| RAZPRAVE IV. RAZREDA SAZU | XXXV | 1 | 3 - 41 | Tab. 1-10 | LJUBLJANA 1994 |
|---|---|---|---|---|---|

# UPPER CRETACEOUS REEF BUILDING COLONIAL CORALS OF GOSAU FACIES FROM STRANICE NEAR SLOVENSKE KONJICE (SLOVENIA)

## ZGORNJEKREDNE GREBENOTVORNE KOLONIJSKE KORALE GOSAVSKEGA FACIESA IZ STRANIC PRI SLOVENSKIH KONJICAH (SV SLOVENIJA)

DRAGICA TURNŠEK

IUGS UNESCO P 262

## INTRODUCTION

The Upper Cretaceous colonial corals had so far been found in Slovenia on Banjška planota where they occur redeposited in Senonian breccia (TURNŠEK & BUSER, 1976). In Stranice until now only solitary forms had been known (TURNŠEK, 1978). Mr. FRANC PAJTLER discovered in the Stranice quarry lately also a great number of colonial reef-building corals which is the first primary finding of such type of corals in Slovenia. The collection comprises about 90 specimens of colonies. For research study of skeletal structures 40 thin sections were made. In the present treatise a systematic description of 17 species or taxa is given. Coral species belong to 11 genera, 8 families and 4 suborders. Researched corals are kept in the Franc Pajtler collection in Pragersko.

## THE LOCALITY OF THE COLONIAL CORALS AT STRANICE

In the Stranice quarry (Fig. 1) FRANC PAJTLER discovered reef-building colonial corals in three levels. The first lower horizon outcrops at the small church; there corals are the

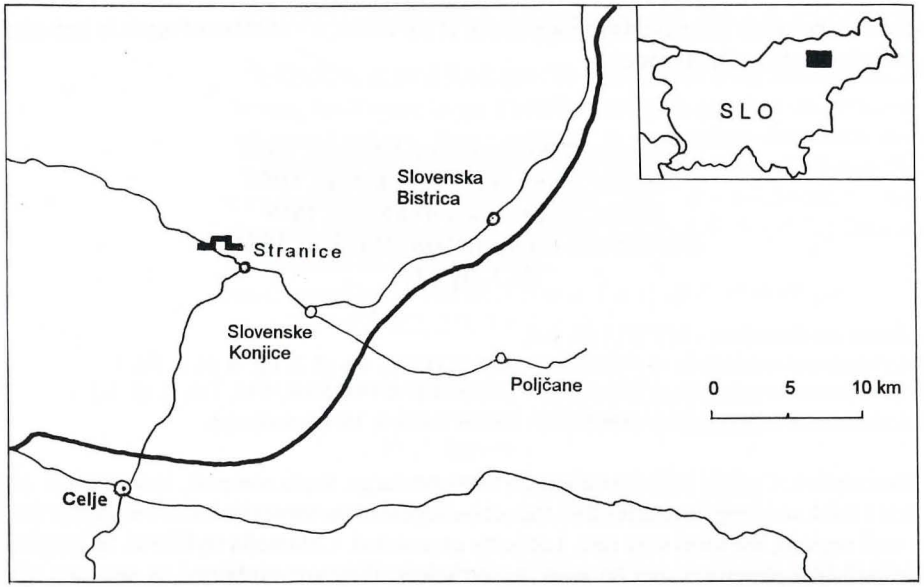



Fig. 1. Location of quarry with the coral finding places at Stranice. Quarry emphasized, not in scale
Sl. 1. Položaj kamnoloma s koralnimi nahajališči v Stranicah. Kamnolom je poudarjen, ni v merilu.

most abundant, and next to them rare hipuritids and radiolitids occur. Specimens of *Cunnolites* are very rare. The second level is found on the plateau above the administration building of the quarry. There the colonial corals are more rare, next to them snails, radiolitids and hippuritids occur. The third level is found still higher in the quarry. Next to rare colonial corals also rare snails and urchins and abundant *Cunnolites* occur. From a spot at the top of the quarry PLENIČAR (1993) described Maastrichtian rudists among which no corals occured any more.

## SYSTEMATIC PALAEONTOLOGY

Corals from Stranice are ranged in the system given in Contents.

In the coral systematics mainly the statements of MARCEL BEAUVAIS (1982) are considered who performed the revision of all Gosau corals on the basis of the original material from Austria. The corals from Stranice resemble much those from Gosau. Particular differences and similarities of our specimens are described with individual species. Recently the Upper Cretaceous corals were studied in various countries, as in Czech Republic (see ELIAŠOVA, 1992), Spain (see REIG ORIOL, 1993), and elsewhere, however, species of those localities could not be compared with the species from Stranice.

With descriptions of already known species only the most important structural elements and comparisons are added. With synonymy the first citation of species and citations dealing with whatever revisions are mentioned, in other cases an appeal to the BEAUVAIS' already compiled synonymy is given.

For dimensions the following international abbreviations are used: d = diameter of corallite, cc = distance between two neighbouring centres of corallites, s = number of septa in one corallite or density of septa in the distance.

Subordo: Achaeocaeniina Alloiteau, 1952
Familia: Actinastraeidae Alloiteau, 1952
Genus: *Actinastraea* d'Orbigny, 1849
*Actinastraea octolamellosa* (Michelin, 1846)
Pl. 1, figs. 1-4

1846 *Astrea octolamellosa* - MICHELIN, n.v.
1954 *Actinastraea octolamellosa* (Michelin) - ALLOITEAU, 49, pl. 3, fig. 6, pl. 8, fig. 1.
1978 *Actinastraea octolamellosa* (Michelin) - TURNŠEK & POLŠAK, 146, Tab. 2, sl. 1-3.
1982 *Actinastraea octolamellosa* (Michelin) - BEAUVAIS, I, 15. (Synonymy).

Description: Cerioid bulbous colony 20 to 90 mm large. Septa compact, in octomeral system. The first 8 thick and long, in centres free, the second cycle of the same thickness but shorter (mainly in the wall region), the third very rare. Laterally granulated. Columella styliform. In longitudinal section pali-like structures can be seen, nevertheless, they are explained as sections of axial ornamentations of septa. Microstructure is of large trabeculae and oblique fibres.

Dimensions: d = 1.5-2.1 mm, cc = 1.5-2.4 mm, s = 16+s3.

Comparison: Revision and remarks see in TURNŠEK & POLŠAK, (1978, 146), and





BEAUVAIS (1982, I, 15). Specimens from Stranice have the same characterictics and are the best preserved specimens of this species.

Distribution: Santonian of Austria and France, Santonian-Campanian of Croatia.

Material: Stranice 1/11 and 1/24 and two more specimens.

*Actinastraea ramosa* (Michelin, 1847)
Pl. 1, figs. 5-6

1847 *Astrea ramosa* - MICHELIN, n.v.
1978 *Actinastraea ramosa* (Michelin) - TURNŠEK & POLŠAK, 145-146, Tab. 1, sl. 1-3. (Synonymy).
1982 *Actinastraea ramosa* (Michelin) - BEAUVAIS, I, 16.

Description and remarks given by TURNŠEK & POLŠAK (1978). Specimens from Stranice are of the same structures and dimensions (d = 1-1.2 mm, s = 8+8).

Distribution: Upper Santonian of Austria, Spain and France (Corbières), Santonian-Campanian of Hungaria and Croatia.

Material: Stranice 1/8 (two colonies on one rock).

Genus: *Columactinastraea* Alloiteau, 1952
*Columactinastraea pygmaea* (Felix, 1903)
Pl. 2, figs. 1-3

1903 *Astrocoenia pygmaea* nov. sp. - FELIX, 54, Taf. 3, Fig. 4-5.
1978 *Columactinastraea pygmaea* (Felix) - TURNŠEK & POLŠAK, 147, 168, Tab. 3, sl. 1-4. (Synonymy).

Description: given by TURNŠEK & POLŠAK (1978). Specimens from Stranice are small crustaceous or bulbous colonies, 10-40 mm large. Corallites are polygonal, sometimes on the surface roundish because of arised calices. Septa compact in incomplete octomeral system. Columella small, styliform, with irregularly joined pali, and looks like papilous. Wall septothecal, dissepiments vesicular. Microstructure is not preserved. Dimensions: d = 1-1.5 mm, s = 16(+s).

Comparison of structures and dimensions see in TURNŠEK & POLŠAK (1978). Specimens from Stranice are identical with those from Medvednica.

Distribution: Santonian-Campanian of France, Croatia, Campanian of portugal.

Material: Stranice 1/14, 1/26, 1/27, 2/2, 2/3, 2/4, 2/5, 2/7.

Genus: *Enallocoenia* d'Orbigny, 1849
*Enallocoenia salisburgensis* Beauvais, 1982
Pl. 2, figs. 4-7

1982 *Enallocoenia salisburgensis* nov. sp. - BEAUVAIS, I, 24-25, Pl. 1, fig. 5ab.

Description: There are many small bulbous subcerioid colonies 15-30 mm large in the same rock sample. Corallites are polygonal on the surface and roundish to oval in thin sections. Septa compact, in hexagonal orders, with large lateral granulation, axially thickened. Columella well preserved, styliform, somewhere slightly lamellar. Between corallites septothecal wall, some-

times recrystallized and thick. It could also be narrow peritheca. Microstructure recrystalized, here and there ?centres of trabeculae can be seen.

Dimensions: d = (1.5)2(2.2) mm, cc = 2.5-3 mm, s = 24(6+6+12).

Comparison: BEAUVAIS (1982) described the surface of this species which is completely identical with our specimen. In thin section we can see a kind of peritheca which is not mentioned by BEAUVAIS. Similar is genus *Placocolumastraea* REIG ORIOL (1989, 6) which is plocoid with "tabulocolumnar" peritheca and pali. Similar is also specimen represented by TSCHESHMEDJIEVA (1981, 35-38, pl. 1, figs. 1-2) who put it between the genera *Actinastraea* and *Columactinastraea*. Complete comparison is not possible because of different preservation state of specimens and because of different preparation and representation of material.

Distribution: Upper Santonian of Austria.

Material: Stranice 1/19.

Subordo: Faviina Vaughan & Wells, 1943
Familia: Heliastraeidae Alloiteau, 1957
Genus: *Procladocora* Alloiteau, 1952
*Procladocora simonyi* (Reuss, 1854)
Pl. 3, figs. 1-2

1854 *Cladocora simonyi* m. - REUSS, 112, Taf. 12, Figs. 5-7.
1976 *Procladocora simonyi* (Reuss) - TURNŠEK & BUSER, 56, Tab. 12, sl. 1-2. (Synonymy).
1978 *Procladocora simonyi* (Reuss) - TURNŠEK & POLŠAK, 151, Pl. 7, figs. 1-7.

Description: Specimens from Stranice are poorly preserved, recrystallized fragments of phaceloid colonies the corallites of which show the structure and dimensions (d = 6-10 mm, s = ca 48) of *P. simonyi*. Microstructure is not preserved.

Distribution: Santonian of Austria, Santonian-Campanian of Croatia, and Senonian breccia of Banjška planota in Slovenia.

Material: Stranice 1/22 and four other specimens.

*Procladocora tenuis* (Reuss, 1854)

1854 *Cladocora tenuis* m. - REUSS, 112, Taf. 6, Figs. 24-25.
1978 *Procladocora tenuis* (Reuss) - TURNŠEK & POLŠAK, 151-152, 171, Pl. 8, figs. 1-9. (Synonymy).
1985 *Procladocora tenuis* (Reuss) - HÖFLING, 98.

Description: given by TURNŠEK & POLŠAK, 1978. Some phaceloid colonies from Stranice are of *Procladocora* structure. In dimensions (d = 3-4 mm) they can be compared with *P. tenuis*.

Distribution: Santonian of Austria and France, Santonian-Campanian of Croatia.

Material: Stranice 1/28 and some other specimens.





Familia: Placosmiliidae Alloiteau, 1952
Genus: *Placosmilia* Milne Edwards & Haime, 1848
*Placosmilia gracilis* (Felix, 1903)
Pl. 3, figs. 5-8

1903 *Lasmogyra gracilis* nov. sp. - FELIX, 246-247, Taf. 21, Fig. 4-4ab.
1982 *Placosmilia gracilis* (Felix) - BEAUVAIS, I, 66-68, Pl. 4, fig. 2-3, Pl. 59, fig. 7. (Synonymy).

Description: given by BEAUVAIS. Specimens from Stranice are flabelo-meandroid uniserial colonies of 30-60 mm lenght. Septa are compact, costate, in 2-3 orders. Wall is paratheca to septotheca. Endotheca of large dissepiments, columella thinly lamelar. Microstructure is completely recrystallized.

Dimensions: d of series = 5-10 mm, s = 12-15/10 mm.

Comparison: Our specimens have sparser septa than in FELIX specimens. Nevertheless, in syntype BEAUVAIS (1982, 67) counted 12/10 septa, so I ascribe the specimens from Stranice to this species.

Distribution: Santonian of Austria, France (Provence), and Spain, Coniacian of France (Corbières).

Material: Stranice 1/13, 1/B, and six other specimens.

Familia: Faviidae Gregory 1900
Genus: *Hydnophora* Fischer & Waldheim, 1807

Revision of genus was made by BEAUVAIS (1982, I, 85) upon the original materials, therefore it is here accepted.

*Hydnophora ataciana* d'Orbigny, 1850
Pl. 4, figs. 1-7

1850 *Hydnophora ataciana* d'Orbigny - d'ORBIGNY, II, p. 207.
?1937 *Hydnophoraraea ataciana* d'Orbigny - BATALLER, p. 168.
1982 *Hydnophora styriaca ataciana* d'Orbigny - BEAUVAIS, I, 90-92, Pl. 5, fig. 4. (Synonymy).

Description: and revision were made by BEAUVAIS, 1982. This is small colony of cylindrical shape, to 15 mm in diameter. Collines very narrow and irregularly arranged. Septa hydnophoroid, compact, laterally granulated, axially thickened. Series and centres of corallites unclear. Columella unclear. Microstructure is not preserved.

Dimensions: d = (1.5)2(2.5) mm, cc = 2-3 mm, s = 6-8(12), d of coline = 0.3-0.6 mm.

Comparison: BEAUVAIS (1982) ascribed *H. ataciana* to subspecies of *H. styriaca*. Both are of very similar dimensions. But because of extremely narrow collines I distinguish *H. ataciana* from *H. styriaca* (d of colline = 1-1.2 mm), and recognise it as independent species.

Distribution: Santonian of Austria and France (Corbières). ?Campanian-Maastrichtian of Spain.

Material: Stranice 1/1, 1/12, 1/23 and four more specimens.

*Hydnophora multilamellosa* Reuss, 1854
Pl. 5, figs. 1-5

1854 *Hydnophora multilamellosa* m. - REUSS, 111, Pl. 14, figs. 5-6.
1982 *Hydnophora multilamellosa* Reuss - BEAUVAIS, 92-93, Pl. 5, fig. 5. (Synonymy).

Description: was made by BEAUVAIS. Specimens from Stranice are bulbous colonies of about 70 mm width, with circular to oval collines, from which septa go radially. Septa are compact, laterally strongly granulated, axially thickened. Columella looks parietal, but centres of series unclear. Endotheca of numerous vesicular dissepiments. Microstructure in some septa looks like having median line with fibres, poorly preserved.

Dimensions: d (colline) = (1.5)2-3.5 mm, s = (10)15-20(21).

Comparison: Our specimens fit with measurements to those of BEAUVAIS (1982, pl. 5, fig. 5a).

Distribution: Santonian of Austria and France (Corbières).

Material: Stranice 1/18 and two more specimens.

Subordo: Meandriina Alloiteau, 1952
Familia: Dendrogyridae Alloiteau, 1952
Genus: *Orbignygyra* Alloiteau, 1952
*Orbignygyra daedalea* (Reuss, 1854)
Pl. 6, figs. 1-3

1854 *Pachygyra daedalea* m. - REUSS, 94, Taf. 14, Fig. 3-4.
1982 *Orbignygyra daedalea* (Reuss) - BEAUVAIS, 203-204, Pl. 6, fig. 5, pl. 8, fig. 6. (Synonymy).

Description: was given by BEAUVAIS. Specimens from Stranice are meandroid colonies 60x50x25 mm large, with series separated by ambulacral peritheca. Septa are compact, costate, laterally granulated, axially become thick in form of letter T. Columella thin, lamellar and long, very rarely interrupted. Dissepiments very scarce. Wall is para-septotheca. Microstructure in axial part of septa and in columella shows thin median line with very dense ?centres of calcification, poorly preserved.

Dimensions: d (series) = 2.5 mm, cc = 3-5 mm, s = 20/10 mm.

Comparison: Specimens from Stranice are identical to those described by BEAUVAIS.

Distribution: Upper Santonian of Austria and France (Corbières), Santonian of Spain.

Material: Stranice 1/25 and two other specimens.

Subordo: Fungiina Verrill, 1865
Familia: Pachyphyllidae Beauvais, 1982
Genus: *Neocaeniopsis* Alloiteau, 1957
*Neocoeniopsis excelsa* (de Fromentel, 1867)
Pl. 6, figs. 4-6

1867 *Phyllocoenia excelsa* - FROMENTEL, 550, Pl. 152, fig.3. Pl. 154, fig. 1.
1982 *Neocaeniopsis excelsa* (de Fromentel) - BEAUVAIS, II, 103. (Synonymy).





Description and revision were made by ALLOITEAU (1957) and BEAUVAIS (1982). Specimen from Stranice is large colony of 40-60 mm. Corallites are plocoid which on the surface sometimes look polygonal. Septa are subcompact, in irregular ?hexameral system, laterally granulated. Columella indefinite, it could be styliform, parietal or even lacking, depending on the section and preservation state of colony. Wall para-septo-synapticulotheca. peritheca costate. Microstructure recrystalized.

Dimensions: d = 3-4(5) mm, cc = 4-6 mm, s = ca 20-24.

Remarks: Skeletal structure and dimensions with number of septa are identical to those in *Neocoeniopsis excelsa.*

Distribution: Santonian of Austria, and France.

Material:Stranice 1/17.

*Neocaeniopsis corollaris* (Reuss, 1854)
Pl. 7, figs. 1-5

1854 *Astraea corollaris* m. - REUSS, 113-114, Taf. 9, Fig. 7-8.
1982 *Neocaeniopsis corollaris* (Reuss) - BEAUVAIS, II, 107-109, pl. 36, fig. 4. (Synonymy).

Description: plocoid colony preserved in pieces of 30-50 mm. Septa subcompact, with extremely well expressed and numerous lateral granulae and distal dents. Wall parasynapticulothecal and partly septal. Columella various, partly parietal, partly irregularly lamellar. peritheca costate, doted. Microstructure poorly preserved, not recognizable.

Dimensions: d = 3-5 mm, cc = 5-7 mm, c = ca 30-36.

Comparison: In structure of skeletal elements our specimens fit with the genus *Neocaeniopsis*. Dimensions are identical to the species *N. corollaris*.

Distribution: Santonian of Austria.

Material: Stranice 1/21, 3/2, 3/4, and two other specimens.

Familia: Thamnasteriidae Vaughan & Wells, 1943
Genus: *Dimorphastraea* d'Orbigny, 1849
*Dimorphastraea leptophyllia* (Felix, 1903)
Pl. 8, figs. 1-5

1903 *Thamnastraea leptophyllia* nov. sp. - FELIX, 208-209, Taf. 22, Fig. 3.
1982 *Dimorphastraea leptophyllia* (Felix) - BEAUVAIS, II, 83-84, Pl. 30, fig. 4, Pl. 71, fig. 3. (Synonymy).

Description: and revision made by BEAUVAIS. Specimens from Stranice are fungiform to cylindrical dimorphastraeid colonies with diameter of ca 30-40 mm. Septa are confluent, porous, laterally sharply granulated, with pennulae. Dissepiments thin tabulate, synapticulae rare. Columella parietal. Microstructure ?mini trabecular, poorly preserved.

Dimensions: d = 3-4(5) mm, s = 26-30 (25-30/10 mm).

Comparison: Comparison can be made by the density of septa which is identical to original FELIX's material (s= 24-32/10 mm).

Distribution: Santonian of Austria, Coniacian-Santonian of France (Corbières).

Material: Stranice 1/4, 1/5, 1/7, 1/15, 1/16, 3/3, and 15 other specimens.

*Dimorphastraea composita* (Sowerby, 1835)
Pl. 9, figs. 1-4

1835 *Cyathophyllum compositum* - SOWERBY, n.v.
1930 *Synastraea composita* Sowerby - OPPENHEIM, 152, Pl. 28, fig. 7-9, Pl. 33, fig. 10.
1982 *Dimorphastraea composita* (Sowerby) - BEAUVAIS, II 81-83, Pl. 29, fig. 4, Pl. 30, fig. 2, Pl. 66, fig. 4. (Synonymy).

Description: and revision made by BEAUVAIS (1982). Specimens from Stranice are fungiform or cylindrical or bulbous massive colonies, ca 30-60 mm large. Septa confluent, porous, laterally sharply granulated, bearing also pennulae. Dissepiments thin tabular, synapticulae numerous. Columella parietal, well developed. Microstructure ?minitrabecular, poorly preserved.

Dimensions: d = (4)5-7 mm, s in thin section = 20/10 mm, on the surface 14-15/10 mm can be counted.

Comparison: It seems that our specimens have denser septa than those of BEAUVAIS (d = 7-10 mm, s = 15/10 mm). But number of septa in our specimen (Str. 1/9) differs in thin sections from those on the surface, where the last order can not be observed. Because the well developed columella and other structures are identical with *D. composita*, our specimens are ascribed to this species. In dimensions our specimens aproach the *D. scutulum* Oppenheim which differs in columella.

Distribution: Santonian of Austria and Spain.

Material: Stranice 1/6, 1/9, 1/A, 2/1, and about 10 other specimens.

Familia: Actinacididae Vaughan & Wells, 1943
Genus: *Actinacis* d'Orbigny, 1849
*Actinacis reussi* Oppenheim, 1930
Pl. 10, figs. 1-3

1930 *Actinacis reussi* n. sp. - OPPENHEIM, 8-9, Pl. 1, fig. 5, Pl. 10, fig. 2, Pl. 15, fig. 6.
1982 *Actinacis reussi* Oppenheim - BEAUVAIS, II, 271-273, Pl. 48, figs. 5-6.

Description: was given by BEAUVAIS (1982). Specimens from Stranice are small circular to encrusting colonies with plocoid corallites surrounded by inner synapticulotheca. Septa are perforated, anastomosing. peritheca is very large, spongy. Columella unclear (?parietal, sometimes looks styliform). Microstructure is poorly preserved, it shows sometimes ?centres of trabeculae.

Dimensions: d = 1.5-2(2.2) mm, cc = 2.5-3(4) mm, s = ca 24 (20-28), density of elements in peritheca = 40-50/10 mm.

Comparison: Corallites from specimens in Stranice are larger than those of BEAUVAIS (1982) (d = 0.8-1.7 mm), but septa and peritheca are identical to Austrian specimens (cc = 2-3 mm, s = 24, density of elements in peritheca 40-45/10 mm).

Distribution: Santonian of Austria, Coniacian of France (Corbières).

Material: Stranice 3/1.





*Actinacis martiniana* d'Orbigny, 1850
Pl. 10, figs. 4-6

1850 *Actinacis martiniana* - d'ORBIGNY, II, 209.
1978 *Actinacis martiniana* d'Orbigny - TURNŠEK & POLŠAK, 160, 177, pl. 16, fig. 1-4.
1982 *Actinacis martiniana* d'Orbigny - BEAUVAIS, II, 267-268, pl. 48, fig. 2. (Synonymy).

Description: given by BEAUVAIS (1982). Specimens from Stranice are small encrusting colonies. Corallites are circular with porous septa, laterally granulated. Wall synapticular. Columella parietal. Large spongy septo-synapticulate peritheca. Microstructure of thick trabeculae, poorly preserved.

Dimension: d = 1.5 mm, cc = 3 mm, s = 24, density of elements in peritheca = 55-60/10 mm.

Comparison: Both mentioned species of *Actinacis* differ especially in density of skeletal elements in peritheca.

Distribution: Santonian of Austria and France, Santonian-Campanian of Croatia.

Material: Stranice 1/2, 1/20, 1/29, 2/6 (this specimen looks like being cylindrical).

Genus: *Polytremacis* d'Orbigny, 1850
*Polytremacis* sp.
Pl. 3, figs. 3-4

Description: One specimen is a small fragment of encrusting plocoid colony with circular corallites. Septa are very short, being only in wall and continuing into the large spongy peritheca. d = 1 mm, s = 20, density of elements in peritheca is 25/square mm. This structure fits with the genus *Polytremacis*.

Material: Stranice 3/2.

## STRATIGRAPHICAL WORLD DISTRIBUTION OF THE STRANICE CORALS

The coral locality in Stranice was rangend into Santonian-Campanian already on the basis of rudists (PLENIČAR, 1993, 1994) and solitary corals (TURNŠEK, 1978), as well as after comparison with the similar locality on Medvednica Mt. (TURNŠEK & pOLŠAK, 1978). This age is supported also by reef-building colonial corals. Although the corals occur in three distinct horizons, these could not be stratigraphically subdivided. The same species appear in all three horizons. Nevertheless, corals are the most abundant in the lower horizont which could belong to the Santonian.

Also the comparison with world localities confirms the same age. All coral species from Stranice (with a single exception) are known from Gosau in Austria (REUSS, 1854, FELIX, 1903, BEAUVAIS, 1982), 12 of them also from Corbières and Provance in southern France (de FROMENTEL, 1889, ALLOITEAU, 1954, BEAUVAIS, 1982), 5 from Catalonia in Spain (BATALLER, 1937), four from the nearest locality at Orešje on Medvednica Mt. in Croatia (TURNŠEK & POLŠAK, 1978), and one species in each Bakony in Hungary (KOLOSVARY, 1954), and Beira Litoral in portugal (BEAUVAIS et al., 1975). One same species is known from the Senonian breccia on Banjška planota in western Slovenia (TURNŠEK & BUSER, 1976). As

probably belonged to the northern shallows of the Tethys, either as a part of a platform or of an island arc.

## POVZETEK

### Zgornjekredne kolonijske korale gosavskega faciesa iz Stranic pri Slovenskih Konjicah

*Uvod.* Zgornjekredne kolonijske korale so v Sloveniji doslej bile najdene na Banjški planoti, kjer se pojavljajo presedimentirane v senonijski breči (TURNŠEK & BUSER, 1976). V Stranicah smo doslej poznali le solitarne oblike (TURNŠEK, 1978). Gospod FRANC PAJTLER je v kamnolomu v Stranicah odkril v zadnjih letih tudi veliko število kolonijskih grebenotvornih koral, ki predstavljajo prvo primarno najdbo koral gosavskega tipa v Sloveniji. Zbirka obsega okoli 90 primerkov kolonij. Za študij skeletnih struktur je narejenih 40 zbruskov. V pričujoči razpravi je sistematsko opisanih 17 vrst oziroma taksonov, ki pripadajo 11 rodovom, 8 družinam in 4 podredovom.

*Nahajališče.* Grebenotvorne kolonijske korale se v Straniškem kamnolomu pojavljajo v treh nivojih. prvi spodnji horizont je pri cerkvici, kjer je koral največ, zraven njih se dobe še hipuriti in radioliti. Vmes so zelo redki kunolitesi. Drugi nivo je na platoju nad upravno zgradbo kamnoloma. Tu so kolonijske korale redkejše, vmes se pojavljajo polži, redki radioliti in hipuriti. Tretji nivo je še više v kamnolomu, kjer so poleg redkih kolonijskih koral prav tako redki polži in ježki, številne pa so solitarne korale rodu *Cunnolites*. Na vrhu kamnoloma omenja PLENIČAR (1993) maastrichtijske rudiste, med katerimi koral ni več.

*Sistematika.* Pri sistematiki koral so v glavnem upoštevane ugotovitve Marcela BEAUVAISa (1982), ki je izdelal revizijo vseh gosavskih koral na osnovi originalnega materiala iz Avstrije. Korale iz Stranic so gosavskim zelo podobne. Posamezne razlike in podrobnosti naših primerkov so opisane pri posameznih vrstah.

V novejšem času so zgornjekredne korale raziskovali v raznih krajih, tako na Češkem (ELIAŠOVA, 1992), v Španiji, (glej REIG ORIOL, 1993) in drugod, vendar posameznih vrst nismo mogli primerjati z vrstami iz Stranic.

Sistematsko uvrstitev in opis koralnih vrst glej v angleškem besedilu.

*Stratigrafija.* Nahajališče koral v Stranicah je bilo že na podlagi rudistov (PLENIČAR, 1993, 1994) in solitarnih koral (TURNŠEK, 1978) ter po primerjavi s podobnim nahajališčem na Medvednici (TURNŠEK & POLŠAK, 1978) uvrščeno v santonij-campanij. To starost potrjujejo tudi grebenske kolonijske korale. Čeprav se korale pojavljajo v treh različnih horizontih, le-teh nismo mogli stratigrafsko razčleniti. Iste vrste se namreč pojavljajo v vseh treh horizontih (glej sl. 2). Res pa je, da jih je največ v spodnjem nivoju, ki bi lahko pripadal santoniju.

Tudi stratigrafska primerjava vrst z evropskimi nahajališči potrjuje omenjeno starost. Vse koralne vrste iz Stranic (razen ene) so znane iz Gosaua v Avstriji (REUSS, 1854, FELIX, 1903, BEAUVAIS, 1982), 12 tudi iz Corbières in Provance v južni Franciji (FROMENTEL, 1889, ALLOITEAU, 1954, BEAUVAIS, 1982), pet iz Katalonije v Španiji (BATALLER, 1937), štiri iz najbližjega nahajališča v Orešju na Medvednici na Hrvaškem (TURNŠEK & POLŠAK, 1978) in po ena vrsta iz Bakony na Madžarskem (KOLOSVARY, 1954) ter iz Beira Litoral na Portugalskem (BEAUVAIS et al., 1975). Ena ista vrsta je znana iz senonijske breče na Banjški planoti (TURNŠEK & BUSER, 1976). Stratigrafsko je 6 vrst uvrščenih samo v santonij, 6 vrst v santonij-campanij, ena domnevno še v maastrichtij, tri pa v coniacij-santonij (sl. 2).





*Paleoekologija.* Paleoekološko je biolititni kompleks v Stranicah predstavil PLENIČAR (1993, 1994). Imenuje ga "štajerski gosavski razvoj". primerjal ga je s podobnimi kompleksi v jugovzhodni Avstriji, jugozahodni Madžarski, in severozahodni Hrvaški. Meni, da je to tip biolititnih kompleksov, ki so nastajali kot bioherme med sedimenti plitvega morja. Južno od njih je potekal rob globljega morja, ki ga predstavlja Slovenski bazen, in za katerega so značilni zgornjekredni apnenci tipa "scaglia". Natančne facialne analize biolititnega kompleksa znotraj gosavskega razvoja je na Medvednici izdelal POLŠAK (1979), v Severnih Apneniških Alpah pa HÖFLING (1985). Oba postavljata sedimente gosavskega faciesa v plitvomorsko lagunsko in grebensko (biolititno) okolje, ki lateralno prehaja v globljemorske bazenske sedimente.

Prvotno sem domnevala (TURNŠEK, 1978), da so lapornati sedimenti z negrebenskimi solitarnimi koralami tipa *Cunnolites* nastajali v nekoliko globljem morju. Z natančnimi raziskavami širše okolice je PLENIČAR (1993) pravilno ugotovil, da so sedimenti gosavskega faciesa pri Stranicah nastajali na plitvini severno od Slovenskega bazena. Plitvomorsko okolje potrjujejo sedaj tudi najdbe kolonijskih grebenotvornih koral.

Koralno okolje santonija-campanija v Stranicah lahko primerjamo z onim v okolici Gosaua v Severnih Apneniških Alpah kakor tudi z nahajališčem na Medvednici. Razlikuje se od razvoja na Dinarski karbonatni platformi. Paleoekološko povezavo s koralami v senonijski breči na Banjški planoti bo potrebno še raziskati. prav tako bo potrebno ugotoviti povezavo z avstro-alpinsko platformo, kakršno predstavljata MARCHANT & STAMPFLI (1993) pri preučevanju geodinamične evolucije Tetidnih obrobij v Alpah. Domnevamo, da so korale gosavskega faciesa v Stranicah uspevale v sedimentacijskem prostoru, ki je po vsej verjetnosti pripadal severnim plitvinam (kot del platforme ali otočnega loka) Tetide.

## ZAHVALE

Zahvaljujem se gospodu FRANCU PAJTLERJU, da je izredno natančno zbiral gradivo in je dal celotno zbirko na voljo za znanstveno obdelavo; KATI CVETKO za prepariranje materiala, za izdelavo slik in za ureditev tabel; CARMEN NAROBE za izdelavo vseh fotografij in dr. SIMONU PIRCU za angleški prevod. Raziskavo so finančno podprli Ministrstvo za znanosti in tehnologijo, Slovenska akademija znanosti in umetnosti in Paleontološki inštitut Ivana Rakovca ZRC SAZU.

## REFERENCES

ALLOITEAU, J., 1954: Le genre *Actinastraea* D'Orb. 1849 dans le Crétacé supérieur Francais. - Annal. Hébert et Haug, 8, 9-104, pl. 1-10, Paris.

ALLOITEAU, J. 1957: Contribution a la systèmatique des Madréporaires fossiles. - CNRS, 462 p., 20 pl., paris.

BATALLER, J. R., 1937: La fauna corallina del Cretàcic de Catalunya i regions limitrofes. - Arxius de l'Escola Sup. Agric., N.S., 3,1, 1-299, Barcelona.

BEAUVAIS, M., 1982: Révision systématique des Madréporaires des Couches de Gosau (Crétacé supérieur, Autriche). - Trav. Lab. Paléont. Invert. (Univ. P. et M. Curie), Tome 1-5, Paris.

BEAUVAIS, M., BERTHOU, P.Y. & LAUVERJAT, J. 1975: Le gisement campanien de Mira (Beira litorale protugal): sédimentologie, micropaléontologie, révision des

Madréporaires. - Comun. Serv. geol. Portug., 59, 37-58, Lisbona.
ELIAŠOVA, H., 1992: Archaeocoeniina, Stylinina, Astraeoina, Meandriina et Siderastraeidae (Scléractiniaires) du Crétacé de Bohême (Cénomanien supérieur-Turonien inférieur; Turonien supérieur, Tchécoslovaquie). - Vestnik Česk. geol. úst., 67, 6, 399-414, pl. 1-8, Praha.
FROMENTEL, E. de, 1862-1889: In: d'ORBIGNY: Paléontologie française. Terrain crétacé. t. 8, Zoophytes. 624 p., 192 pl., Paris.
FELIX, J., 1903: Die Anthozoen der Gosauschichten in den Ostalpen. - Palaeontographica, 49, 163-360, Taf. 17-25, Stuttgart.
HÖFLING, R., 1985: Faziesverteilung und Fossilvergesellschaftungen im karbonatischen Flachwasser-Milieu der alpinen Oberkreide (Gosau-Formation). - Münchner Geowiss. Abh., (A), 3, 1-241, pl. 1-18, 55 Abb., München.
KOLOSVARY, G. 1954: Magyarország kréta-idöszaki koralljai. - M. All. földt. intéz. Évkönyve, 42,2, 67-163, Tab. 1-16, Budapest.
MARCHANT, R. & STAMPFLI, G. M., 1993: Crustal and lithospheric structures and geodynamic evolution of the Tethyan margins of the Western Alps. PNR/NFP-20 Final Report: - Deep Structures of Switzerland. Interpretation and synthesis, 22. 1-45, Fig. 1-37., Lausanne.
OPPENHEIM, p., 1930: Die Anthozoen der Gosauschichten in den Ostalpen. - Selbstverlag, I-XXVIII + 1-576, Taf. 1-48, Berlin.
ORBIGNY, A. d', 1850: Prodrôme de Paléontologie. Paris.
PLENIČAR, M., 1993: Južni rob štajerskih krednih biolititnih razvojev. Rudarsko-metalurški zbornik, 40, 1-2, 233-240, Ljubljana.
PLENIČAR, M., 1994: Hippuritids from the Upper Cretaceous rudistid reefs near Stranice and Lipa (NE Slovenia). - Razprave IV. razr. SAZU, 35, Ljubljana.
POLŠAK, A., 1979: Stratigrafija i paleogeografija biolititnog kompleksa senona kod Donjeg Orešja (Medvednica, sjev. Hrvatska). - Prirod. istraž. 42, Acta geologica, 9/6, 191-231, Tab. 1-18, Zagreb.
REIG ORIOL, J. M., 1989: Sobre varios generos y especies de Escleractinias fosiles del cretacico Catalan. - Ed. autor, pp. 1-49, (pl. 1-7), Barcelona.
REIG ORIOL, J. M., 1993: Madreporarios cretácicos de Cataluña. - Ed. autor, p. 1-61 (pl. 1-7), Barcelona.
REUSS,. A. E., 1854: Beiträge zur Charakteristik der Kreideschichten in den Ostalpen, besonders im Gosauthale und am Wolfgangsee. Anthozoen. - Denkschr. k. Akad. Wiss. Math. Nat. Cl., 7, 73-156, Taf. 1-24, Wien.
TCHECHMEDJIEVA, V., 1981: Sur quelques particularites de la morphologie du squelette des genres *Actinastraea* D' Orbigny et *Columactinastraea* Alloiteau (Crétacé supérieur) de Bulgarie du Sud-ouest. - Annuaire Univ. Geol., 75, 35-38, pl. 1, Sofia.
TURNŠEK, D., 1978: Solitarne senonijske korale iz Stranic in z Medvednice. - Razprave IV. razr. SAZU, 21, 61-128, Tab. 1-31, Ljubljana.
TURNŠEK, D. & BUSER, S., 1976: Knidarijska favna iz senonijske breče na Banjški planoti. - Razprave IV. razr. SAZU, 19, 37-88, Tab. 1-25, Ljubljana.
TURNŠEK, D. & POLŠAK, A., 1978: Senonijske kolonijske korale iz biolititnega kompleksa v Orešju na Medvednici. - Razprave IV. razr. SAZU, 20, 129-179, Tab. 1-16, Ljubljana.





# PLATES - TABLE

PLATE 1

Figs. 1-4. *Actinastraea octolamellosa* (Michelin, 1846)

1. Cerioid colony surface, specimen 1/24, x 1.
2. Transverse thin section. 1/24b, x 4.
3. Longitudinal thin section. 1/24a, x 8.
4. Detail from fig. 2, x 8.

Figs. 5-6. *Actinastraea ramosa* (Michelin, 1847)

5. Colony surface, specimen 1/8, x 1.
6. The same surface, x 4.

TABLA 1

Sl. 1-4. *Actinastraea octolamellosa* (Michelin, 1846)

1. Površina cerioidne kolonije. Vzorec 1/24, x 1.
2. Prečni presek, zbrusek 1/24b, x 4.
3. Podolžni presek, zbrusek 1/24a, x 8.
4. Detajl s sl. 2, x 8.

Sl. 5-6. *Actinastraea ramosa* (Michelin, 1847)

5. Površina kolonije, vzorec 1/8, x 1.
6. Ista površina, x 4.

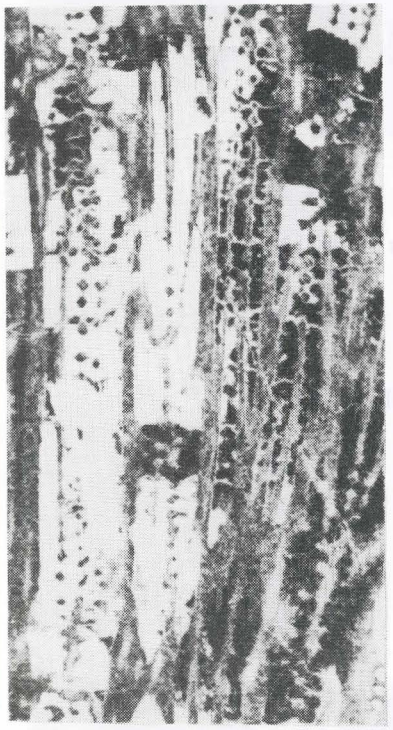




PLATE - TABLA 1

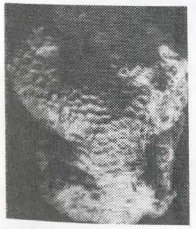
1

2

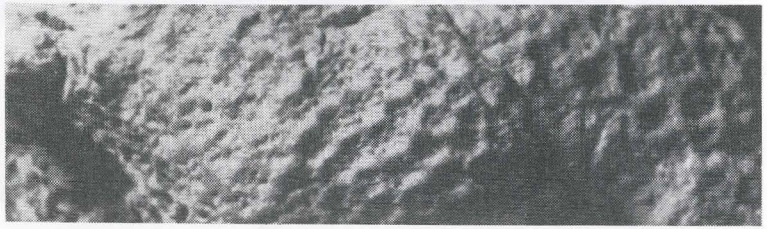


3

4



5



6

PLATE 2

Figs. 1-3. *Columactinastrae pygmaea* (Felix, 1903)
1. Plocoid colony surface, specimen 1/14, x 1.
2. The same surface, x 4.
3. Transverse thin section, 1/14a, x 4.

Figs. 4-7. *Enallocoenia salisburgensis* Beauvais, 1982
4. Plocoid colony surface, specimen 1/19, x 1.
5. The same surface, x 4.
6. Transverse thin section, 1/19a, x 4.
7. Detail from fig. 6, x 8.

TABLA 2

Sl. 1-3. *Columactinastrae pygmaea* (Felix, 1903)
1. Površina plokoidne kolonije, vzorec 1/14, x 1.
2. Ista površina, x 4.
3. Prečni presek, zbrusek 1/14a, x 4.

Sl. 4-7. *Enallocoenia salisburgensis* Beauvais, 1982
4. Površina plokoidne kolonije. Vzorec 1/19, x 1.
5. Ista površina, x 4.
6. Prečni presek, zbrusek 1/19a, x 4.
7. Detajl s sl. 6, x 8.



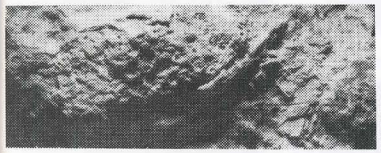


PLATE - TABLA 2

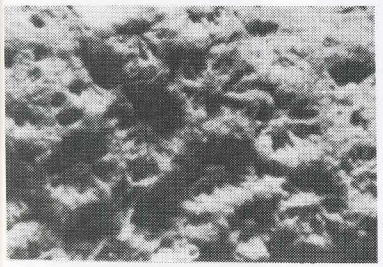
1

2

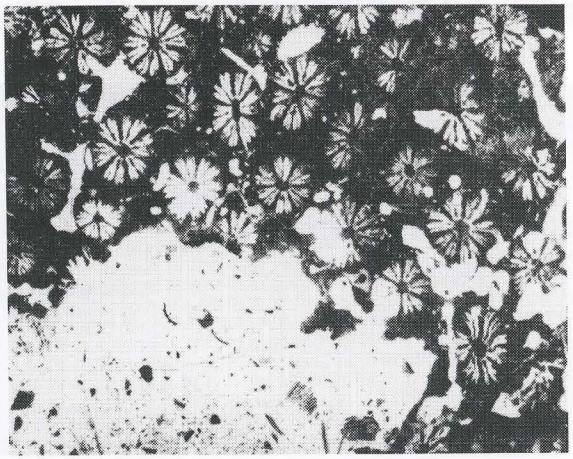
3



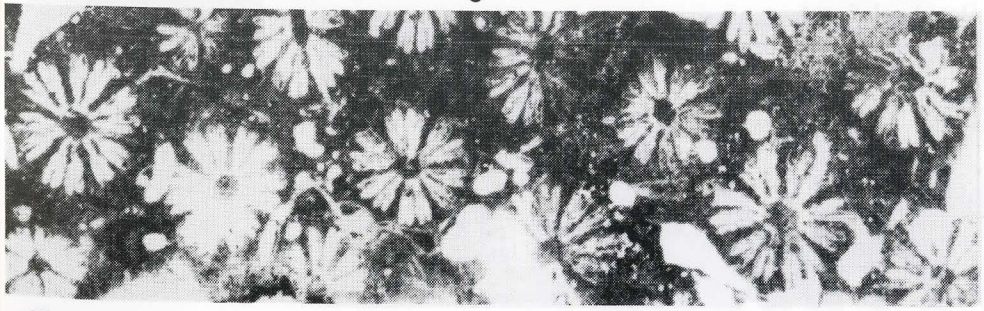
4



5



6



7

PLATE 3

Figs. 1-2. *Procladocora simonyi* (Reuss, 1854)
1. Phaceloid colony surface, specimen 1/22, x 1.
2. Detail from fig. 1 with one corallite, x 4.

Figs. 3-4. *Polytremacis* sp.
3. Plocoid colony surface, specimen 3/2, x 1.
4. The same surface, x 4.

Figs. 5-8. *Placosmilia gracilis* (Felix, 1903)
5. Coral surface from above, specimen 1/13, x 1.
6. Surface of another coral, specimen 1/B, x 1.
7. Detail from fig. 5, x 4.
8. Transverse thin section 1/13a, x 4.

TABLA 3

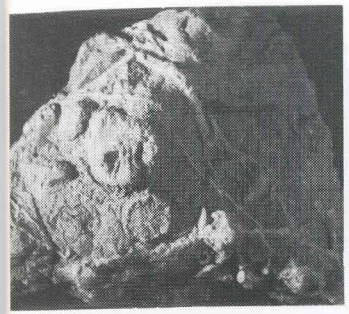
Sl. 1-2. *Procladocora simonyi* (Reuss, 1854)
1. Površina faceloidne kolonije, vzorec 1/22, x 1.
2. Detajl s sl. 1 z enim koralitom, x 4.

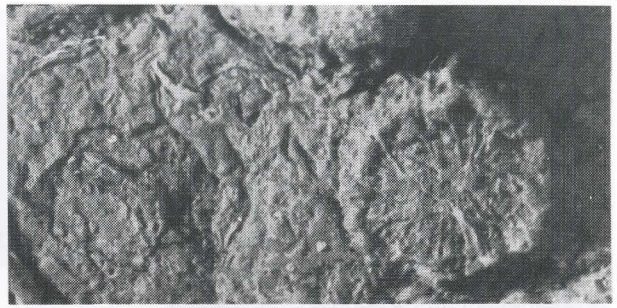
Sl. 3-4. *Polytremacis* sp.
3. Površina plokoidne kolonije, vzorec 3/2, x 1.
4. Ista površina, x 4.

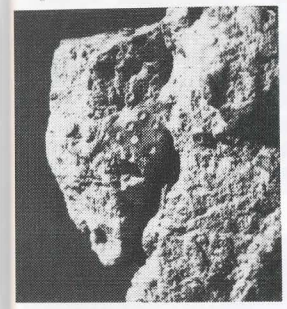
Sl. 5-8. *Placosmilia gracilis* (Felix, 1903)
5. Površina korale, vzorec 1/13, x 1.
6. Površina druge korale, vzorec 1/B, x 1.
7. Detajl s sl. 5, x 4.
8. Prečni presek korale, zbrusek 1/13a, x 4.

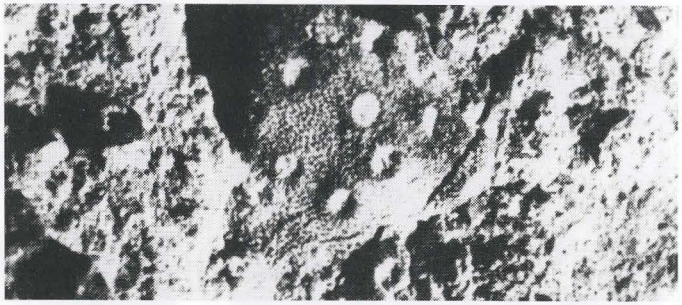


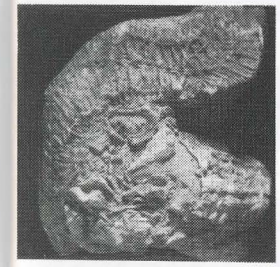
PLATE - TABLA 3

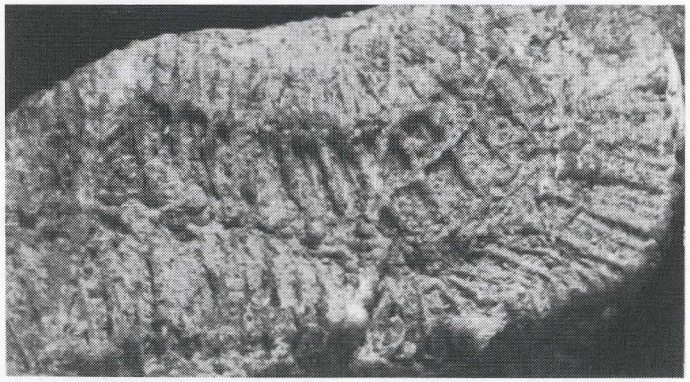

1


2


3


4


5


7


6

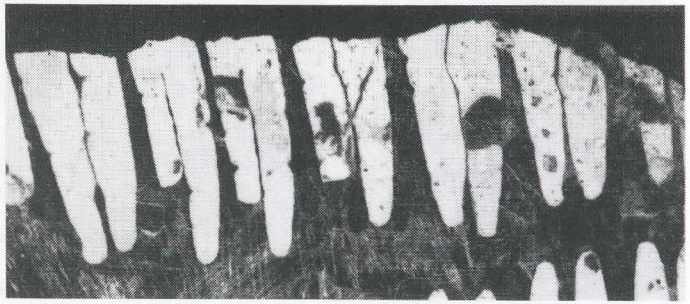

8

PLATE 4

Figs. 1-7. *Hydnophora ataciana* d'Orbigny, 1850

1. Colony surface, specimen 1/23, x 1.
2. Longitudinal thin section, 1/23a, x 4.
3. Transverse thin section showing narrow walls and hexameral septa, 1/23b, x 4.
4. The same as fig. 3, x 8.
5. Colony surface from side, showing radial growth of elements, specimen 1/12, x 1.
6. Radial thin section, 1/12a, x 4.
7. Tangential transverse section, 1/12b, x 4.

TABLA 4

Sl. 1-7. *Hydnophora ataciana* d'Orbigny, 1850

1. Površina kolonije, vzorec 1/23, x 1.
2. Podolžni presek, zbrusek 1/23a, x 4.
3. Prečni presek kolonije kaže ozke stene in heksamerna septa, zbrusek 1/23b, x 4.
4. Isto kot na sl. 3, x 8.
5. Površina kolonije od strani, kaže radialno rast elementov, vzorec 1/12, x 1.
6. Radialni presek, zbrusek 1/12a, x 4.
7. Tangencialni prečni presek, zbrusek 1/12b, x 4.





PLATE - TABLA 4

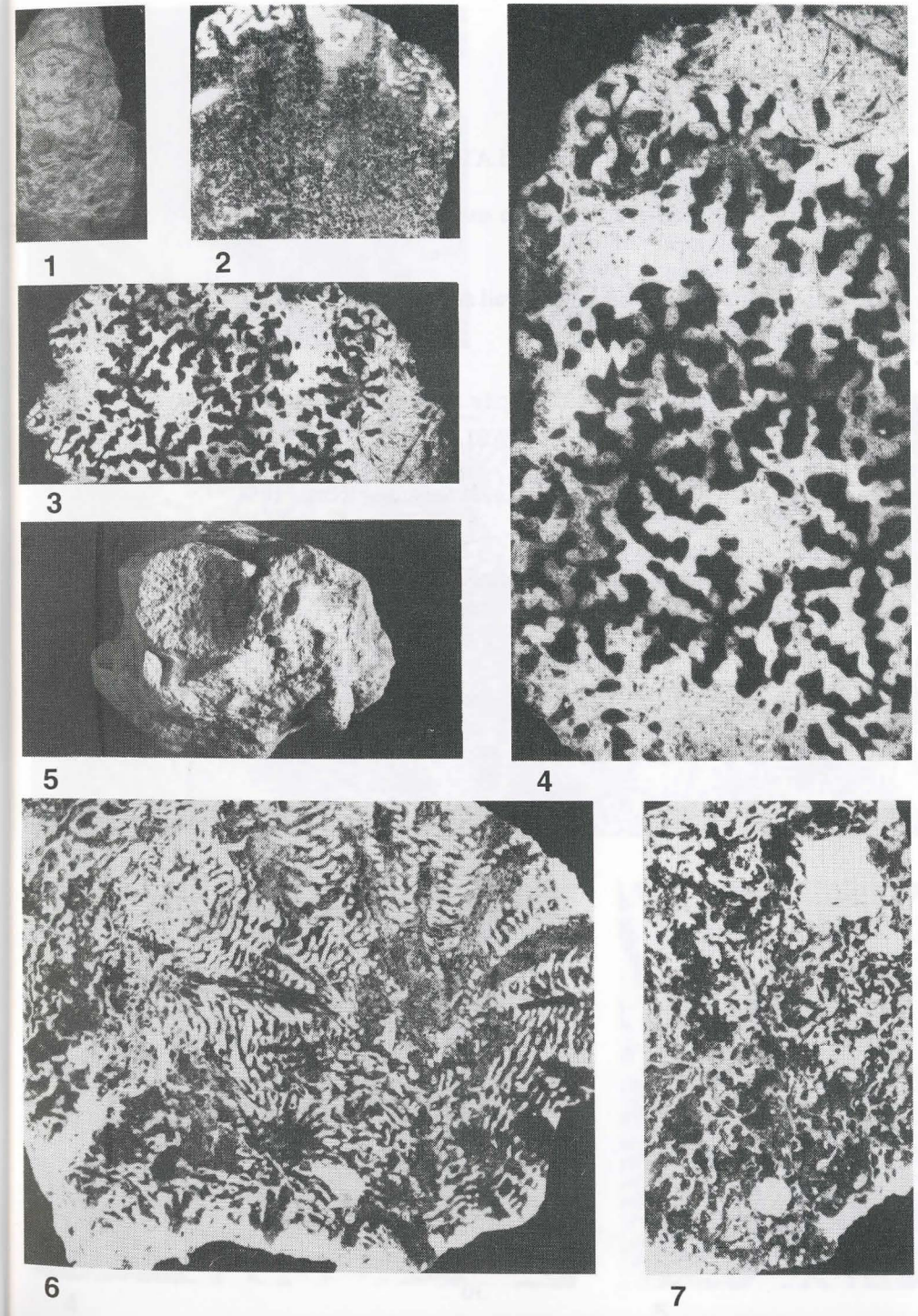


PLATE 5

Figs. 1-5. *Hydnophora multilamellosa* Reuss, 1854

1. Colony surface, specimen 1/18, x 1.
2. Longitudinal thin section, 1/18b, x 4.
3. Transverse thin section showing longer wall and more septa, 1/18a, x 4.
4. Detail from fig. 3, x 8.
5. Detail from fig. 2, x 8.

TABLA 5

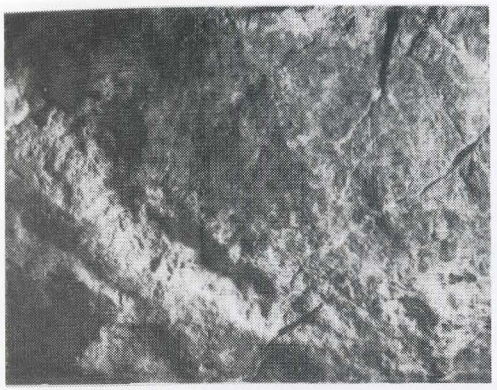
Sl. 1-5. *Hydnophora multilamellosa* Reuss, 1854

1. Površina kolonije, vzorec 1/18, x 1.
2. Podolžni presek, zbrusek 1/18b, x 4.
3. Prečni presek z daljšo steno in več sept, zbrusek 1/18a, x 4.
4. Detajl s sl. 3, x 8.
5. Detajl s sl. 2, x 8.

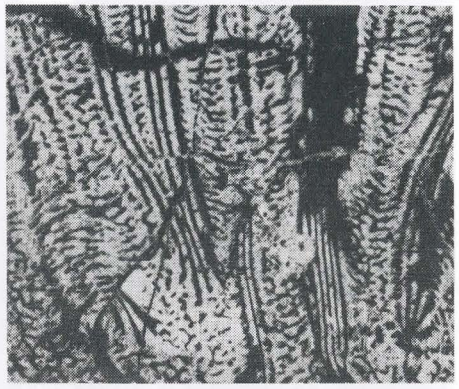




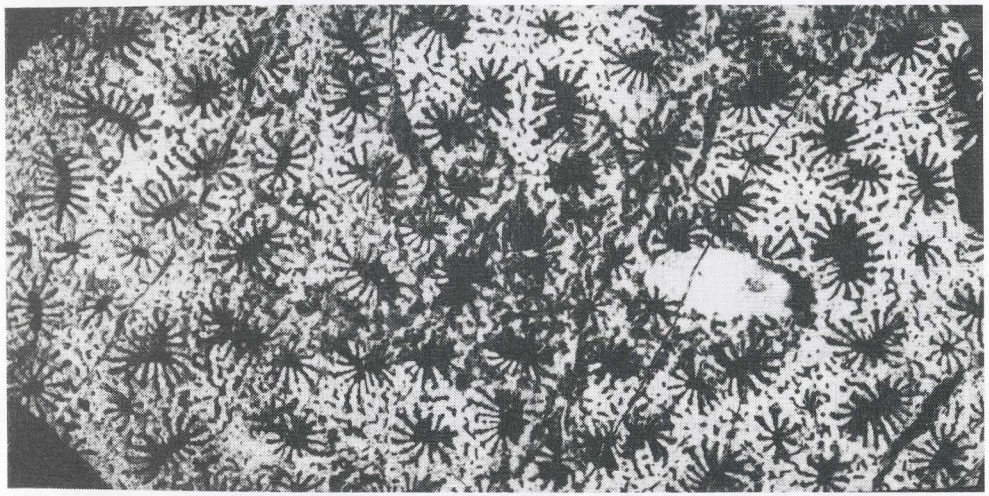
PLATE - TABLA 5



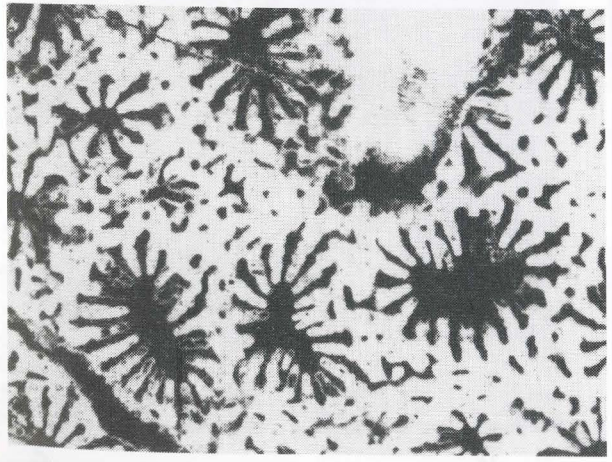
1



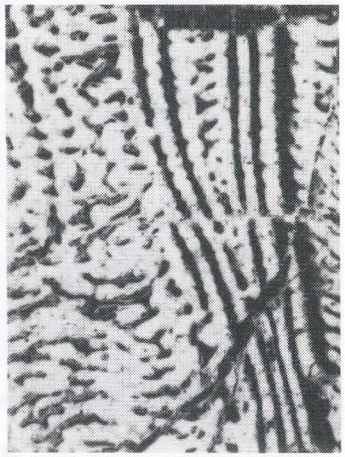
2



3



4



5

## PLATE 6

Figs. 1-3. *Orbignygyra daedalea* (Reuss, 1854)

1. Colony surface showing meandroid series, specimen 1/25, x 4.
2. Transverse thin section, 1/25a, x 4.
3. Longitudinal-oblique thin section, 1/25b, x 4.

Figs. 4-6. *Neocoeniopsis excelsa* (de Fromentel, 1867)

4. Colony surface, specimen 1/17, x 1.
5. Transverse thin section, 1/17a, x 4.
6. Detail from fig. 5, x 8.

## TABLA 6

Sl. 1-3. *Orbignygyra daedalea* (Reuss, 1854)

1. Površina kolonije z meandroidnimi serijami, vzorec 1/25, x 4.
2. Prečni presek, zbrusek 1/25a, x 4.
3. Podolžno-poševni presek, zbrusek 1/25b, x 4.

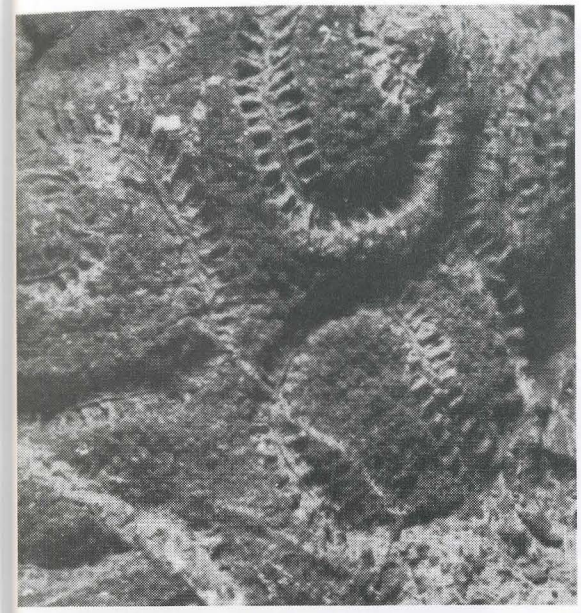
Sl. 4-6. *Neocoeniopsis excelsa* (de Fromentel, 1867)

4. Površina kolonije, vzorec 1/17, x 1.
5. Prečni presek, zbrusek 1/17a, x 4.
6. Detajl s sl. 5, x 8.

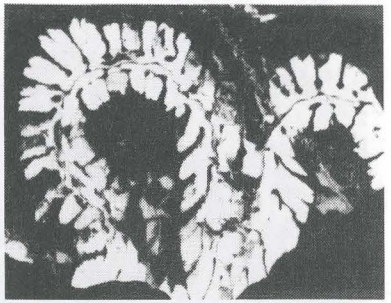




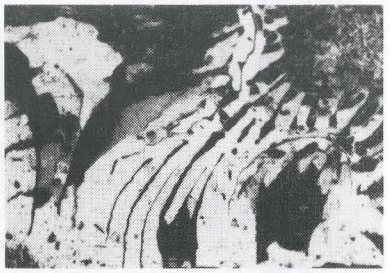
PLATE - TABLA 6



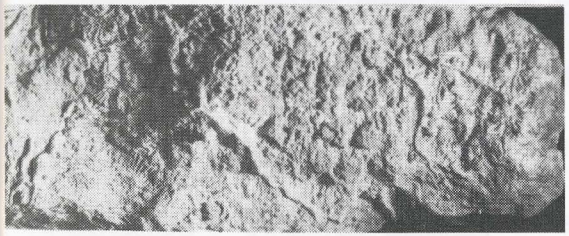
1



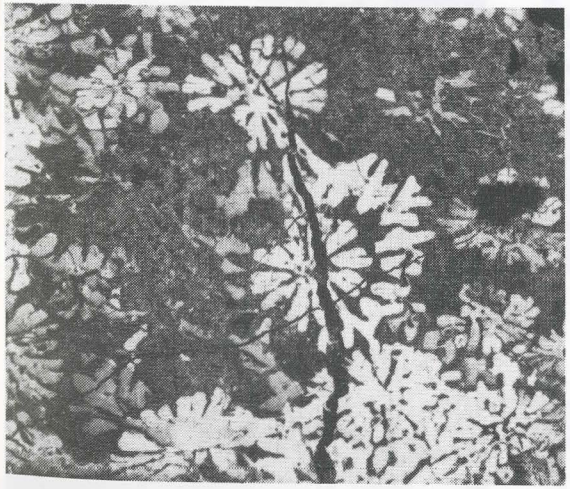
2



3



4



5

6

PLATE 7

Figs. 1-5. *Neocoeniopsis corollaris* (Reuss, 1854)

1. Plocoid colony surface, specimen 1/21, x 1.
2. Transverse thin section, 1/21a, x 4.
3. Detail from fig. 2, x 8.
4. Transverse thin section of another colony, 3/2a, x 4.
5. Detail from fig. 4, x 8.

TABLA 7

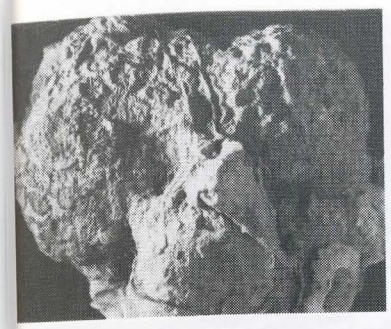
Sl. 1-5. *Neocoeniopsis corollaris* (Reuss, 1854)

1. Površina plokoidne kolonije, vzorec 1/21, x 1.
2. Prečni presek, zbrusek 1/21a, x 4.
3. Detajl s sl. 2, x 8.
4. Prečni presek druge kolonije, zbrusek 3/2a, x 4.
5. Detajl s sl. 4, x 8.

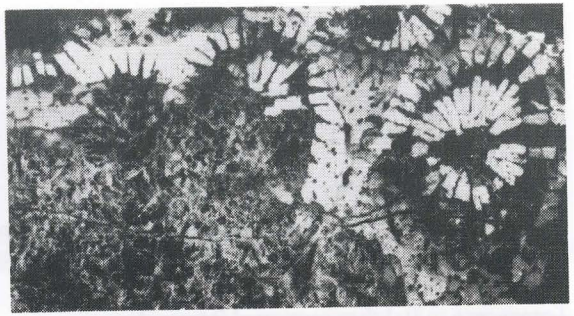




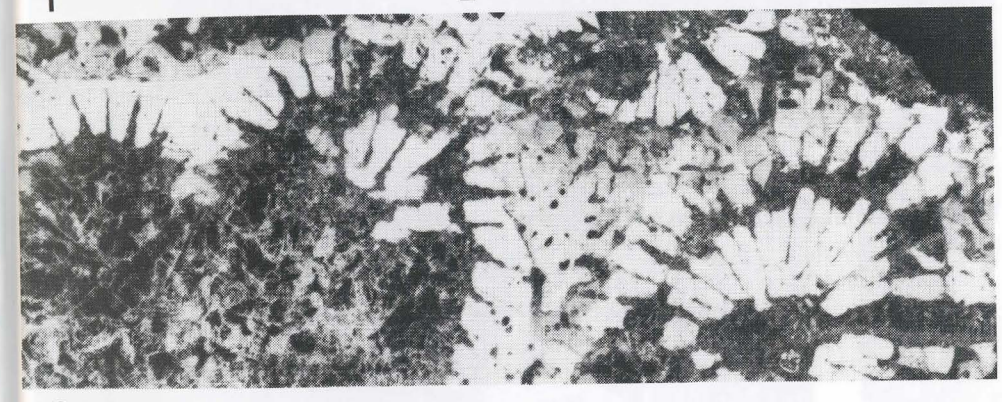
PLATE - TABLA 7



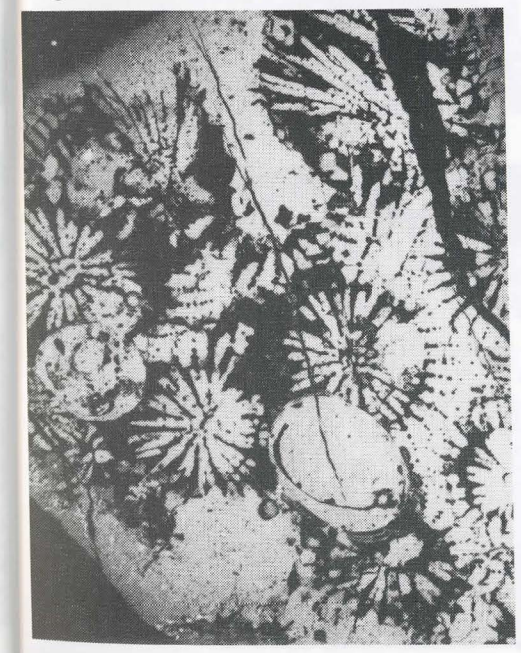
1



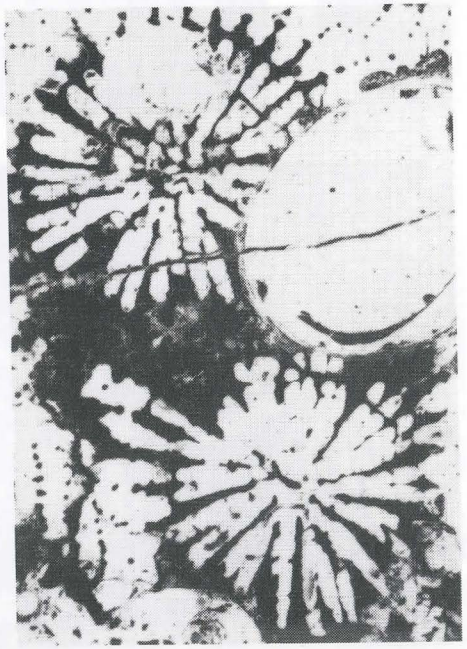
2



3



4



5

## PLATE 8

Figs. 1-5. *Dimorphastraea leptophyllia* (Felix, 1903)

1. Colony surface, specimen 1/16, x 1.
2. Detail from fig. 1, x 4.
3. Transverse radial thin section, 1/16a, x 4.
4. Transverse tangential thin section, 1/16b, x 4.
5. Detail from fig. 3, x 8.

## TABLA 8

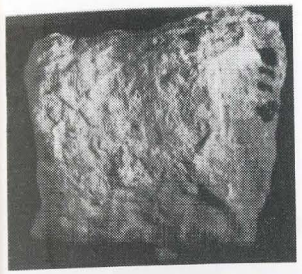
Sl. 1-5. *Dimorphastraea leptophyllia* (Felix, 1903)

1. Površina kolonije, vzorec 1/16, x 1.
2. Detajl s sl. 1, x 4.
3. Prečni radialni presek, zbrusek 1/16a, x 4.
4. Prečni tangencialni presek, zbrusek 1/16b, x 4.
5. Detajl s sl. 3, x 8.

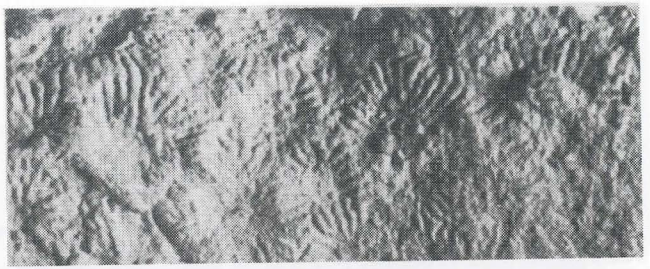




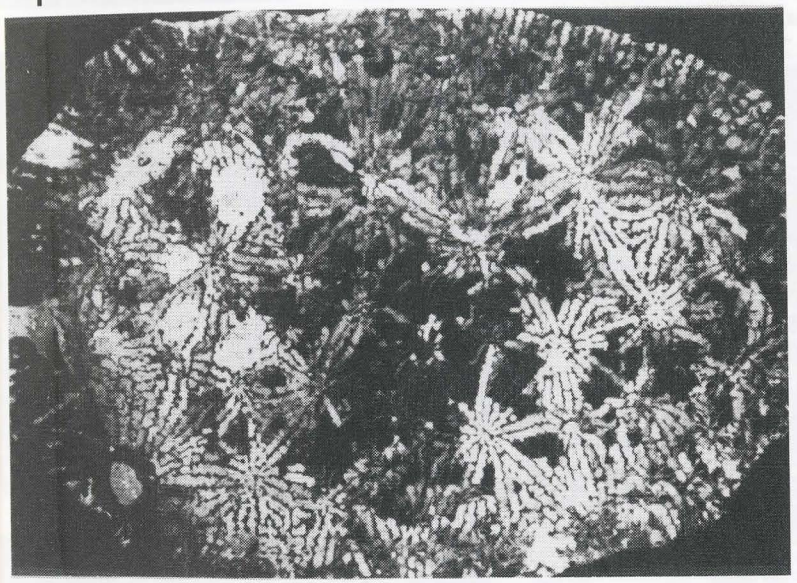
PLATE - TABLA 8



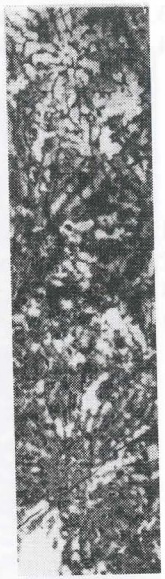
1



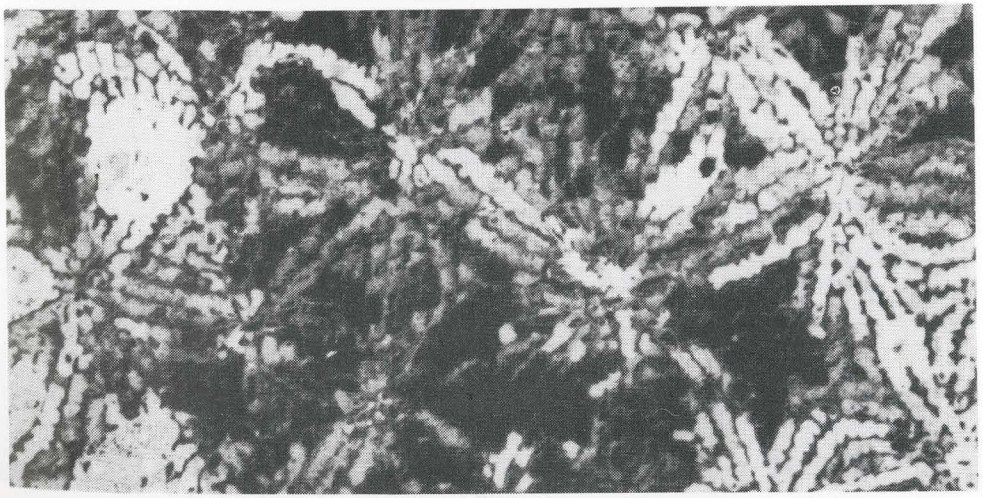
2



3



4



5

PLATE 9

Figs. 1-4. *Dimorphastraea composita* (Sowerby, 1835)

1. Colony surface, specimen 1/9, x 1.
2. Transverse tangential thin section , 1/b. x 4.
3. Transverse radial thin section, 1/9a, x 4.
4. Detail from fig. 2, x 8.

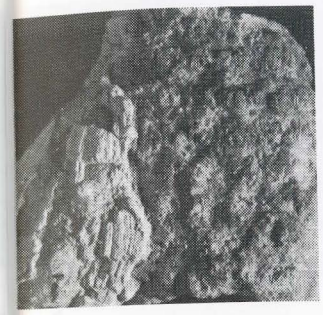
TABLA 9

Sl. 1-4. *Dimorphastraea composita* (Sowerby, 1835)

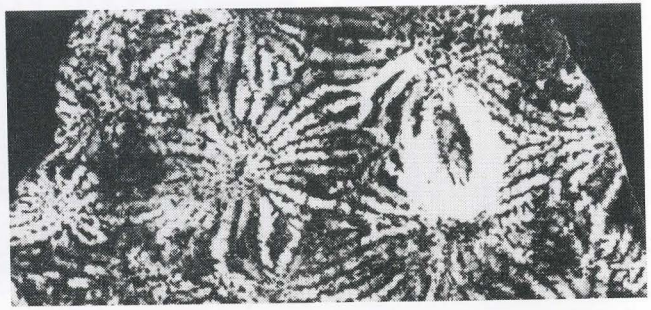
1. Površina kolonije, vzorec 1/9, x 1.
2. Prečni tangencialni presek, zbrusek 1/9b. x 4.
3. Prečni radialni presek, zbrusek 1/9a, x 4.
4. Detajl s sl. 2, x 8.



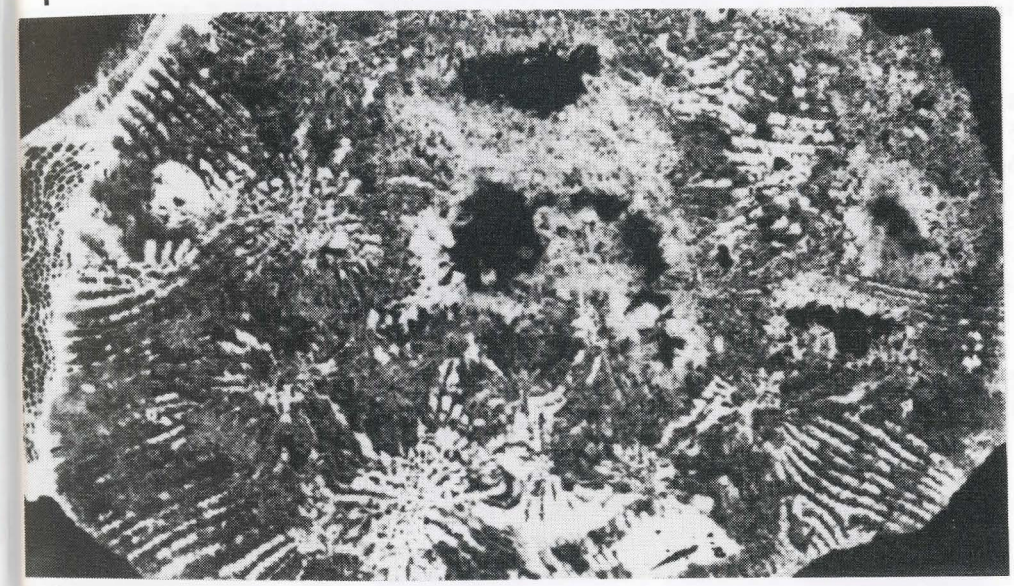
PLATE - TABLA 9



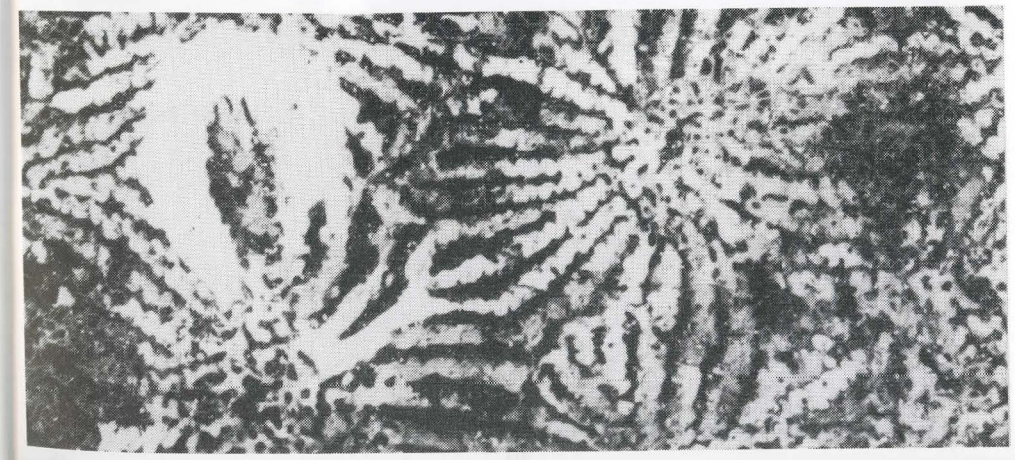
1



2



3



4

## PLATE 10

Figs. 1-3. *Actinacis reussi* Oppenheim, 1930

1. Transverse thin section of the colony, 3/1b, x 4.
2. Longitudinal thin section of the colony, 3/1a, x 4.
3. Detail from fig. 1, x 8.

Figs. 4-6. *Actinacis martiniana* d'Orbigny, 1850

4. Plocoid colony surface, specimen 1/20, x 1.
5. Detail from fig. 4, x 4.
6. Transverse thin section of another colony, 1/2a, x 8.

## TABLA 10

Sl. 1-3. *Actinacis reussi* Oppenheim, 1930

1. Prečni presek kolonije, zbrusek 3/1b, x 4.
2. Podolžni presek kolonije, zbrusek 3/1a, x 4.
3. Detajl s sl. 1, x 8.

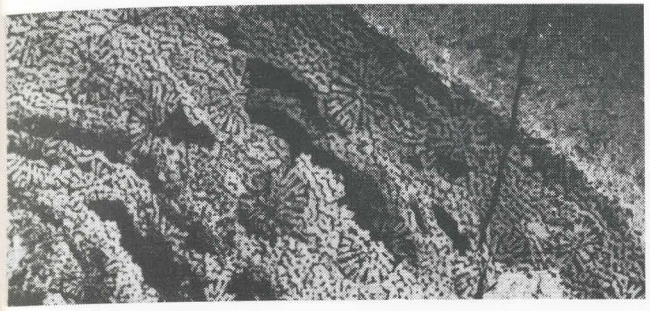
Sl. 4-6. *Actinacis martiniana* d'Orbigny, 1850

4. Površina plokoidne kolonije, vzorec 1/20, x 1.
5. Detajl s sl. 4, x 4.
6. Prečni presek druge kolonije, zbrusek 1/2a, x 8.

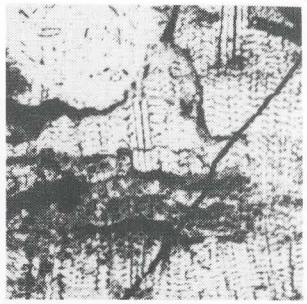




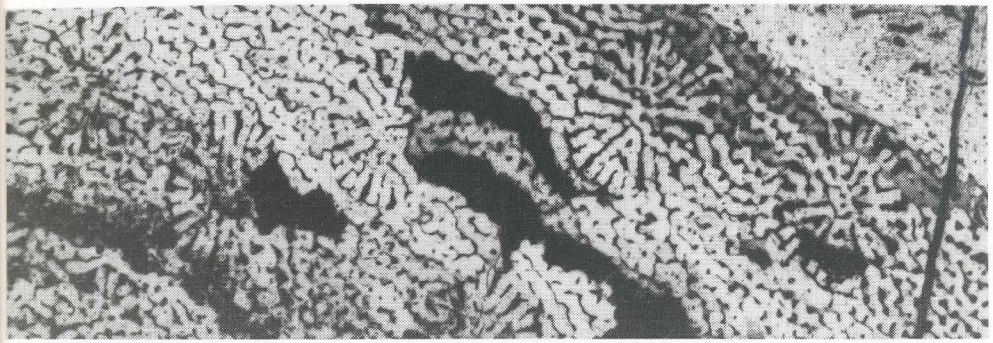
PLATE - TABLA 10



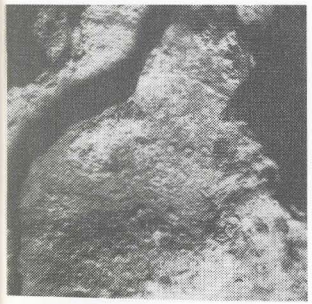
1



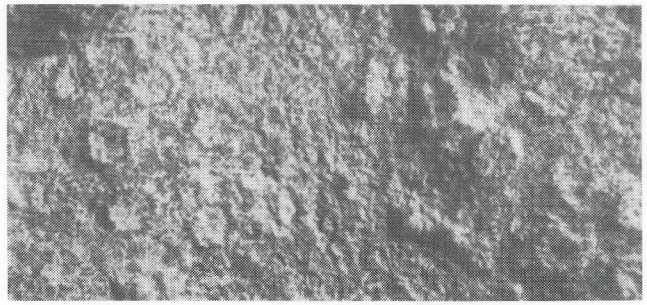
2



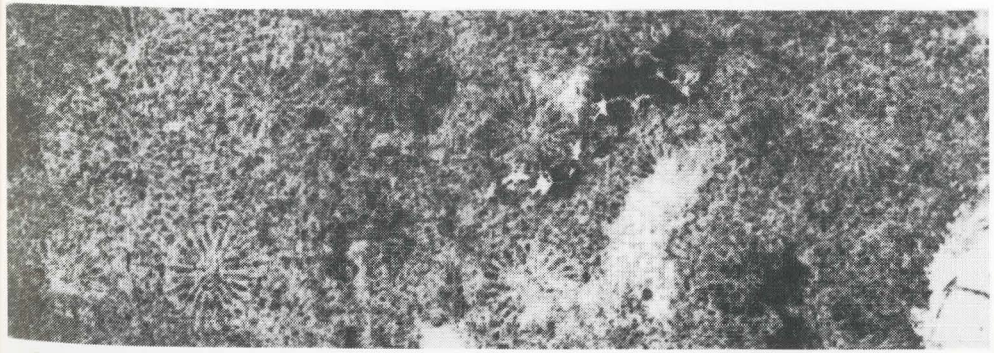
3



4



5



6