati iz strmih in navpičnih sten. Ti fosili so zato večinoma že iz višjih delov 250 do 300 m debelega grebenskega apnenca. Zato sta najdišči Razor in Planja toliko bolj pomembni, saj kažeta ozko zvezo med zgornjetuvalsko grebensko favno razorskega apnenca in najnižjo norijsko grebensko favno. Med obema favnoma je bila na tem prostoru severnih Julijskih Alp samo kratka prekinitev v rasti grebenske favne, ko se je poglobil del julijske karbonatne platforme in se je v globlji brazdi naselila globljemorska cefalopodna favna hallstattskega tipa. Kaže pa, da je nekje v okolici obstajalo okolje, v katerem je tekel grebenski razvoj neprekinjeno od tuvalske dobe v norijsko dobo.

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Explanation of Plates – Razlaga k tablam

Figures of thin sections are negatives, enlarged directly onto the photographic paper, if not marked otherwise. Photos taken by Carmen Narobe and partly by Marjan Grm.

Slike zbruskov so negativi, povečani direktno na fotografski papir, če ni drugače označeno. Fotografije je izdelala Carmen Narobe in deloma Marjan Grm.

PLATE 1

Fig. 1. Planja with Lower Norian reef limestone (1T2/3). Below it some thin bedded Lower Norian limestone occurs and on the fold of uppermost Upper Tuvanian, in the lower part, the bedded Julian–Tuvanian Razor limestone (2+3T1/3) can be seen.

Fig. 2. Razor with Lower Norian bedded and reef limestone (1T2/3), Upper Tuvanian (3T1/3) and Julian–Tuvanian Razor limestone (2+3T1/3).

TABLA 1

- Sl. 1. Planja z grebenskimi spodnjemorijskim apnencem (1T2/3). Pod njim je nekaj malega skladnega spodnjemorijskega apnenca in na pregibu vrhnjega tuala, v spodnjem delu pa je viden plastnati julsko–tuvalski razorski apnenec (2+3T1/3)
- Sl. 2. Razor s spodnjemorijskim skladnatim in grebenskimi apnencem (1T2/3), vrhnjim tualom (3T1/3) in julsko–tuvalskim razorskim apnencem (2+3T1/3).

Both photos by Anton Ramovš.

Obe sliki Anton Ramovš.

TABLA – PLATE 1

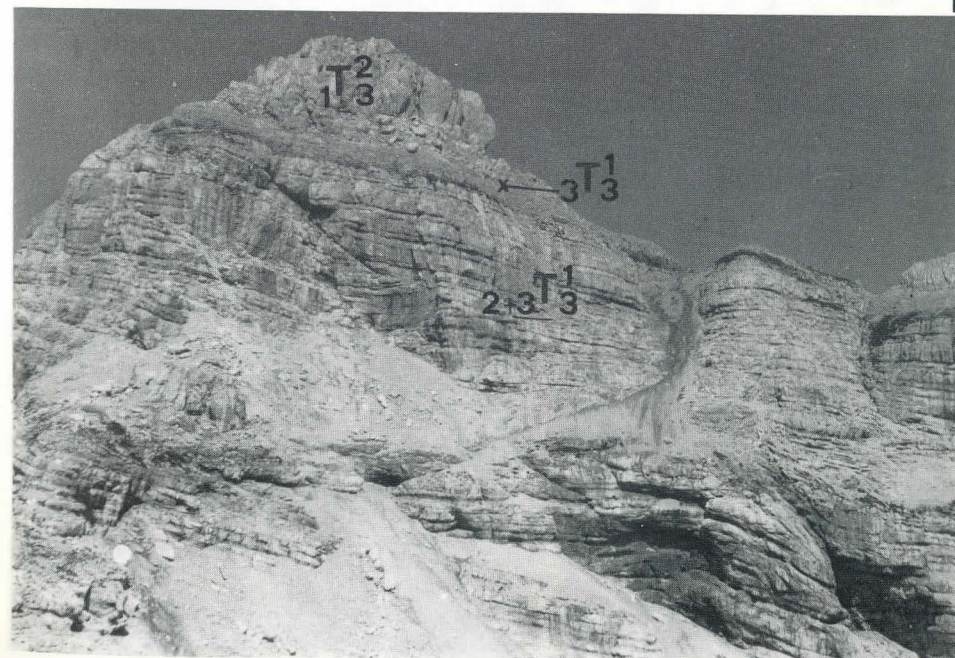
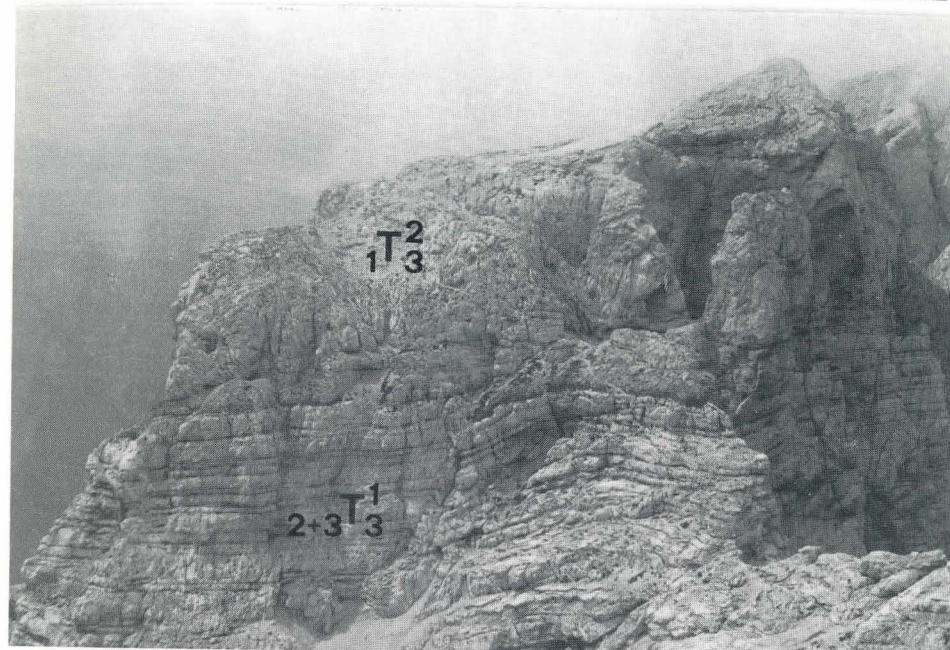


PLATE 2

Fig. 1-3. *Protoheterastraea razorensis* n. sp.

Locality: Razor, Specimen R-18, holotype. Lower Norian.

1. Transverse section of colony with many corallites. Thin section R-18a. x 4.
2. Transverse section of one corallite, showing hexameral septa, thick wall and "fossula". Thin section R-18a. x 20. Positive.
3. Longitudinal section of one corallite showing dissepiments in levels. Thin section R-18c. x 15. Positive.

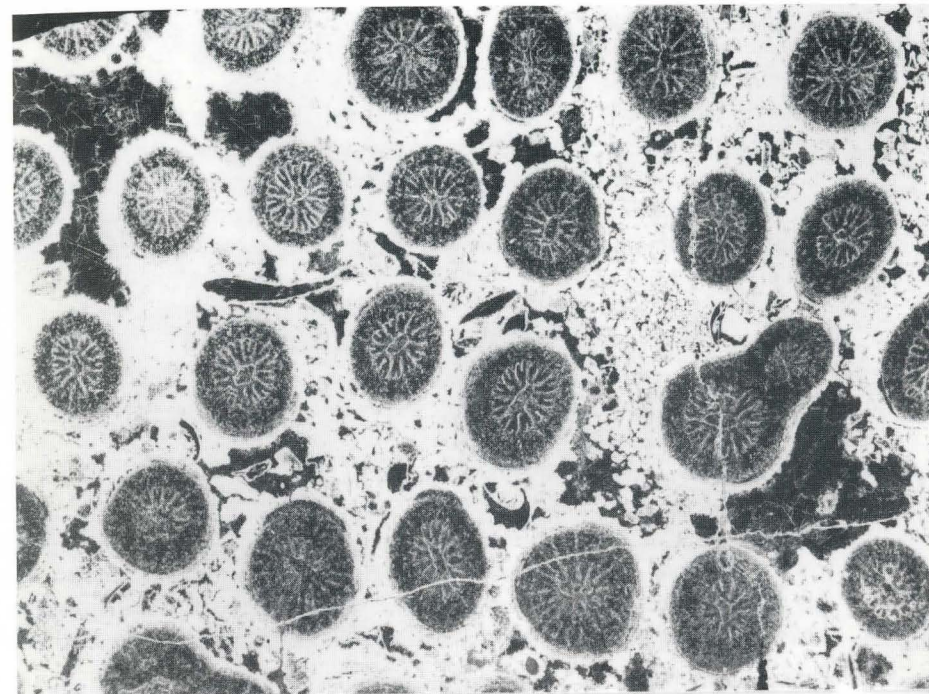
TABLA 2

Sl. 1-3. *Protoheterastraea razorensis* n. sp.

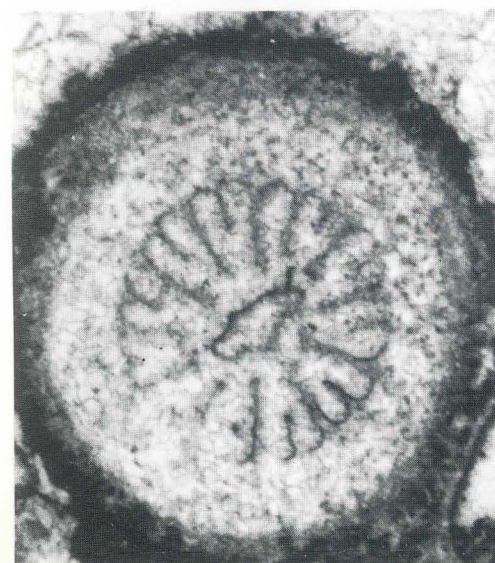
Nahajališče: Razor, Vzorec R-18, holotip. Sp. norij.

1. Prečni presek kolonije z mnogimi koraliti. Zbrusek R-18a. x 4.
2. Prečni presek enega koralita, heksamerna septa, debela stena in "fosula". Zbrusek R-18a. x 20 Pozitiv.
3. Podolžni presek enega koralita. Disepimenti so v istih nivojih. Zbrusek R-18c. x 15. Pozitiv.

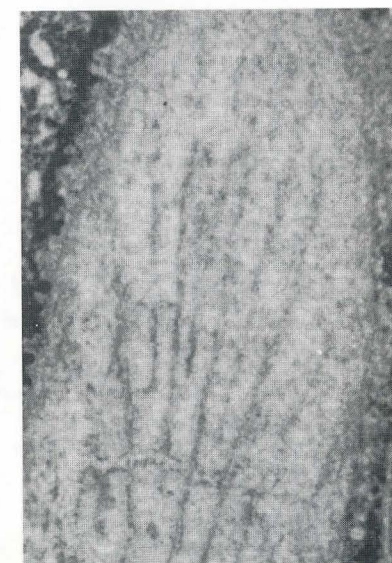
TABLA - PLATE 2



1



2



3

PLATE 3

Fig. 1–2. *Protoheterastraea razorensis* n. sp.

Locality: Razor, Specimen R–18, holotype. Lower Norian.

1. Transverse section of colony with many corallites. Thin section R–18a. x 8.
2. The same thin section as Fig. 1, showing two corallites. In one case the prolongations of septa are visible in the wall and it looks like eutheca. Hexameral system of septa becomes irregular because of the incomplete third cycle. Microstructure looks trabecular with median line and orthogonal fibres in septa, and recrystallized in wall. x 15.

TABLA 3

Sl. 1–2. *Protoheterastraea razorensis* n. sp.

Nahajališče: Razor, vzorec R–18, holotip. Sp. norij.

1. Prečni presek kolonije z mnogimi koraliti. Zbrusek R–18a. x 8.
2. Isti zbrusek kot na 1. sl. z dvema koralitoma. V enem primeru so v steni vidna podaljšana septa, zato je podobna euteki. Heksamerni sistem sept je nepravilen zaradi nepopolnega razvoja tretjega cikla. Mikrostruktura v septih zgleda trabekularna z osrednjo linijo in ortogonalnimi vlakni, v steni pa je prekrizalizirana. x 15.

TABLA – PLATE 3



1



2

PLATE 4

Fig. 1-4. *Cyclophyllia raricorallita* n. sp.

Locality: Razor, specimen 27/85-2, holotype. Planja specimen 10/86. Lower Norian.

1. Surface of the colony from above. Specimen R-27/85. x 1.5.
2. Transverse section of colony with some corallites. Thin section R-27/85-2a. x 4.
3. Longitudinal section of one corallite, showing vesicular and bent dissepiments. Thin section R-27/85-2c. x 4.
4. Transverse section of two corallites. Thin section P-10/86-34. x 4.

TABLA 4

Sl. 1-4. *Cyclophyllia raricorallita* n. sp.

Nahajališče: Razor, vzorec 27/85-2 (holotip). Planja vzorec 10/86. Sp. norij.

1. Površina kolonije od zgoraj. Vzorec R-27/85. x 1,5.
2. Prečni presek kolonije z nekaj koraliti. Zbrusek R-27/85-2a. x 4.
3. Podolžni presek enega koralita, vidimo vezikularne in upognjene disepimente. Zbrusek R-27/85-2c. x 4.
4. Prečni presek dveh koralitov. Zbrusek P-10/86-34. x 4.

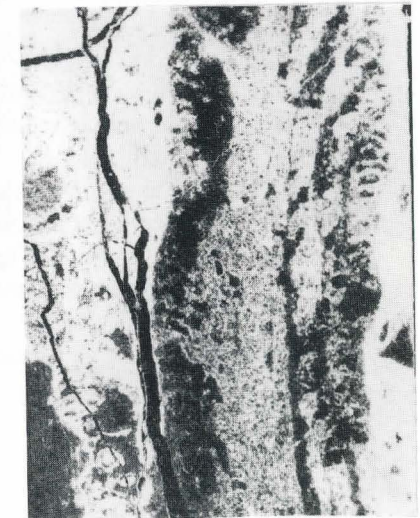
TABLA - PLATE 4



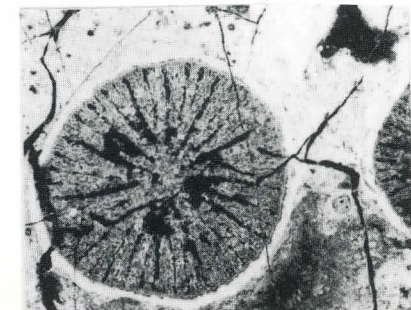
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PLATE 5

Fig. 1–2. *Cyclophyllia raricorallita* n. sp.

Locality: Razor, specimen 27/85–2, holotype. Lower Norian.

1. Transverse section of one corallite. Note epitheca and septal teeth. Thin section R–27/85–2a. x 15.

2. Detail of the corallite on Fig. 1. Note epitheca. Positive. x 20.

Fig. 3–4. *Cyclophyllia cyclica* (Schäfer & Senowbari–Daryan 1978)

Locality: Razor, specimen 977. Lower Norian.

3. Transverse section of colony with very dense corallites. Poorly preserved. Thin section R–977b. x 4.

4. Longitudinal section of two dense corallites. Note vesicular dissepiments. Thin section R–977d. x 4.

TABLA 5

Sl. 1–2. *Cyclophyllia raricorallita* n. sp.

Nahajališče: Razor, vzorec 27–85–2, holotip. Sp. norij.

1. Prečni presek enega koralita. Vidna je epiteka in septalni zobci. Zbrusek R–27/85–2a. x 15.

2. Detajl koralita na sl. 1. Vidna je epiteka. Pozitiv. x 20.

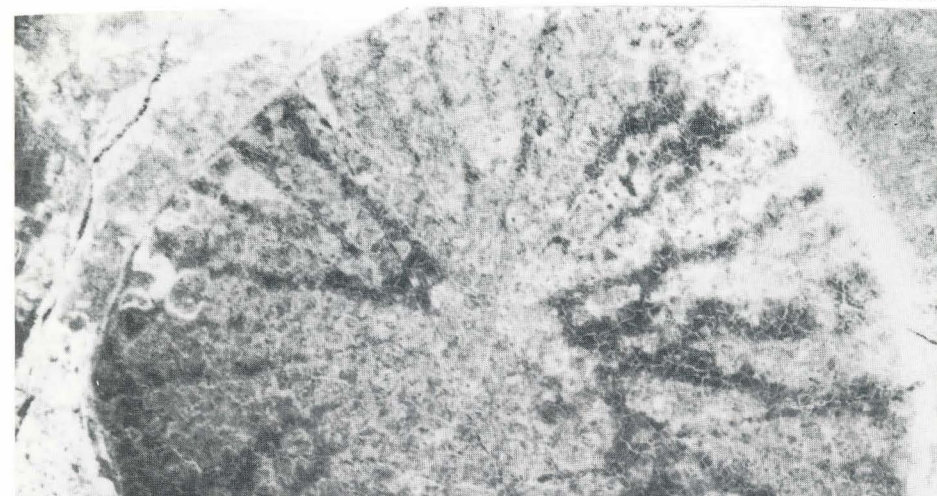
Sl. 3–4. *Cyclophyllia cyclica* (Schäfer & Senowbari–Daryan 1978)

Nahajališče: Razor, vzorec 977. Spodnji norij.

3. Prečni presek kolonije z zgoščenimi koraliti. Slabo ohranjeno. Zbrusek R–977b. x 4.

4. Podolžni presek dveh koralitov. Vidi se vezikularni disepimenti. Zbrusek R–977d. x 4.

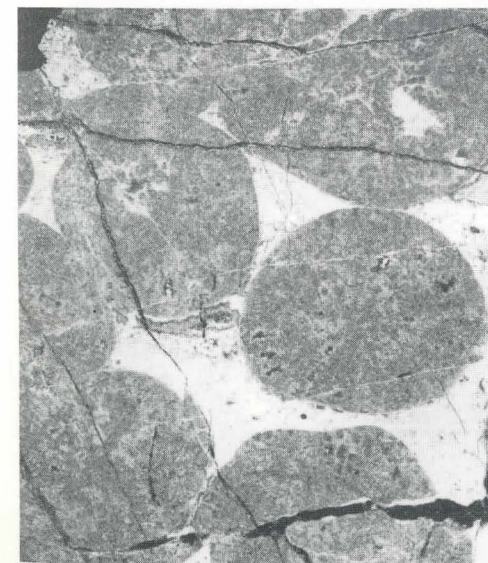
TABLA – PLATE 5



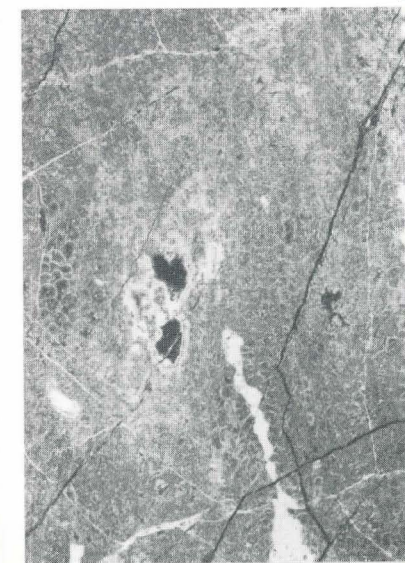
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PLATE 6

Fig. 1–3. *Margarosmilia nova* n. sp.

Locality: Planja, specimen 624/82 (holotype), 625/82. Lower Norian.

1. Transverse section of colony with two corallites. Regular septal arrangement. Smooth edges in first cycle septa. Lateral teeth on younger septa only. Thin section P–624/82a. x 4.
2. Part of transverse corallite from fig. 1. In septa very thin uneven lines of calcification centres. Thin section P–624/82a. x 20. Pozitiv.
3. Longitudinal section of one corallite, showing tabulate and bent dissepiments. Thin section P–625/82 b. x 4.

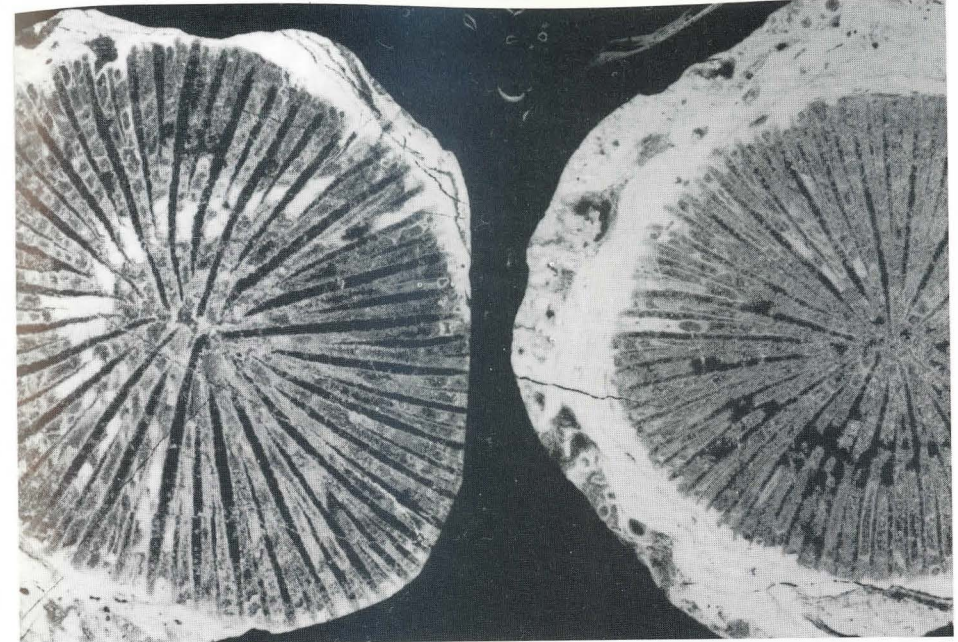
TABLA 6

Sl. 1–3. *Margarosmilia nova* n. sp.

Nahajališče: Planja, vzorec 624/82 (holotip), 625/82. Spodnji norij.

1. Prečni presek kolonije z dvema koralitoma. Pravilen septalni aparat. Gladka septa prvih ciklov. Lateralni zobci samo na mlajših septih. P–624/82a. x 4.
2. Del prečnega koralita s sl. 1. V septih so vidne zelo tanke neravne linije kalcifikacijskih centrov. Lateralni zobci so predvsem na mlajših septih. x 20. Pozitiv.
3. Podolžni presek enega koralita, vidni so tabulatni in upognjeni disepimenti. Zbrusek P–625/82b. x 4.

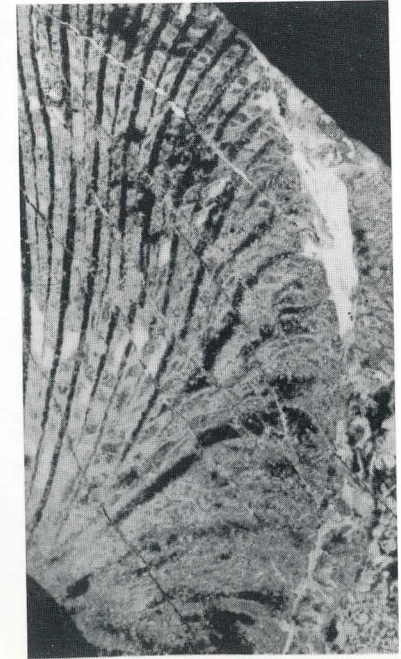
TABLA – PLATE 6



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PLATE 7

Fig. 1–2. *Retiophyllia* sp. (Cuif 1974, type III)

Locality: Razor, specimen 27/85–3. Lower Norian.

1. Transverse section of colony with several corallites, showing massive septotheca.

Thin section R–27/85–3a. x 4.

2. Part from fig. 1. x 8.

Fig. 3–4. *Pokljukosmilia tuvalica* Turnšek 1989

Locality: Planja, specimen P–11/86–36. Lower Norian.

3. Transverse section of corallites, showing typical equal thickness of septa. Thin section P–11/86–36a. x 4.

4. Part from fig. 3, showing trabecular microstructure of septa with orthogonal fibres. x 8.

TABLA 7

Sl. 1–2. *Retiophyllia* sp. (Cuif 1974, type III)

Nahajališče: Razor, vzorec 27/85–3. Spodnji norij.

1. Prečni presek kolonije z različnimi koraliti. Vidna je masivna septoteka. Zbrusek R–27/85–3a. x 4.

2. Detajl s sl. 1. x 8.

Sl. 3–4. *Pokljukosmilia tuvalica* Turnšek 1989

Nahajališče: Planja, vzorec P–11/86–36. Spodnji norij.

3. Prečni presek koralitov s tipičnimi enakomerno debelimi septi. Zbrusek P–11/86–36a. x 4.

4. Detajl s sl. 3. Vidi se trabekularna mikrostruktura sept z ortogonalnimi vlakni. x 8.

TABLA – PLATE 7

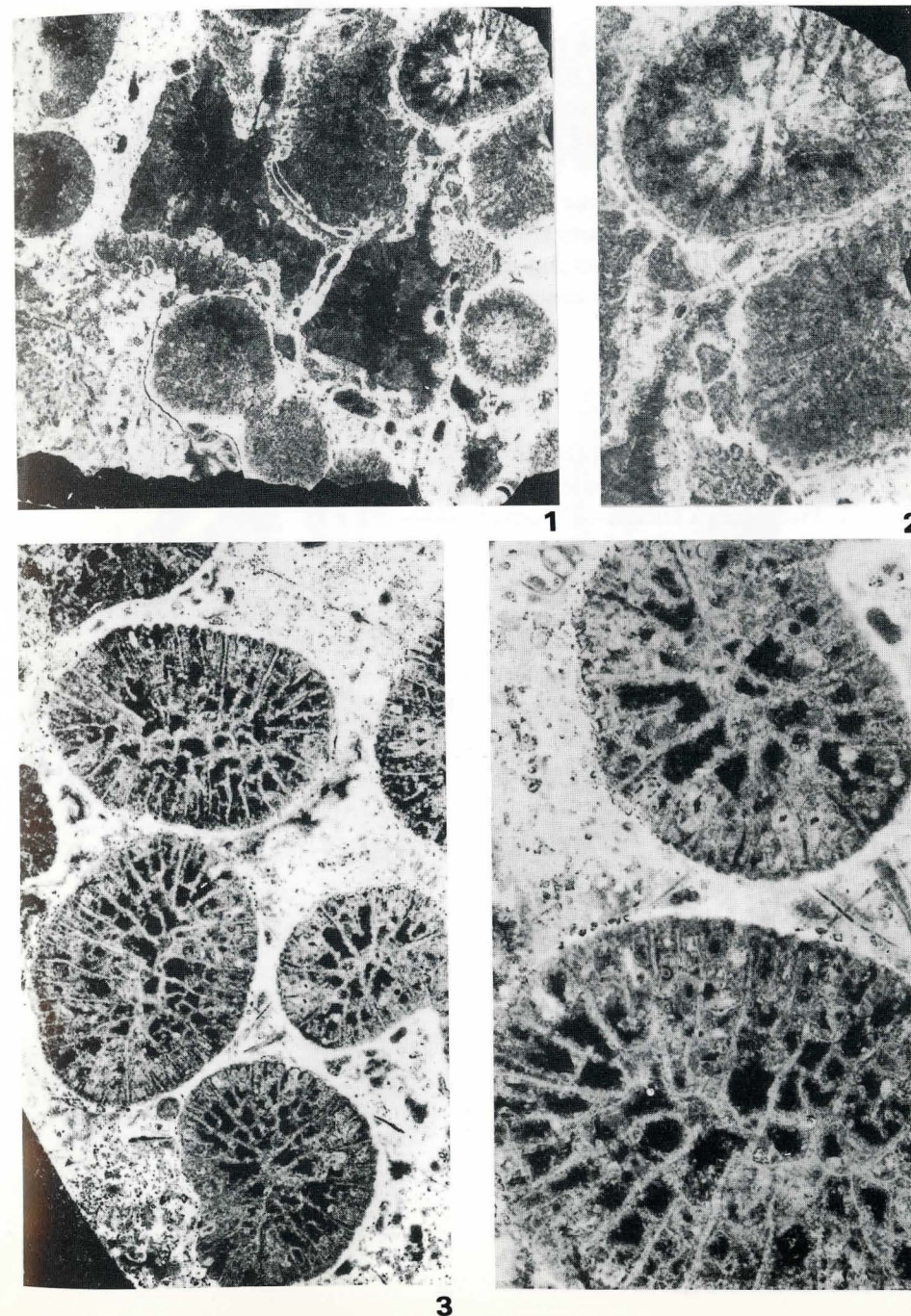


PLATE 8

Fig. 1–3. *Rhopalodendron juliensis* Turnšek 1989

Locality: Planja, specimen 10/86–35. Lower Norian.

1. Transverse section of corallites. Thin section P–10/86–35a. x 4.

2. Part of fig. 1, showing subporous septa, synapticulae and pennulae-like lateral ornamentations. x 8.

3. Transverse section of one corallite from fig. 1. Positive. x 20.

Fig. 4. Limestone surface with association of bivalve *Halobia* and coral *Cyclophyllia*.

Locality: Planja, from lower part of the section. Positive. x 1.5.

Fig. 5. Bivalve *Halobia* from the same specimen as in fig. 3. Positive. x 3.

TABLA 8

Sl. 1–3. *Rhopalodendron juliensis* Turnšek 1989

Nahajališče: Planja, vzorec 10/86–35. Spodnji malm.

1. Prečni presek koralitov. Zbrusek P–10/86–35a. x 4.

2. Detajl s sl. 1. Vidna so subporozna septa, sinaptikule in penulam podobne okrasitve. x 8.

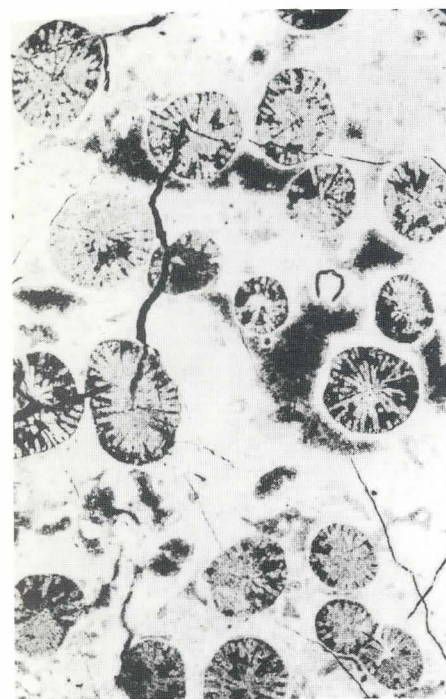
3. Prečni presek enega koralita. Isti zbrusek kot sl. 1. Pozitiv. x 20.

Sl. 4. Površina apnenca z združbo školjke *Halobia* in koral *Cyclophyllia*.

Nahajališče: Planja, iz spodnjega dela profila. Pozitiv. x 1,5.

Sl. 5. Školjka *Halobia* iz istega vzorca kot sl. 3. Pozitiv. x 3.

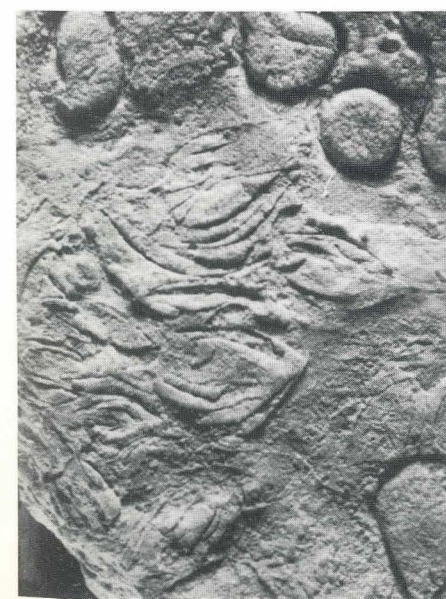
TABLA – PLATE 8



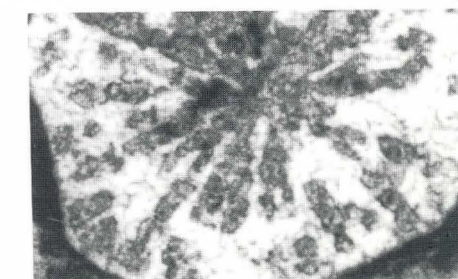
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