DEVONSKA STROMATOPOROIDNA FAVNA S KARAVANK

(Z eno sliko v besedilu in 14 tablami)

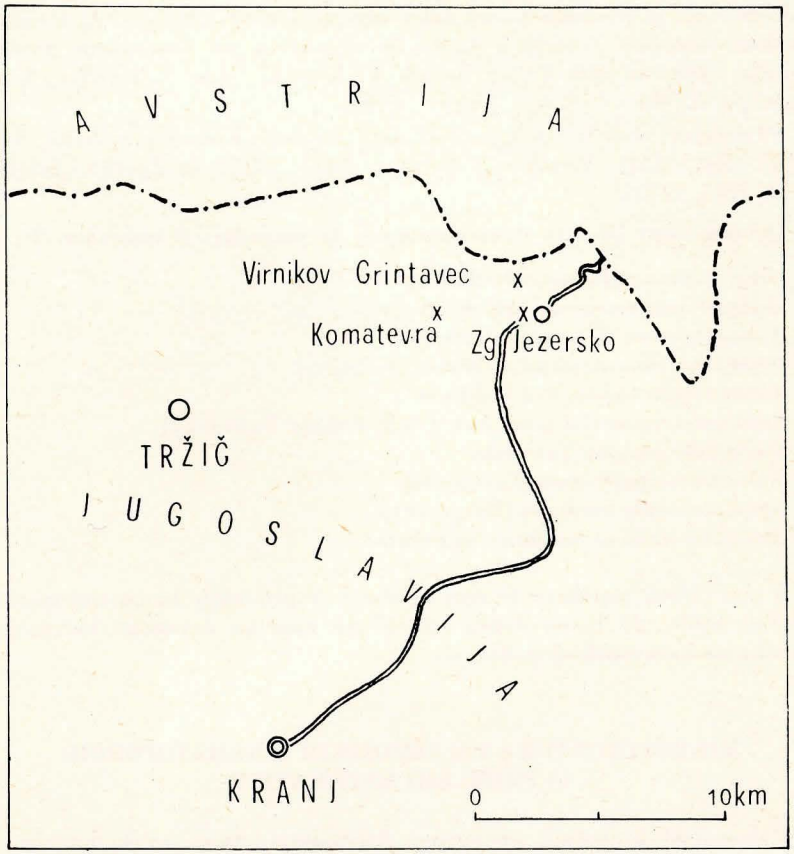
THE DEVONIAN STROMATOPOROID FAUNA FROM THE KARAVANKE MOUNTAINS

(With one Figure in Text and 14 Plates)

DRAGICA TURNŠEK

Nicholson (1886—1892) je že omenjal mikrostrukturo tkiva, vendar brez prave povezave s sistemom. Stromatoporoidea je razdelil na dve skupini na podlagi zooidnih cevi.

Heinrich (1914) je že predlagal, da se stromatoporoide razdelijo na družini Actinostromidae in Stromatoporidae; ločita se po mikrostrukturi skeletnih elementov. Actinostromidae imajo kompaktno, Stromatoporidae pa porozno ali perforirano tkivo. Pri nadaljnji delitvi na rodove in vrste pa se ozira na skeletne elemente in njih dimenzije.



x Nahajališča stromatoporoidov
Finding-places of stromatoporoids

Kühn (1939) je pri sistemu fosilnih hidrozojev upošteval sorodnosti hidrozojskih skupin od kambrija do recentnih oblik. Njegov sistem sloni prav tako na mikrostrukturi. Paleozojske hidrozoje je delil na redova Stromatoporoidea in Labechioidea. Stromatoporoidea je razdelil na družini Actinostromatidae in Stromatoporidae. Mezozojske hidrozoje je uvrstil v samostojen red Sphaeractinoidea.

Velik pomen daje mikrostrukturi prav tako Lecompte (1951, 1952). Tudi on loči v glavnem dve mikrostrukturi: kompaktno in celularno, vendar sloni njegova osnovna delitev na grobih skeletnih elementih.

Eden najplodnejših raziskovalcev stromatoporoid sredi sedanjega stoletja, Yaworsky (1955), je ponovno prevzel Nicholsonovo delitev na hidraktinoidno in mileporoidno skupino, ki se ločita po zooidnih ceveh.

V zadnjem času postaja mikrostruktura predmet vse bolj natančnega preučevanja (Galloway, 1957; Galloway in Jean, 1957; Flügel, 1959; Jean, 1960, 1962, 1967; Stearn, 1966; Sleumer, 1968, 1969).

Skoraj vsi sedanji raziskovalci stromatoporoid so enotni v mnenju, da je mikrostruktura eden najvažnejših kriterijev pri preučevanju in sistematiki te fosilne skupine. Grobi skeletni elementi so se spreminjali in prilagajali različnim ekološkim razmeram, mikrostruktura pa naj bi bila stalna lastnost organizma in torej važna pri evoluciji. Novejša raziskovanja pa odkrivajo vedno več mikrostrukturnih tipov in različkov, razni raziskovalci jih tudi različno imenujejo in razlagajo. Eden bolj poudarja pomen por in makul, drugi pa pomen tkiva in vlaken. Galloway (1957) je na primer postavil klasifikacijo na podlagi makul v skeletnih elementih. Stearn (1966, 39) in Jean (1967, 419) pa pravita, da je zaradi sekundarnih sprememb v mikrostrukturi tak predlog težko sprejemljiv, ker makule lahko zamenjamo z drugimi mikrostrukturnimi pojavi. Nadalje vidimo, da ima eden mikrostrukturni tip za primarnega, drugi za sekundarnega. Tako je na primer Stearn (1966), ko je analiziral 22 znanih rodov stromatoporoid, ugotovil 14 tipov mikrostruktur, od katerih naj bi bile samo 4 sekundarne. Primarne mikrostrukture po njegovem mnenju so: kompaktna, celularna in mikroretikulatna, vakuolatna, ordinicelularna, progasta (striated), tubulatna, periferno mešičkasta (peripherally vesicular) in delno primarno vlaknata (fibrous), tripartitno laminarna in transverzalno porozna. Sekundarne pa so: vlaknata v obliki vodnega curka (water jet fibrous), ki jo pri mezozojskih hidrozojih imenujemo klinogonalno in jo imamo za primarno, gobasta (flocculent), psevdotubularna in melanosferična. Sleumer (1969) pa je pri preučevanju devonskih stromatoporoid ugotovil samo 4 originalne mikrostrukturne tipe (kompaktno, celularno, ordinicelularno (= mikroretikulatna in ordinicelularna po Stearnu) in mikrolaminatno (tripartite laminae po Stearnu). Vse drugo naj bi bili sekundarni različki, nastali iz primarnih tipov pri raznih sedimentacijskih spremembah ali drugačnih ekoloških pogojih. Obenem Sleumer meni, da edino po mikrostrukturi lahko ločimo posamezne rodove. Zato bi bilo treba več doslej znanih rodov z enako mikrostrukturo združiti v enega, ne glede na skelet.

Konkretnega predloga klasifikacije na podlagi mikrostrukture pa še nimamo. To je razumljivo, saj je ob upoštevanju vseh različkov mikrostrukture in obenem vse literature včasih nemogoče zavzeti neko stališče.

V zvezi s klasifikacijo paleozojskih stromatoporoid se še najbolj približujem mnenju Heinricha (1914). Mikrostrukturni tipi naj bodo osnova za ločitev družin ali celo naddružin. Makrostruktura ali retikulum pa tudi

mikrostrukturni različki naj bodo kriterij pri ločevanju družin oziroma rodov. Tudi z makrostrukturnimi elementi lahko pridemo do primerjave fosilne favne. Mikrostruktura je večkrat presedimentirana, zato si z njo ne moremo pomagati. Če bi zavrgli vse fosile, kjer mikrostruktura ni primarna, ne bi mogli dobiti tudi približnega pregleda ne nad razširjenostjo paleozojskih hidrozojev.

Paleontolog ima pri svojem delu na voljo samo kameno ogrodje, živega organizma pa ne more opazovati. Zato upravičeno loči in primerja fosilne ostanke s pomočjo tiste strukture, ki jo pač ima na voljo. S tako primerjavo in z vsako najmanjšo spremembo na skeletnem ogrodju opozarja na drugačen razvoj in drugačno rast, ki je posledica, če ne evolucijskih, pa vsaj ekoloških dogajanj.

MIKROSTRUKTURA PRI DEVONSKIH HIDROZOJIH V SLOVENIJI

Pri slovenskih devonskih stromatoporoidah ločimo več mikrostrukturnih različkov, vendar so zaradi prekristalizacije fosilov nekateri močno spremenjeni. Od že znanih mikrostruktur sem lahko ločila kompaktno, celularno, ordinicelularno (v Sleumerjevem smislu), progasto (striated) in nekakšno sestavljeno. Menim pa, da sta od vseh teh mikrostruktur osnovna tipa samo dva, to je kompaktna in celularna mikrostruktura. Ordinicelularna, progasta in sestavljena mikrostruktura pa so samo različki celularne mikrostrukture, ki so nastali ob določenih ekoloških pogojih ali v zvezi z drugačno zgradbo cenosteja.

1. Kompaktno mikrostrukturo imata rodova *Actinostroma* in *Anostylostroma*. Zaradi različnih sprememb ob presedimentaciji pa kompaktna mikrostruktura prehaja v istih cenostejih tudi v melanosferično in gobasto, ponekod celo v vlaknato.

2. Celularna mikrostruktura je značilna za rod *Stromatopora*. Naši primerki so precej spremenjeni, melanosferični in imajo zelo drobne celule. Taka sekundarna mikrostruktura je mestoma podobna sekundarni mikrostrukturi sicer kompaktnega tkiva. V takih primerih je razločevanje med kompaktno in celularno mikrostrukturo zelo otežkočeno. Toda tudi Sleumer, ki daje mikrostrukturi zelo velik pomen, ugotavlja, da imajo vrste rodu *Stromatopora* večkrat sekundarno mikrostrukturo, ki je videti kompaktna (Sleumer, 1969, 45—47).

3. Pri rodu *Stromatoporella* opazujemo ordinicelularno mikrostrukturo, vendar tudi ta prehaja v melanosferično in transverzalno vlaknato. V naših primerkih so celule zelo drobne.

Ordinicelularna mikrostruktura se jasneje izraža le v laminah. V stebričkih je navadno celularna ali melanosferična. Tudi v laminah samih dobimo celule nepravilno razvrščene po elementu. Celule v tkivu torej niso stalno razporejene. Zato menim, da je ordinicelularna mikrostruktura samo različek celularnega mikrostrukturnega tipa in je odvisna od okolja in rasti organizma. V cenostejih z močno laminarno zgradbo preide celularna mikrostruktura v ordinicelularno. Celule se postavijo v eno ali več vrst.

4. Progasta mikrostruktura se pojavlja pri rodu *Stachyodes*. Temne črte v cenosteju so jasno vidne in spominjajo na ortogonalno mikrostrukturo mezozojskih hidrozojev. Mestoma pa v istih primerkih dobimo melanosferično mikrostrukturo. Sleumer (1969) pravi, da se je progasta mikrostruktura rodu *Stachyodes* razvila iz celularne mikrostrukture, zato da rod *Stachyodes* pripada rodu *Stromatopora*. Melanosfere so se lahko razvile iz celul. Zato je originalna mikrostruktura rodu *Stachyodes* bila morda res celularna, kot trdi Sleumer. Menim pa, da je že makrostruktura rodu *Stachyodes* tako različna od rodu *Stromatopora*, da rod *Stachyodes* lahko ostane veljaven rod.

5. Zanimiva je »sestavljena« mikrostruktura pri rodu *Taleastroma*. Skeletni elementi, lamine in stebrički, so v sredini drugačni kot ob straneh. V sredini so povečini kompaktni ali homogeni, na periferiji pa celularni in melanosferični. Na nekaterih mestih pa je ves element celularen. Popolnoma enak pojav opazujejo raziskovalci pri primerkih iz raznih svetovnih nahajališč (Jean 1960). Stearn (1966) razlaga, da je taka mikrostruktura nastala iz celularne mikrostrukture tako, da so se celule spremenile v melanosfere, v sredini elementa pa so še te izginile in je tkivo postalo homogeno. Taka razlaga je sprejemljiva, saj so tudi v naših primerkih celule ponekod še ohranjene v celem elementu. Ker je to spreminjanje tako enotno pri vseh vrstah tega rodu iz raznih nahajališč, je moralo biti vezano na posebne značilnosti organizma že v času njegove rasti. Zato ga lahko imamo za poseben znak rodu.

Videli smo, da posebni različki mikrostrukture lahko nastanejo zaradi posebnih lastnosti organizma ali zaradi posebnih ekoloških razmer. Tudi pri preučevanju jurskih hidrozojev iz Slovenije sem prišla do sklepa, da je mikrostruktura posledica raznih zunanjih vplivov in ekologije. Zato menim, da moramo biti pri vrednotenju mikrostrukture previdni, ker verjetno nima nobenega večjega pomena ne pri sistematiki in ne pri evoluciji hidrozojev kot makrostrukturni elementi. S tem mikrostrukturi ne jemljem njenega pomena. Hočem samo poudariti, da ni najvažnejša, ampak se pri sistematiki prepleta njena vrednost z vrednostjo grobega skeleta. Ker se podobni mikrostrukturni tipi pojavljajo pri velikem številu hidrozojev, ki imajo različne makrostrukturne značilnosti, so nam lahko kriterij pri razločevanju višjih sistematskih kategorij, na primer naddružin. Razni mikrostrukturni različki so lahko le značilnosti posameznih družin ali rodov, če so razširjeni enako pri vseh vrstah in v vseh nahajališčih.

Devonske hidrozoje s Karavank bi na podlagi mikrostrukturnih tipov lahko delila na dve skupini: aktinostromidno skupino s kompaktnim tipom mikrostrukture in stromatoporidno skupino s celularnim tipom mikrostrukture. Če ti skupini primerjam s sistemom mezozojskih hidrozojev, jima dajem pomen naddružin. V aktinostromidno skupino uvrščam že znano družino Actinostromidae. Stromatoporidna skupina pa vključuje vse različke mikrostrukture, ki imajo celule, torej tudi ordinicelularno in sestavljeno mikrostrukturo. Zato sem uvrščam prav tako znani družini Stromatoporidae in Stromatoporellidae, ki se ločita po vrsti skeletnih elementov. Družina Stromatoporellidae ima močno razvite horizontalne lamine, zaradi tega ima morda tudi ordinicelularno in mikroretikulatno mikrostrukturo.

Shematski sistem naših hidrozojev bi bil na primer takle:

Superfamilia	Familia	Genus
Actinostromicae	Actinostromidae	Actinostroma Anostylostroma
Stromatoporicae	Stromatoporidae	Stromatopora Taleastroma Stachyodes
	Stromatoporellidae	Stromatoporella

Ta razdelitev je le shematska in upošteva samo naše primerke. Končnega sistema paleozojskih in tudi devonskih hidrozojev ne morem podati, ker je doslej znanih s Karavank premalo vrst.

PRIMERJAVA MIKROSTRUKTURE PRI DEVONSKIH IN JURSKIH HIDROZOJIH V SLOVENSKIH NAHAJALIŠČIH

Pri devonskih hidrozojih ločimo kompaktno mikrostrukturo, celularno mikrostrukturo z različno razvrščenimi celulami ter progasto in sestavljeno mikrostrukturo, ki sta nastali iz celularne. Pri jurskih hidrozojih pa ločimo ortogonalno in klinogonalno mikrostrukturo, za kateri je značilna vlaknatost, in zrnato ali homogeno mikrostrukturo.

Kompaktna mikrostruktura devonskih hidrozojev je podobna zrnati oziroma homogeni mikrostrukturi jurskih oblik. Vlaknatost, ki je najbolj pogost pojav v mezozoiku, se pojavlja sicer tudi v paleozoiku, vendar je drugačna in raziskovalci menijo, da je sekundarna (Stearn, 1966; Sleumer, 1969). Neko podobnost sem opazila tudi med celularno mikrostrukturo devonskih stromatoporoid in med mikrostrukturo družine Sporadoporidiidae iz jurske dobe. Te imajo v sredini skeletnega elementa širok temen pas, v njem se včasih pojavljajo nekakšne odprtine ali mešički, ki spominjajo na paleozojske celule ali melanosfere (Turnšek, 1966, Pl. 11. fig. 5). Jurske oblike pa imajo na periferiji vlakna, ki jih v paleozojskih ni. Mešičke poznamo tudi pri klinogonalni mikrostrukturi jurskih hidrozojev, vendar se pojavljajo nepravilno v raznih vrstah in so nedvomno sekundarni (Turnšek, 1966, Pl. 17, fig. 4).

Primerjava mikrostruktur med devonskimi in jurskimi hidrozoji pa je odprla nov problem. Na podlagi mikrostrukture so bili v zadnjem času paleozojski in mezozojski hidrozoji ločeni na dva reda: Stromatoporoidea in Sphaeractinoidea (Kühn, 1939; Flügel, 1959; Fenninger et Hötzl, 1965; Turnšek, 1966). Razlika med celularno mikrostrukturo v paleozoiku in vlaknato (ortogonalno in klinogonalno) mikrostrukturo v mezozoiku je res tolikšna, da tako delitev omogoča. Vendar podobnost med kompaktno mikrostrukturo paleozojskih oblik in zrnato (homogeno) mikrostrukturo nekaterih mezozojskih hidrozojev take delitve ne dovoljuje. Mezozojsko družino Burgundiidae bi mogli celo neposredno izvajati iz paleozojske družine Clathrodictyonidae (Steiner, 1932), ker se poleg mikrostrukture (kompaktna oziroma homogena) ujemata tudi po močni laminarni zgradbi cenosteja. Zato nastane vprašanje, ali smo upravičeni deliti hidrozoje na paleozojske Stromatoporoidea in mezozojske Sphaeractinoidea na podlagi mikrostrukture. Videli smo, da imajo paleozojski hidrozoji več mikrostrukturnih tipov, prav tako mezozojski. Nekateri med njimi so si celo podobni. Delitev se potemtakem opira predvsem na starost hidrozojev, to pa ne sme biti kriterij za razločevanje sistematskih enot. Če imamo mikrostrukturo za osnovni kriterij pri ločevanju redov, bi z enako upravičenostjo že same paleozojske hidrozoje z različnimi mikrostrukturami delili v več redov. Zato menim, da imajo bolj prav tisti raziskovalci, ki priznavajo en sam red (Hudson, 1960, Steiner, 1932 in drugi), to je red Stromatoporoidea.

OPIS FAVNE

Actinostroma stellulatum Nicholson

Tab. 1, sl. 1—4, tab. 2, sl. 1—3, tab. 13, sl. 1

1886—1892, *Actinostroma stellulatum* n. sp., Nicholson, pp. 75—77,140—143, Pl. 14, fig. 1—8, Pl. 15.
1951, *Actinostroma stellulatum*, Lecompte, 111—118, Pl. 11, fig. 1—5
1959, *Actinostroma* (*Actinostroma*) *stellulatum*, Flügel, 179—185, T. 6, fig. 5, T. 7, fig. 4
1968, *Actinostroma stellulatum*, Flügel et Flügel-Kahler, 401-403, 524, s sinonimiko
1969, *Actinostroma stellulatum*, Sleumer, 34—35, Pl. 21, Pl. 22, fig. 1—2

Opis: Cenostej je masiven, okroglast, s koncentrično latilaminarno zgradbo. Skelet je iz koncentričnih lamin, ki so stalne in potekajo po vsem cenosteju. Večinoma so ravne, ponekod tudi vijugaste in dihotomirajo. Radialni stebrički so enakovredni lamelam, so pa različno dolgi. Ob orientiranem preseku dajejo mrežast pravokoten, enakomeren retikul ob nekoliko poševnem preseku pa prevladujejo lamine in skelet je podoben rodu *Clathrodictyon* (cf. Nicholson, 1889, 141). Stebrički in lamine so približno enako debeli in enako gosti. Na 2 mm pride 7 do 12 stebričkov in lamin. V tangencialnem preseku dobimo heksaktinelidno pa tudi črvasto zgradbo. Astrorize so močno razvite z osrednjo cevjo in stranskimi prečnimi kraki, ki dajejo lepo zvezdasto astrorizo. Centri astroriz so oddaljeni 1 do 1,5 cm. Vmesni prostori so okroglasti, oglati in nepravilni.

Mikrostruktura: kompaktna, mestoma rahlo gobasta.

Primerjava: Naši primerki so zelo podobni po retikularni zgradbi vrsti *A. tenuicolumnum*, le da ima ta ruska vrsta tanjše radialne stebričke.

Razširjenost: Vrsta *A. stellulatum* je zelo razširjena skoraj po vsem svetu. Znana je večinoma iz srednjega devona in deloma iz frasnija v Evropi, Mali Aziji, Sibiriji in Kaliforniji.

Primerki iz Slovenije izhajajo iz Komatevre (7230/D6) in iz Virnikovega Grintavca (5317/2, 7267/D17).

Actinostroma verrucosum (Goldfuss)

Tab. 3, sl. 1—2

1826, *Ceriopora verrucosa*, Goldfuss, n. v.
1886—1892, *Actinostroma verrucosum* Goldfuss sp., Nicholson, 75—77, 134—136, Pl. 16, fig. 1—8
1951, *Actinostroma verrucosum*, Lecompte, 107—111, Pl. 9, fig.1—8, Pl. 10, fig. 1—2
1955, *Actinostroma verrucosum*, Yaworsky, 28—29, T. 8, fig. 3—5
1968, *Actinostroma verrucosa*, Flügel et Flügel-Kahler, 465—468, 524, s sinonimiko
1969, *Actinostroma verrucosum*, Sleumer, 32—34, Pl. 4, fig. 5—6, Pl. 18, fig. 3—4, Pl. 19, fig. 20.

Opis: Cenostej je polkroglast, latilaminaren. Lamine so neprekinjene, dolge, ravne. Na 2 mm pride približno 9 lamin. Stebrički so pogostni, mestoma nekoliko upognjeni. Z laminami delajo pravokotno mrežo. Na 2 mm pride 10 do 11 stebričkov. Vmesni prostori so navadno vertikalno podolgovati. Cevi ni. Astrorize so v naših primerkih nejasne. V prečnem preseku je heksaktinelidna mreža, večkrat pa so stebrički tudi izolirani.

Mikrostruktura: kompaktna ali homogena, mestoma melanosferična.

Razširjenost: *A. verrucosum* je zelo razširjena devonska stromatoporoidna vrsta. Najdena je bila v srednjem devonu Nemčije, Belgije, Španije, Rusije, Maroka, Španske Sahare in Kitajske. Znana je tudi iz spodnjedevonskih skladov Avstralije in Španije ter zgornjega devona Rusije, Češkoslovaške in Belgije. Naš primerek je najden v Komatevri (št. 5493/D20).

Anostylostroma lozvense Yaworsky

Tab. 4, sl. 1—3

1955, *Clathrodictyon lozvense* n. sp., Yaworsky, 54, T. 21, fig. 6—8
1963, *Anostylostroma lozvense* nom. nov., Yaworsky, 41—42, T. 13, fig. 1—3
1968, *Intexodictyon? Anostylostroma? lozvense*, Flügel et Flügel-Kahler, pp. 248, 528, 550

Opis: Cenostej je nepravilno okroglast. Horizontalne lamele so močne, neravne. Razdalja med njimi variira, in sicer od 0,25 do 1 mm. Ponekod lamele dihotomirajo. Stebrički so pogostni, toda kratki, navadno se pojavljajo le med dvema laminama. Na zgornji strani se ponekod cepijo. Večkrat pa so daljši, potekajo skozi več lamin in delajo mrežasto zgradbo. Na 2 mm pride 4 do 5 lamin in stebričkov. Vmesni prostori so zelo neenaki in nepravilni. V njih so redke tabule ali ciste. V prečnem preseku dobimo večinoma okrogle prereze stebričkov, mestoma pa je skelet črvast.

Mikrostruktura: Mikrostruktura naših primerkov je v glavnem kompaktna, mestoma rahlo vlaknata ali melanosferična.

Yaworsky (1955) omenja pri tej vrsti drobnoluknjičasto mikrostrukturo. Jean (1960, 241) navaja pri tej vrsti transverzalno vlaknatost. Stearn (1966, 91) je preučeval mikrostrukturo pri več vrstah rodu *Anostylostroma* in ugotovil kompaktno tkivo, v nekaterih stopnjah transverzalno vlaknato ali transverzalno porozno, mestoma tudi gobasto in melanosferično. Za gobavost in melanosferičnost vemo, da sta sekundarna pojava, za vlaknatost pa je Stearn mnenja, da je odvisna od ekoloških razmer. Sleumer (1969)

omenja pri nekaterih vrstah tega rodu ordinicelularno mikrostrukturo. Tako mikrostrukturo je našel tudi v nekaterih vrstah rodov *Stromatoporella* in *Stictostroma*. Zato predlaga, da bi vse te tri združili v en rod.

Pripombe: Vrsto *A. lozvense* je Yaworsky prvotno uvrstil v rod *Clathrodictyon* in jo potem na podlagi pogostnih vertikalnih stebričkov prištel k rodu Anostylostroma. Flügel je to vrsto na podlagi kratkih stebričkov primerjal z rodom *Intexodictyon*. Vendar menim, da so krajši stebrički samo na nekaterih delih cenosteja, sicer pa je skelet mrežast. Pri naših primerkih opažamo tudi cepitev stebričkov. Zato jih uvrščam v rod *Anostylostroma*.

Razširjenost: Vrsta *Anostylostroma lozvense* je bila doslej znana iz srednjega devona Urala. Pri nas je najdena na Zgornjem Jezerskem (7275/D1).

Anostylostroma carnicum (Vinassa de Regny)

Tab. 5, sl. 1—3

1910, *Clathrodictyon regulare* Rosen sp. var. *carnica* n., Vinassa de Regny, 49—50, T. 1, fig. 8, 9b
1958a, *Clathrodictyon carnicum carnicum*, E. Flügel, 145—146, T. 6, fig. 3
1958b, *Anostylostroma carnicum*, E. Flügel, 172
1968, *Hammatostroma? Clathrodictyon? regulare carnicum*, Flügel et Flügel-Kahler, 355—357, s sinonimiko.
1969, *Anostylostroma carnicum*, E. Flügel, 4—5

Opis: Cenostej je masiven, okroglast. Prevladujejo debele, neprekinjene lamele, ki potekajo po cenosteju. Na nekaterih mestih je skelet redkejši, v teh delih se navadno pojavljajo astrorize, lamele pa so vzbočene. Stebrički so večinoma kratki, nastopajo med dvema lamelama, ponekod so tudi daljši in sestavljajo precej pravokoten mrežasti retikulum, značilen za *Anostylostroma*.

Mikrostruktura: Naši primerki imajo kompaktno mikrostrukturo, mestoma je gobasta, ne opažamo pa vlaknatosti.

Primerjava: Vinassa je novo podvrsto dal v rod *Clathrodictyon*. Flügel (1958b, 1969) pa je primerke iz Karnijskih Alp in graškega devona uvrstil v rod *Anostylostroma* kot samostojno vrsto.

Razširjenost: Doslej je znana obravnavana vrsta le iz srednjega devona v Karnijskih Alpah in iz okolice Gradca.

Naša primerka sta bila odkrita na Zgornjem Jezerskem (7271/D8) in na Virnikovem Grintavcu (7267/D19).

Stromatopora concentrica Goldfuss

Tab. 6, sl. 1—3, tab. 14, sl. 2

1826, *Stromatopora concentrica* n. sp., Goldfuss, n. v.
1886—1892, *Stromatopora concentrica*, Nicholson, 91—92, 164—169, Pl. 11, fig. 1—18, Pl. 20, fig. 10—12, Pl. 21, fig. 1—2
1952, *Stromatopora concentrica*, Lecompte, 271—275, Pl. 53, fig. 1—4, Pl. 54, fig. 1—5
1955, *Stromatopora concentrica*, Yaworsky, 107—108, T. 56, fig. 5—6 T. 57, fig. 1—2

1958a, *Stromatopora concentrica concentrica*, Flügel, 157—159, T. 1, fig. 5
1958b, *Ferestromatopora tyrganensis*, Flügel, 175
1968, *Stromatopora concentrica*, Flügel et Flügel-Kahler, 83—89, 569, s sinonimiko
1969, *Stromatopora concentrica*, Sleumer, 45—46, Pl. 34, 35

Opis: Cenostej je masiven, nepravilno okroglast, velik, z močno latilaminarno zgradbo. Skelet sestavljajo dolgi neravni stebrički in horizontalni elementi, ki v glavnem niso prave lamine, ampak izrastki ali cistne plasti. Med elementi so interlaminarni prostori, ki so okrogli in nepravilni, ter neravne zooidne cevi s tabulami. Astrorize so majhne. V tangencialnem preseku je skelet črvast, redki stebrički so izolirani.

Mikrostruktura: Mikrostruktura naših primerkov je celularna, z drobnimi celulami, ponekod tudi gobasta in melanosferična.

Pripombe: Lecomptejeve primerke vrste *S. concentrica* je Galloway uvrstil v rod *Ferestromatopora*, in sicer v vrsto *F. tyrganensis* zaradi močnih horizontalnih lamel. Potem je tudi Flügel (1958b) vrsto *S. concentrica* iz graškega devona revidiral in jo prav tako pripisal rodu *Ferestromatopora*. Sleumer (1969, 46) pa je ugotovil, da je vrsta *S. concentrica* zelo variabilna in da je vrsta *Ferestromatopora tyrganensis* delno samo posebna oblika vrste *Stromatopora concentrica* in da je ponekod drugačna zaradi drugačnih ekoloških razmer.

V slovenskih primerkih vidimo, da v latilaminah z gostim tkivom dobimo številnejše in daljše horizontalne lamele kot v latilaminah z redkejšim skeletom, kjer pravih lamin skoraj ni. Vsega materiala ne morem revidirati, pridružujem pa se mnenju Sleumerja, zato menim, da Lecomptovi in Flüglovi primerki ter vzorci iz Slovenije pripadajo vrsti *Stromatopora concentrica*.

Razširjenost: Pod imenom *S. concentrica* so opisani številni primerki iz skoraj vsega sveta od silurja do karbona. Ne moremo ugotoviti, koliko jih res pripada tej vrsti, ker so večkrat opisi preveč skromni ali je vrsta celo samo omenjena, materiala pa ni več. Natančneje opisani primerki so večinoma iz srednjega devona.

V Sloveniji je bila ta vrsta najdena v Komatevri (5485/7, 8, 5492/12) in na Virnikovem Grintavcu (7267/D15).

K rodu *Stromatopora* spadajo tudi vzorci 5492/10, 25 iz Komatevre, vendar so ohranjeni premajhni odlomki, tako da ni mogoče določiti vrste. Sem spada tudi primerek 5493/2 (Tab. 7, sl. 1—2, Tab. 13, sl. 2), od katerega imamo samo podolžni presek.

Stachyodes yaworskii nom. nov.
(= *Stachyodes radiata* Yaworsky)
Tab. 9, sl. 1—2, 5, tab. 14, sl. 3

1961, *Stachyodes radiata* sp. nov., Yaworsky, 54, T. 33, fig. 9—10
1968, *Stachyodes radiata*, Flügel et Flügel-Kahler, 341, 566

Opis: Paličast cenostej ima v srednjem delu podolžen kanal, od njega potekajo stranske cevi. Nekatere od teh cevi divergirajo. V njih so tabule. Širina centralnega kanala je okrog 0,50 mm, druge cevi so večinoma manjše.

Skeletni elementi potekajo prav tako vzporedno s cevmi in se upogibajo navzven. Prevladujejo stebrički, pravih lamin ni, ampak so med stebrički le krajši izrastki. V prečnem prerezu je retikul črvast.

Mikrostruktura: V naših primerkih je mikrostruktura progasta. Proge potekajo vzporedno z osjo skeletnega elementa ali pa nekoliko poševno. Na nekaterih mestih v cenosteju pa je celularna in melanosferična mikrostruktura.

Stearn (1966, 116—118) imenuje mikrostrukturo rodu *Stachyodes* progasto (striated). Sleumer (1969, 28) meni, da je rod osnovan na sekundarno spremenjeni mikrostrukturi, ki je nastala iz celularne, zato je podoben rodu *Stromatopora*. Ker se tudi v naših primerkih ponekod pojavljajo celule, se strinjam s Sleumerjevim mnenjem, da se je progasta mikrostruktura rodu *Stachyodes* razvila iz celularne. Vendar so te spremembe enake pri vseh predstavnikih rodu *Stachyodes*, zato so morale biti vezane na določene pogoje in na posebne lastnosti organizma. Kot take jih lahko imamo za posebnost rodu. Poleg tega je tudi makrostruktura tako svojevrstna, da upravičuje rod *Stachyodes*.

Pripomba: Glede na enako ime *Stachyodes radiata* Lecompte (Lecompte 1952, glej tudi Flügel et Flügel-Kahler, 1968, 341) mora dobiti vrsta Yaworskega drugo ime. Predlagam ime po njenem avtorju »*yaworskii*«.

Razširjenost: Vrsto *S. yaworskii* omenja njen avtor Yaworsky iz srednjega devona (eifelija) v Kuzneckem bazenu. Pri nas je bila najdena na Zgornjem Jezerskem (7273/D11) in v Komatevri (5492/11).

Stachyodes venusta Yaworsky
Tab. 9, sl. 3—4, 5

1961, *Stachyodes venusta* sp. nov., Yaworsky, 54—55, T. 34, fig. 1—5
1961, *Stachyodes cf. venusta*, Yaworsky, 55, T. 34, fig. 6—8
1968, *Stachyodes venusta*, Flügel et Flügel-Kahler, 464—465, 566

Opis: Kolonija je paličasta s premerom 4 do 8 mm. Centralni kanal poteka vzdolž cenosteja. Stranske cevi potekajo navzven, v prečnem preseku so okrogle. Skelet je iz stebričkov in podrejenih horizontalnih izrastkov. Cevi so ožje in številnejše kot pri vrsti *S. yaworskii*.

Mikrostruktura: Naši primerki imajo progasto mikrostrukturo.

Razširjenost: Doslej je bila ta vrsta znana iz eifelijskih skladov Kuzneckega bazena. Pri nas se pojavlja v Komatevri (5492/11, 12 in 7252/2A, B).

Taleastroma pachytexta (Lecompte)
Tab. 7, sl. 3, tab. 8, sl. 1—2, tab. 13, sl. 3

1952, *Stromatopora pachytexta* nov. sp., Lecompte, 275—276, Pl. 54, fig. 6, Pl. 55, fig. 1—2
1957, *Taleastroma pachytexta*, Galloway, 181—182, Pl. 15, fig. 3a—b
1958b, *Stromatopora cf. pachytexta*, E. Flügel, 175.
1967, *Taleastroma pachytexta*, Birkhead, 72—73, Pl. 14, fig. 1a—b
1967, *Taleastroma pachytextum*, J. St. Jean, 424, Pl. 2, fig. 2—3
1968, *Taleastroma pachytexta*, Flügel et Flügel-Kahler, 300—301, 579, s sinonimiko

Opis: Cenostej je masiven, latilamelaren. Skeletni elementi so debeli. Stebrički močno prevladujejo. V posameznih latilaminarnih pasovih so sosedni stebrički spojeni in sestavljajo masiven skelet, v drugih pa so elementi redkejši in je več vmesnih prostorov in cevi. Astrorize so nejasne. Na 2 mm pride 4 do 7 stebričkov. V prečnem preseku je skelet črvast.

Mikrostruktura: V sredini stebrička ali lamine je kompaktno rjavkasto tkivo, ob straneh pa celularno ali ponekod melanosferično. Celule in melanosfere zavzemajo širok del perifernega elementa. Mestoma jih najdemo v vsem elementu.

Po Gallowaju (1957) je za rod *Taleastroma* značilna mikrostruktura, pri kateri so aksialni deli stebričkov kompaktni, ob robovih pa so koncentrirane celule in makule. Jean (1960, 247, 1967, 423—424) še ugotavlja, da ima vrsta *T. pachytexta* debele stebričke, v katerih so makule dobro vidne. Ob presedimentaciji pa se tkivo lahko močno spremeni. Tudi Stearn (1966, 112—113) je dognal, da je mikrostruktura pri rodu *Taleastroma* v sredini elementa kompaktna, na periferiji pa so celule in makule ali pa melanosfere, ki so nastale iz makul. Mikrostruktura naših primerkov ustreza tem opisom. Strinjam se z mnenjem Stearna, da se je »sestavljena« mikrostruktura rodu *Taleastroma* razvila iz celularne mikrostrukture, ker je ponekod še v celoti ohranjena. Spremembe pa se pojavljajo pri velikem številu primerkov na popolnoma enak način, zato so nastale že, ko je organizem živel, ali pa so odvisne od njegovih posebnih značilnosti in jih lahko štejemo za karakteristiko rodu.

Razširjenost: Vrsta *Taleastroma pachytexta* je znana samo iz srednjega devona v Ardenih, v Avstriji, Nemčiji, Ameriki in Španski Sahari. Naš primerek je najden v Komatevri (5493/D22).

Stromatoporella laminata (Bargatzky)

Tab. 10, sl. 1—2, tab. 11, sl. 1—2, tab. 14, sl. 1

1881, *Diapora laminata*, Bargatzky, 288—289
1886—1892, *Stromatoporella laminata*, Nicholson, 93—94, 117, Pl. 10, fig. 1—4
1951, *Stromatoporella laminata*, Lecompte, 167—169, Pl. 24, fig. 1—5
1968, *Stromatoporella laminata*, Flügel et Flügel-Kahler, 233—234, 574

Opis: Natančne opise so podali poleg Bargatzkega še Nicholson in predvsem Lecompte, ki je ponovno opisal holotip.

Cenostej je laminaren do okroglast. Navadno obrašča kako drugo žival, največkrat koralo. Lamele so neprekinjene in goste, na 2 mm jih pride 5 do 9. Stebrički so omejeni na 1 interlaminarni prostor. Vmesni prostori so različno veliki, okrogli do nepravilni in se večkrat horizontalno spajajo v prečne kanale. Astrorize so redke in majhne. Pogostne so »kavnopore«.

Mikrostruktura: Naši primerki imajo v glavnem gobasto mikrostrukturo, redko je tudi transverzalno vlaknata. Mestoma pa je dobro ohranjena ordinicelularna mikrostruktura (v Sleumerjevem smislu) z zelo drobnimi celulami, postavljenimi v eni vrsti ali pa tudi v več vrstah.

Sleumer (1969, 37) ugotavlja, da imajo dosedanje vrste rodu *Stromatoporella* dva osnovna tipa mikrostrukture, mikroretikulatno in ordinicelularno,

zato bi jih morali deliti v dva rodova. Vrste z mikroretikulatno strukturo bi ostale pri rodu *Stromatoporella*, vrste z ordinicelularno mikrostrukturo pa bi morale biti prištete k novemu rodu.

Poglejmo še ugotovitve drugih raziskovalcev tega rodu. Mikrostrukturo pri rodu *Stromatoporella* je Nicholson (1886, 36—37, 93) opisal kot vakuolatno. Lecompte (1951, 15—16) jo imenuje fino porozno in transverzalno vlaknato s tubulami. Stearn (1966, 93—96) jo opisuje kot mikroretikulatno in celularno z različno razvrščenimi celulami. Tudi Jean (1967, 438) je ugotovil tubulozno in celularno, pa tudi retikulatno mikrostrukturo. Pravi, da se je tubulozna in mikrolaminatna mikrostruktura razvila iz celularne tako, da so se stopile stene med dvema celulama. Ta razlaga je sprejemljiva in nasprotuje Sleumerjevi domnevi o dveh mikrostrukturah. Mikrolaminatna mikrostruktura je lahko nastala iz ordinicelularne tako, da so se spojile sosedne celule. To se pravi, da je osnovna mikrostruktura rodu *Stromatoporella* enaka. Delitev na dva rodova bi zato ne bila upravičena.

Razširjenost: Vrsta *Stromatoporella laminata* je znana doslej iz srednjega devona Belgije, Nemčije, Poljske, Avstrije, pa tudi iz zgornjega devona Poljske. Primerki opisani kot *S. cf. laminata* pa se pojavljajo v srednjem in spodnjem devonu Francije in Avstrije. Naši primerki so bili odkriti v Komatevri (5492/5, 19) in na Virnikovem Grintavcu (7267/D16).

Stromatoporella cf. solitaria Nicholson

Tab. 12, sl. 1—3

1886—1892, *Stromatoporella solitaria* n. sp., Nicholson, 210—213, Pl. 7, fig. 4, Pl. 27, fig. 4—7
1951, *Stromatoporella solitaria*, Lecompte, 173—174, Pl. 23, fig. 6—7
1968, *Stromatoporella solitaria*, Flügel et Flügel-Kahler, 396, 574, s sinonimiko

Opis: Naši primerki so okroglaste kolonije z zelo drobnim skeletom. Lamele so goste, neprekinjene, stebrički so tudi gosti, vendar omejeni večinoma na en interlaminarni prostor. Vmesni prostori so različni, vendar bolj enotni kot pri vrsti *S. laminata*. Astrorize so majhne, vidimo jih samo v prečnih presekih. Pogostne so kavnopore.

Mikrostruktura: Mikrostruktura je enaka kot pri vrsti *S. laminata*. Prevladuje gobasta, ohranjena pa je tudi ordinicelularna mikrostruktura z drobnimi celulami.

Razširjenost: Vrsta *S. solitaria* je znana samo iz srednjega devona. Doslej so jo dobili v Angliji, Belgiji, Nemčiji, Franciji, Poljski, v Maroku, v Rusiji in na Kitajskem.

Naši primerki so iz Komatevre (5492/21, 23).

REGIONALNA IN STRATIGRAFSKA PRIMERJAVA

Najdbe devonskih stromatoporoid v slovenskem vzhodnem delu Karavank so nov prispevek k regionalni razširjenosti te favne. Naši fosili predstavljajo najjužnejše nahajališče v osrednjem delu Evrope. Pomembno vlogo bodo

imele tudi pri študiju paleogeografskih razmer v devonski dobi na alpskem področju.

Iz obdelane favne je moč sklepati, da so bile najdene vrste izredno razširjene skoraj po vsem svetu in niso bile vezane na kako ožje področje. Tako je kar 6 vrst od določenih desetih (*Actinostroma verrucosum, A. stellulatum, Taleastroma pachytexta, Stromatopora concentrica, Stromatoporella laminata* in *S. solitaria*) razširjenih po vsej Evropi in celo na drugih celinah. Edino vrsta *Anostylostroma carnicum* je bila doslej znana samo z alpskega področja (Gradec, Karnijske Alpe). Vrste *Anostylostroma lozvense, Stachyodes yaworskii* in *S. venusta* pa kažejo na podobnost s favno v Kuzneckem bazenu v Rusiji.

Glede stratigrafske pripadnosti stromatoporoidne favne moremo trditi, da kažejo na srednjedevonsko starost. Iz priložene razpredelnice je razvidno, da se vse pri nas najdene vrste tudi v drugih nahajališčih pojavljajo v srednjem devonu. Le nekatere od njih imajo nekoliko večji stratigrafski oz. vertikalni obseg. Vrste *Actinostroma verrucosum, A. stellulatum* ter *Stromatoporella laminata* se omenjajo razen v srednjem devonu ponekod tudi v zgornjedevonskih skladih. Nekateri primerki vrste *Stromatoporella laminata* pa se omenjajo v srednjem in spodnjem devonu. Vrsta *Stromatopora concentrica* se pojavlja v vsem devonu, omenjajo pa jo tudi v silurju in karbonu. Vrste *Anostylostroma lozvense, Anostylostroma carnicum, Stachyodes yaworskii, Stachyodes venusta* in *Taleastroma pachytexta* so doslej znane samo iz srednjega devona. Ker se tudi vse druge vrste križajo oziroma srečujejo v srednjem devonu, z upravičenostjo sklepam, da so nahajališča v Karavankah iz srednjega devona. Srednjedevonsko starost ugotavljajo tudi predhodne raziskave koralne favne, konodonti iz enakih plasti pa kažejo na spodnji devon (Buser, 1969).

Dokončna stratigrafska slika devonskih skladov v Karavankah bo jasna šele, ko bo popolnoma preučena vsa favna in ko bodo opravljene natančne primerjave vseh profilov.

Stratigrafska razširjenost v Karavankah najdenih stromatoporoid

Vrsta (Species)	Silur Silurian	Devon Devonian			Karbon Carboni ferous
		spod. Low.	sred. Midd.	zgor. Upper	
Actinostroma stellulatum			x	x	
Actinostroma verrucosum			x	x	
Anostylostroma lozvense			x		
Anostylostroma carnicum			x		
Stromatopora concentrica	x	x	x	x	x
Stromatoporella laminata		x?	x	x	
Stromatoporella solitaria			x		
Stachyodes yaworskii			x		
Stachyodes venusta			x		
Taleastroma pachytexta			x		

SUMMARY

THE DEVONIAN STROMATOPOROID FAUNA FROM THE KARAVANKE MOUNTAINS

INTRODUCTION

During the work on the geologic mapping on the Karavanke mountains, rich Devonian finding places with the reef fauna, consisting above all of corals and stromatoporoids have been discovered by the colleague Dr. Stanko Buser and his collaborator, engineer of geology Jože Cajhen. The Hydrozoa have been lent to me — to have them examined — by the Geological survey of Ljubljana, with the permission to publish results of this research. The fauna here discussed is preserved at Geological survey. The coral fauna from the same localities has been determined by V. Kostić, algae by S. Pantić, and conodonts by A. Ramovš (cf. Buser, 1969)

The present study covers samples from three finding places: Komatevra (5485, 5492, 5493, 7230, 7252), Virnikov Grintavec (5317, 7267), and the Upper Jezersko (Zgornje Jezersko: 7271, 7273, 7275).

Ten species of stromatoporoids, belonging to six genera, have been determined. These are:

Actinostroma stellulatum Nicholson
Actinostroma verrucosum (Goldfuss)
Anostylostroma lozvense Yaworsky
Anostylostroma carnicum Vinassa de Regny
Stromatopora concentrica Goldfuss
Stachyodes yaworskyi nom. nov. (= *S. radiata* Yaworsky)
Stachyodes venusta Yaworsky
Taleastroma pachytexta (Lecompte)
Stromatoporella laminata (Bargatzky)
Stromatoporella cf. *solitaria* Nicholson

This research has not yet been completed with the present study. In future we shall continue to collect systematically fossils to obtain in this way the possibly complete Devonian fauna of the Karavanke mountains.

The Microstructure of the Paleozoic Stromatoporoids and the Problems of Their Systematization

The Paleozoic Hydrozoa called Stromatoporoidea are sessile animals that lived in colonies. Their calcareous skeleton — the coenosteum — is built of similar skeletal elements that can be found in the Mesozoic Hydrozoa (cf. Turnšek, 1966, 6—8). Recently increased attention has been paid by scholars to their microstructure.

The paleontologists originally based their descriptions of the stromatoporoids on their gross skeleton and on the surface. Under the expression »the structure« they understood the mutual relation of skeletal elements (such as laminae, pillars, astrorhizae, etc.) in the coenosteum.

The microstructure of the tissue was mentioned already by Nicholson (1886—1892), yet without any true connection with the system.

A division of the stromatoporoids into the families Actinostromidae and Stromatoporidae which differ from each other in the microstructure of their skeletal elements has been suggested already by Heinrich (1914).

Kühn (1939) has attributed considerable significance for the systematization to the microstructure; somewhat less attention has been paid to it by Lecompte (1951, 1952), Yaworsky (1955), Bogoyavlenskaja (1969).

Recently the microstructure has become more and more a subject of precise research (Galloway, 1957; Galloway and Jean, 1957; Flügel, 1959; Jean, 1960, 1962, 1967; Stearn, 1966; Sleumer, 1968, 1969).

Almost all scholars who have so far investigated the stromatoporoids agree that the microstructure is one of the most important criteria in the study and systematization of this fossil group. The gross skeletal elements had changed and adapted themselves to different ecologic conditions while their microstructure had supposedly been a permanent property of the organism, and thus important in their evolution. In recent researches, however, an increasing number of microstructural types and varieties have been discovered which have been given different names and interpretations by various scholars. Some scholars stress the importance of pores and maculae, others the importance of the tissue and of fibres. Galloway (1957), e. g., has based his classificatien on the maculae in skeletal elements. Stearn (1966, 39) and Jean (1967, 419), however, are of the opinion that such a suggestion can hardly be accepted because of the secondary changes of the microstructure, since maculae can be mistaken for other microstructural elements. Furthermore, some scholars consider a certain microstructural type as primary, others as secondary. Thus, e. g., Stearn (1966) established 14 types of microstructures — of which in his view 4 only were secondary — when he analyzed 22 known genera of the stromatoporoids. Sleumer (1969) has in his study of the Devonian stromatoporoids established 4 only original microstructural types. In his view all the rest are secondary varieties, developed from the primary types under the influence of various changes in sedimentation and of different ecologic conditions. At the same time Sleumer believes that it is possible only on the basis of their microstructures to distinguish between individual genera. It would therefore be necessary to unite — regardless of the skeleton — several of the genera that had been known until them because of their identical microstructure.

So far, no concrete suggestion has been made how to classify the stromatoporoids on the basis of their microstructure. This can be easily understood taking into consideration all the varieties of microstructure, and all the literature which makes it occasionally difficult to take a certain position.

In connection with the classification of the Paleozoic stromaporoids I come closest to the views proposed by Heinrich (1914). Microstructural types should be used as a basis for the determination of families, or even superfamilies. The macrostructure, or the reticulum, as well as microstructural varieties, should serve as a criterion for the determination of families or genera. Macrostructural elements may also help in the comparison of the fossil fauna. The microstructure is frequently altered and it can therefore be of no avail. If we had disregarded all the fossils in which the microstructure is not primary we would be unable to obtain an even approximate survey of the distribution of the Paleozoic Hydrozoa.

The paleontologist has at his disposal the calcareous frame only; he is never able to observe the living organism. For this reason he is justified to distinguish and to compare fossil remains on the basis of that structure which he has available. On the basis of such a comparison and of each least change of the skeletal frame he calls

attention to a different development and different growth which are a consequence, if not of evolutional, then at least of ecologic happenings.

The Microstructure of the Devonian Hydrozoa from Slovenia

Several microstructural types and varieties can be distinguished in the Devonian stromatoporoids from Slovenia; these are, however, much altered due to the transcrystallization of fossils. From among the microstructures that have already been known I have been able to identify the compact, cellular, ordinicellular (in Sleumer's sense), striated, and a kind of combined microstructures. Still, I think that of all these microstructures two types only are basic, i. e., the compact and the cellular microstructures. The ordinicellular, the striated, and the combined microstructures are only varieties of the cellular microstructure that had developed under certain ecologic conditions, or in connection with a different structure of the reticulum.

1. The compact microstructure have the genera *Actinostroma*, and *Anostylostroma*. Owing to various changes that had taken place during the transsedimentation this compact microstructure passes over in the same coenostea into a melanospheric and flocculent, and occasionally fibrous microstructures.

2. The celular microstructure is characteristic of the genus *Stromatopora*. Our specimina are considerably changed, melanospheric, and they have very fine cellulae. Such a secondary microstructure resembles occasionally the microstructure of an otherwise compact tissue. In such cases it is very difficult to distinguish between the compact and the cellular microstructures. Yet even Sleumer who attributes considerable importance to the microstructure finds that the species of the genus *Stromatopora* have a secondary microstructure which looks compact (Sleumer, 1969, 45—47).

3. In the genus *Stromatoporella* we find the ordinicellular microstructure; this, too, passes into the melanospheric and transversally fibrous microstructures. In our specimens the cellulae are very small.

The ordinicellular microstructure is more clearly expressed in the laminae only. In pillars it is usually cellular or melanospheric. Even in laminae themselves we can find cellulae irregularly arranged in the element. The arrangement of cellulae in the tissue is therefore not constant. I therefore consider the ordinicellular microstructure as a variant only of the cellular microstructural type whose emergence depends on the surroundings and on the growth of the organism. In coenostea with a strong laminar structure, the cellular microstructure passes over into the ordinicellular microstructure. The cellules appear in one or in several rows.

4. The striated microstructure appears in the genus *Stachyodes*. The dark stria are clearly visible in the coenostea; they remind of the orthogonal microstructure of the Mesozoic Hydrozoa. Occasionally we can find, however, the melanospheric and cellular microstructures in the same specimens. Sleumer (1969) says that the striated microstructure of the genus *Stachyodes* had developed from the cellular microstructure, and that for this reason the genus *Stachyodes* belongs to the genus *Stromatopora*. The melanospheres could have developed from the cellules. It is therefore possible that the original microstructure of the genus *Stachyodes* was indeed cellular, as this is suggested by Sleumer. I think, however, the macrostructure alone of the genus *Stachyodes* to be so different from that of the genus *Stromatopora* that we are justified to keep the genus *Stachyodes* as a valid genus.

5. Interesting is the combined microstructure of the genus *Taleastroma*. The skeletal elements, laminae, and pillars are in the axial part different from those of peripheral. In the middle they are mainly compact and homogeneous, while at the periphery they are cellular and melanospheric. In some places, however, the whole element is cellular. Exactly the same phenomenon has been observed in specimens from various finding places throughout the world (Jean, 1960). Stearn (1966) explains that this microstructure had developed from the cellular microstructure through the change of the cellules into the melanospheres, so that finally even these have disappeared in the middle of the element where the tissue has become homogenous. Such an interpretation is acceptable; in our specimens we also find occasionally the cellulae preserved in the whole element. Since these alterations are so uniform in all the species of this genus from various finding places they must be connected with some particular characteristics of the organism already at the time of its growth. They can therefore be considered a special characteristic of the genus.

We have seen that the special varieties of the microstructure may be a result either of special properties of the organism or of specific ecologic conditions. In my study of the Jurassic Hydrozoa from Slovenia I have come to the conclusion that the microstructure is a consequence of various external influences and of the ecology. It is therefore my view that it is necessary to be cautious in the evaluation of the microstructure, because it has probably no greater significance than the macrostructural elements either in the systematization or in the evolution of the Hydrozoa. With this I do not wish to disqualify the importance of the microstructure. I only wish to emphasize that it is not the most important element, that instead in the systematization its value intertwines with the value of the gross skeleton. Because of the fact that similar microstructural types appear in a large number of Hydrozoa that have different macrostructural characteristics, we may use them as a criterion for the differentiation of higher systematic categories, such as superfamilies. On the other hand we may use various microstructural varieties for the characterization of individual genera when these characteristics are distributed equally in all the species from all the finding places.

On the basis of their microstructural types the Devonian Hydrozoa from the Karavanke mountains can be divided into two groups: the actinostromid group with the compact type of microstructure, and the stromatoporoid group with the cellular type of microstructure. After a comparison with the system of the Mesozoic Hydrozoa I attribute to these groups the position of superfamilies. The actinostromid group includes the already known family Actinostromatidae. The stromatoporid group includes all the varieties of microstructure which have the cellules, thus also the ordinicellular striated and the combined microstructures. For this reason I place into this group also the known families Stromatoporidae and Stromatoporellidae. They differ from each other in the character of their skeletal elements. The family Stromatoporellidae possesses strongly developed horizontal laminae; perhaps it is also due to this that it has the ordinicellular and microreticulate microstructures. The schematic system of our Hydrozoa can be seen in the Slovene text.

In spite of these findings and suggestions I am not able to give a final system of the Paleozoic and Devonian Hydrozoa because of the too small number of the species that have so far been known from the Karavanke mountains.

A Comparison of the Microstructure in the Devonian and Jurassic Hydrozoa from Slovenia

In the Devonian Hydrozoa we distinguish between the compact microstructure, the cellular microstructure with variously arranged cellulae, and the striated and combined microstructures which had developed from the cellular microstructure. In Jurassic Hydrozoa we distinguish the orthogonal and clinogonal microstructures whose characteristic is fibrosity, and the granular or homogeneous microstructure.

The compact microstructure of the Devonian Hydrozoa resembles the granular or homogeneous microstructure of Jurassic forms. The fibrosity, one of the most frequently occurring phenomena in the Mesozoic, appears also in the Paleozoic, yet it is different and the scholars consider it to be secondary (Stearn, 1966; Sleumer, 1969).

The comparison of microstructures of the Devonian and Jurassic Hydrozoa from Slovenia, however, has opened a new problem. The Paleozoic and Mesozoic Hydrozoa have recently been divided on the basis of their microstructures into two orders: Stromatoporoidea and Sphaeractinoidea (Kühn, 1939; Flügel, 1959; Fenninger et Hötzl, 1965, Turnšek, 1966. The difference between the cellular microstructure in the Paleozoic and the fibrous (orthogonal and clinogonal) microstructure in Mesozoic is indeed such that it makes possible such a division. On the other hand, the similarity of the compact microstructure of Paleozoic forms and the granular (homogeneous) microstructure of some Mesozoic Hydrozoa does not allow us to make such a division. The Mesozoic family Burgundiidae could be even directly derived from the Paleozoic family Clathrodictyonidae (Steiner, 1932): the two resemble each other not only in their microstructures (compact or homogeneous), but also in the strong laminar gros structure of the coenosteum. The question therefore arises whether we are justified to divide the Hydrozoa on the basis of their microstructure into the Paleozoic Stromatoporoidea and the Mesozoic Sphaeractinoidea. We have seen that the Paleozoic Hydrozoa have several types of microstructures; the same is also true of the Mesozoic Hydrozoa. Some among them even resemble each other. Such a division is therefore based above all on the age of the Hydrozoa which, however, should not be used as a criterion for the distinction of systematic units. If the microstructure is considered as the basic criterion for the identification of orders, then we are equally well justified to divide the Paleozoic Hydrozoa themselves, when they have different microstructures, into several orders. I therefore mean that are rigt those scholars who acknowledge the existence of one only order (Hudson, 1959; Steiner, 1932; and others), that is the order Stromatoporoidea. This may be then divided into superfamilies which are different in the Paleozoic and different in the Mezozoic, depending on their microstructures and other characteristics.

Systematic Palaeontology

Actinostroma stellulatum Nicholson

Pl. 1, fig. 1—4, Pl. 2, fig. 1—3, Pl. 13, fig. 1.

Description: Coenosteum is massive, spheric, with latilaminar structure. Concentric laminae are permanent and extend over the whole coenosteum. They are mainly straight. Radial pillars are in their number equivalent with the lamellae, they are, however, of various lengths. The skeleton is uniformly rectangular. In 2 mm

there are 7 to 12 pillars and laminae. Tangential section shows hexactinellid and vermiculate structures. Astrorhizae have a central tube and lateral stellate rows. Centres are 1 to 1.5 cm distant. Interspaces are spheric, angular, and irregular.

Microstructure: Compact, here and there flocculent.

Comparison: Our specimens resemble closely the species *A. tenuicolumnum*, with the difference that the radial pillars are thinner in the species from Russia.

Distribution: The species *A. stellulatum* is widely distributed almost all over the world. It is mainly known from the Middle Devonian, and partly from the Frasnian from Europe, Asia Minor, Siberia, and California.

Specimens from Slovenia were found in Komatevra (7230/D 6) and Virnikov Grintavec (5317/2, 7267/D 17).

Actinostroma verrucosum (Goldfuss)

Pl. 3, fig. 1—2

Description: Coenosteum is semispheric, latilaminar. Laminae are long, pillars here and there curved. Skeleton is rectangular. In 2 mm there are ca 9 laminae and 10 to 11 pillars. Interspaces are usually vertically longitudinal. Astrorhizae are unclear. In transverse section the structure is hexactinellid and dotted.

Microstructure: Compact, here and there melanospheric.

Distribution: The species *A. verrucosum* is widely distributed. It has been found in the Middle Devonian in Europe, Asia, Morocco, Spanish Sahara. It is also known from the Lower Devonian strata in Australia and Spain, and from the Upper Devonian strata in Russia, Czechoslovakia, and Belgium. Our specimen was found in Komatevra (No. 5493/D 20).

Anostylostroma lozvense Yaworsky

Pl. 4, fig. 1—3

Description: Coenosteum is irregularly spheric. Horizontal lamellae are strong, not straight, in some places they dichotomize. Pillars are frequent, of various lengths, here and there divided in their upper parts. In 2 mm there are 4 to 5 laminae and pillars. Interspaces are unequal. They contain rare tabulae or cysts. In transverse section the skeleton is vermiculate and dotted. Astrorhizae cannot be seen.

Microstructure: Compact, here and there melanospheric or slightly fibrous.

Very different microstructures have been mentioned in connection with this genus, due to secondary changes. Yaworsky (1955) mentions finely porous microstructure (probably melanospheric?). Jean (1960, 24) reports transversal fibrosity. Stearn (1966, 91) studied the microstructure in several species of the genus *Anostylostroma* and established a compact tissue, and in some stages of preservation also transversal fibrous or transversal porous, here and there also flocculent and melanospheric. Sleumer (1969) mentions even the ordinicellular microstructure for some species of this genus. He has found such a microstructure also in some species of the genera *Stromatoporella* and *Stictostroma*; he therefore suggests that all these genera should be united into one genus.

Remarks: Yaworsky originally classified the species *A. lozvense* into the genus *Clathrodictyon*; later, however, he changed the classification and attributed this species — because of the frequent vertical pillars — to the genus *Anostylostroma*.

Because of its short pillars Flügel compared this species with the genus *Intexodictyon*. I think the pillars to be shorter in some parts only of the coenosteum, while on the whole the skeleton is reticular. The division of pillars can also be observed in smaller specimens; for this reason I allocate this species into the genus *Anostylostroma*.

Distribution: the species *A. lozvense* has been known so far from the Middle Devonian from Ural mountains. In Slovenia it has been found at Upper Jezersko (Zgornje Jezersko) (7275/D 1).

Anostylostroma carnicum Vinassa de Regny

Pl. 5, fig. 1—3

Description: Coenosteum is massive spheric. Thick uninterrupted lamellae are prevalent. Pillars are mainly short, they appear also longer. Astrorhizae are large, skeletal elements at them curved.

Microstructure: Compact, here and there flocculent or melanospheric.

Comparison: Vinassa de Regny put his new subspecies to the genus *Clathrodictyon*. Flügel revised the material and allocated the specimens of C. regulare carnieum from the Carnian Alps and from the surroundings of Graz into the independent species *Anostylostroma carnicum* (Flügel, 1958b, 1969).

Distribution: So far the species *A. carnicum* has been known from the Middle Devonian from the Carnian Alps and from the surroundings of the town of Graz. Our specimens were found at Upper Jezersko (Zgornje Jezersko) (7271/D 8) and Virnikov Grintavec (7267/D 19).

Stromatopora concentrica Goldfuss

Pl. 6, fig. 1—3, Pl. 14, fig. 2.

Description: Coenosteum is large, irregularly spheric, latilaminar. Pillars are not straight, they are long; horizontal elements are mainly not the true laminae, but rather excrescences or cyst strata. Interlaminar spaces are of various forms. Among elements we also find uneven zooidal tubes. Astrorhizae are small. The skeleton is in the tangential section vermiculate, the rare pillars are isolated.

Microstructure: Cellular, with fine cellules, here and there flocculent and melanospheric.

Remarks: Galloway classified Lecompte's specimens of the species *S. concentrica* into the genus *Ferestromatopora* — that is into the species *F. tyrganensis* — because of their strong horizontal elements. Later the species *S. concentrica* from the Devonian of Graz was also revised by Flügel (1958b) who attributed it to the genus *Ferestromatopora*. Sleumer (1969, 46), however, has established a great variability in the species *S. concentrica*, and that the species *Ferestromatopora tyrganensis* is partly a special form only of the species *Stromatopora concentrica*. It is different due only to different ecologic conditions.

In specimens from Slovenia we see that in the latilaminae with dense tissue the horizontal elements are more numerous and longer than in the latilaminae with a sparser skeleton, in which the true laminae do almost not occur. I join the opinion of Sleumer and think that Lecompte's and Flügel's specimens, and the specimens from Slovenia, do all belong to the species *S. concentrica*.

Distribution: Under the name *Stromatopora concentrica*, numerous specimina have been described from almost all over the world, from the Silurian to the Carboniferous. We cannot establish how many of these do indeed belong to this species; the descriptions are frequently too humble or the species only briefly mentioned while at the same time the material is no longer preserved. Specimens that have been described more in detail are mainly from the Middle Devonian.

In Slovenia this species was found in Komatevra (5485/7, 8, 5492/12), and in Virnikov Grintavec (7267/D15). The specimens 5492/10, 25 and 5493/2 from Komatevra belong also to the genus *Stromatopora* sp.; these fragments are, however, too small that we could determine their species.

Stachyodes yaworskii nom. nov.
(= *Stachyodes radiata* Yaworsky)
Pl. 9, fig. 1—2, 5, Pl. 14, fig. 3.

Description: Rodlike coenosteum has in its central part a longitudinal channel from which lateral tubes extend. Some of these tubes diverge. They contain tabulae. Skeletal elements run parallel to the tubes, that is, they are curved outwards. Vertical elements are prevalent, there are no true laminae, but short offsets only between pillars. In transverse section the reticulum is vermiculate. The width of the central channel is ca 0.50 mm.

Microstructure: In our specimens is striated. Dark stria run parallel to the axis of the skeletal element, or slightly obliquely towards it. In some parts of the coenosteum the microstructure is finely cellular or melanospheric (Pl. 14, fig. 3, left).

Stearn (1966, 116—118) calls the microstructure of the genus *Stachyodes* striated. Sleumer (1969, 28) thinks the genus *Stachyodes* to be based on secondarily changed microstructure which had developed from the cellular microstructure; this genus therefore resembles in his view the genus *Stromatopora*. In our specimens, too, the striation disappears occasionally and fine cellules appear. I therefore agree with Sleumer's suggestion that the striated microstructure of the genus *Stachyodes* did develop from the cellular microstructure. These alterations however, are the same in all the representatives of the genus; they are therefore necessarily connected with certain conditions and special properties of organism. As such we may consider them as characteristics of the genus. In addition to this, the macrostructure, too, is so specific that it justifies the existence of the genus *Stachyodes*.

Remarks: Because of the identity of the name *Stachyodes radiata* (Lecompte 1952, 307—308, see also Flügel et Flügel-Kahler, 1958, 341) it is necessary to give a new name to Yaworsky's species. I suggest to call it after its author »*yaworskii*«.

Distribution: Yaworsky mentions the species *S. yaworskii* from the Middle Devonian (Eifelian) from the Kuzneck Basin. In Slovenia it was found at Upper Jezersko (Zgornje Jezersko) (7273/D11) and in Komatevra (5492/11).

Stachyodes venusta Yaworsky
Pl. 9, fig. 3—4, 5

Description: Rodlike colony with a central channel. Lateral tubes diverge outwards; they are round in transverse section. The skeleton consists of pillars and of subordinate horizontal excrescences. The tubes are more narrow and more numerous than in the species S. yaworskii.

Microstructure: Striated.

Distribution: So far, the species has been known from the Eifelian strata of the Kuzneck Basin. In Slovenia it appears at Komatevra (5492/11, 12, and 7252/2A, B).

Taleastroma pachytexta (Lecompte)
Pl. 7, fig. 3, Pl. 8, fig. 1—2, Pl. 13, fig. 3.

Description: Coenosteum is massive, latilamellar. Skeletal elements are thick, Pillars are strongly prevalent. The neighbouring pillars are joined in individual latilamellar belts and form a massive skeleton; in others, the elements are more sparse, with several interspaces and tubes. There are no laminae. Astrorhizae are unclear. In 2 mm there are 4 to 5 pillars. In transverse section the skeleton is vermiculate.

Microstructure: In the axial part of the pillar, or of the horizontal element we find a compact brownish tissue, and at periphery cellular or rarely melanospheric tissue. Cellulae cover a wide part of the peripheral element. Occasionally they can be found in the whole element.

According to Galloway (1957), the genus T*aleastroma* has a typical microstructure in which the axial parts of the pillars are compact, with cellulae and maculae concentrated at the edges. Jean (1960, 247; 1967, 423—424) finds that the species T. *pachytexta* has thick pillars in which maculae are clearly visible. When transsedimented, the tissue may become considerably changed. Stearn (1966, 112—113), too, has established that the genus *Taleastroma* has in the centre of the element a compact microstructure, and cellulae or melanospheres — that had developed from the maculae — at the periphery. He belives that the axial compact part had also developed from the cellular tissue. The microstructure of our specimens corresponds to these descriptions. I concur with opinion proposed by Stearn that the »combined« microstructure of the genus *Taleastroma* had developed from the cellular microstructure, the latter being occasionally completely preserved. In specimens the alterations take place in exactly the same manner; they had therefore emerged already during the life of the organism, or in dependence on its special characteristics, which can therefore be considered characteristics of the genus.

Distribution: The species *Taleastroma* is known from the Middle Devonian only, from the Ardennes, Austria, Germany, America, and from Spanish Sahara. Our specimen was found at Komatevra (5493/D22).

Stromatoporella laminata (Bargatzky).
Pl. 10, fig. 1—2, Pl. 11, fig. 1—2, Pl. 14, fig. 1.

Description: Coenosteum is laminar to spheric. Lamellae are uninterrupted and dense. Pillars are limited to one interlaminar space. In 2 mm there are 5 to 9 laminae. Interspaces are variously large, round to irregular and frequently join into horizontal channels. Astrorhizae are rare. Frequent are the »caunopores«.

Microstructure: Our specimens have mainly a flocculent microstructure, rarely also transversal fibrous microstructure. Here and there the ordinicellular microstructure (in Sleumer's sense) is well preserved with very fine cellules arranged in a row.

Sleumer (1969, 37) states that the species of the genus *Stromatoporella* have two basic types of microstructure (microreticulate and ordinicellular) and that for this reason they should be divided into two genera.

Let us review the findings of other scholars who have studied this genus. Nicholson (1886, 36—37, 93) described the microstructure of the genus *Stromatoporella* as vacuolate. Lecompte (1951, 15—16) calls it a fine porous and transversal fibrous microstructure with tubules. Stearn (1966, 93—96) describes it as microreticulate and cellular with variously distributed cellules. Jean (1967, 438), too, has established, besides the tubulous and cellular, also the microreticulate microstructure. He states that the tubulous and microlaminar microstructures had developed from the cellular microstructure by the breakdown of walls between the neighbouring cells. This interpretation stands in opposition to Sleumer's suggestion of two basic microstructures. Thus the microlaminate microstructure could have developed from the ordinicellular microstructure through the merging of the neighbouring cells. This means that there was only one basic microstructure in all the species of the genus *Stromatoporella*. I, too, agree with the suggestion made by Jean. I consider that the division of the genus *Stromatoporella* is probably not justified.

Distribution: The species *Stromatoporella laminata* has so far been known from the Middle Devonian in Belgium, Germany, Poland, Austria, and from the Upper Devonian in Poland. Specimens described as *S.* cf. *laminata* appear also in the Middle and Lower Devonian in France and Austria. Our specimens were found in Komatevra (5492/5, 19) and in Virnikov Grintavec (7267/D16).

Stromatoporella cf. *solitaria* Nicholson

Pl. 12, fig. 1—3.

Description: Colonies are spheric, with very fine skeleton. Lamellae are dense, uninterrupted; pillars are also dense, but short. Interspaces vary, nevertheless they are more uniform than in the species *S. laminata*. Astrorhizae are small, they can be seen in transverse sections only.

Microstructure: Is the same as in the species *S. laminata*. Flocculent microstructure is prevalent; preserved, however, is also the ordinicellular microstructure with fine cellules. Here and there a kind of tubes can be observed that remind of the microreticular microstructure.

Distribution: the species *S. solitaria* is known from the Middle Devonian only. So far it has been found in England, Belgium, Germany, France, Poland, Morocco, Russia, and China.

Our specimina are from Komatevra (5492/21, 23).

A Regional and Stratigraphic Comparison

The findings of the Devonian Stromatoporoidea in the Slovene eastern part of the Karavanke mountains are a new contribution to the knowledge of the regional distribution of this fauna. They will have also an important role in the study of the palaeogeographic conditions in the Alpine region during the Devonian period.

On the basis of the fauna described in the present article we may conclude that the species here found were extraordinarily widely distributed all over the world, so that they were not connected to a limited region only. Thus there are 6 out of the total number of 10 species here determined (*Actinostroma verrucosum, A. stellulatum, Taleastroma pachytexta, Stromatopora concentrica, Stromatoporella laminata,* and *S.* cf. *solitaria*) that are spread all over Europe and even in other continents. The species *Anostylostroma carnicum* only has been known so far from the Alpine region (Graz, Carnian Alps). The species *Anostylostroma lozvense, Stachyodes yaworskii,* and *S. venusta* show similarities with the fauna in the Kuzneck Basin in Russia.

As regards the stratigraphic distribution of the stromatoporoid fauna we may maintain that they are of the Middle Devonian age. The table in the Slovene text p. 180 shows that all the species found in Slovenia occur in other finding places in the Middle Devonian. A few only among them have a somewhat broader stratigraphic or vertical distribution. Owing to the fact, however, that all these species meet in the Middle Devonian I believe that we are justified to conclude that the finding places in the Karavanke mountains are of the Middle Devonian age. The Middle Devonian age has also been established by the preliminary studies of the coral fauna; the conodonts, on the other hand, found in similar strata point to the Lower Devonian (cf. Buser, 1969).

The definite stratigraphic picture of the Devonian strata in the Karavanke mountains will become clear only after all their fauna had been fully studied, and after a careful comparison of all their profiles had been made.

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TABLE — PLATES

Fotografije hidrozojskih kolonij, ki so povečane 4 × in 8 ×, so negativi, zbruski so direktno povečani na papir. Skeletni elementi so zato svetli, vmesni prostori pa temni. Pri fotografijah mikrostrukture (20 × in 40 ×) so elementi temni. Vsi vzorci so iz srednjega devona.

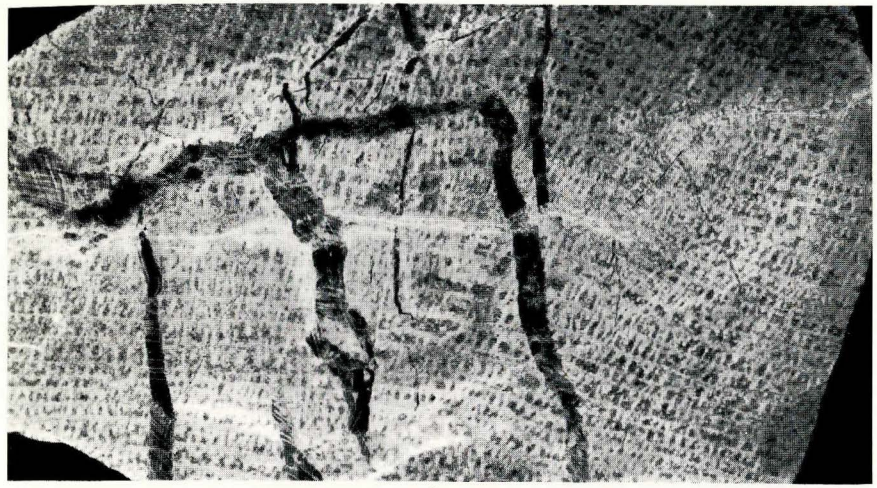
The photos of the Hydrozoa, enlarged 4 × and 8 ×, are negatives, the thin sections being directly enlarged on the paper. The skeleton is therefore of light colour, the interspaces and tubes dark. In photos of the microstructure (enlarged 20 × and 40 ×) the elements are dark. All specimens are from the Middle Devonian.

Foto — Photo: Carmen Narobè

TABLA — PLATE 1

Sl. 1—4, Fig. 1—4. *Actinostroma stellulatum* Nicholson

1. podolžni presek — radial section; 7230/D6b, Komatevra, × 4
2. prečni presek — transverse section; 7230/D6e, × 4
3. podolžni presek — longitudinal section; 7267/D17d, Virnikov Grintavec, × 4
4. podolžni presek — longitudinal section; 7267/D17b, × 4



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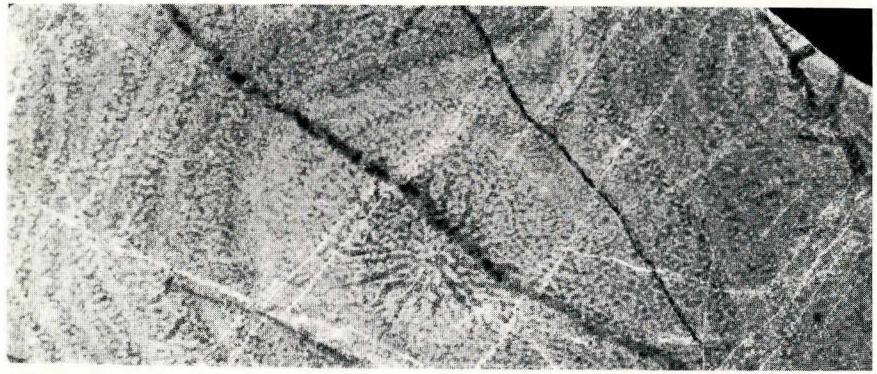

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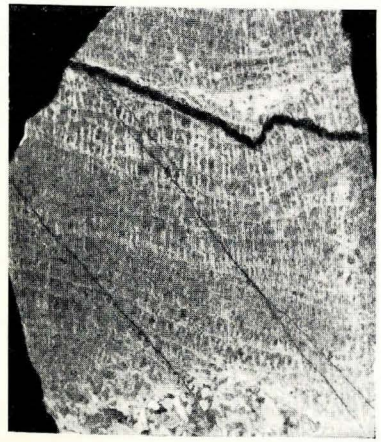

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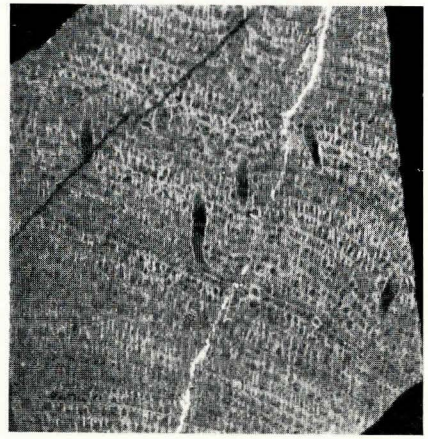

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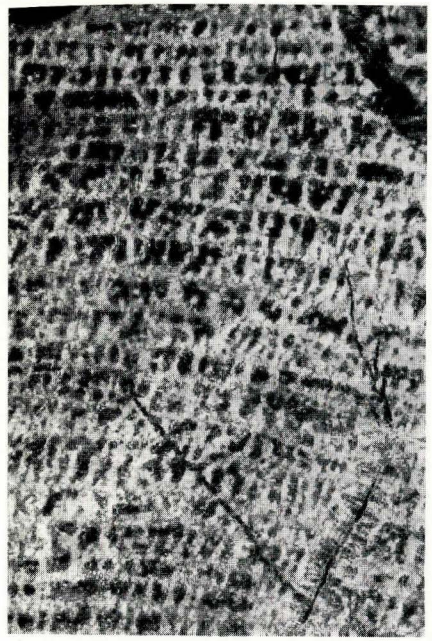

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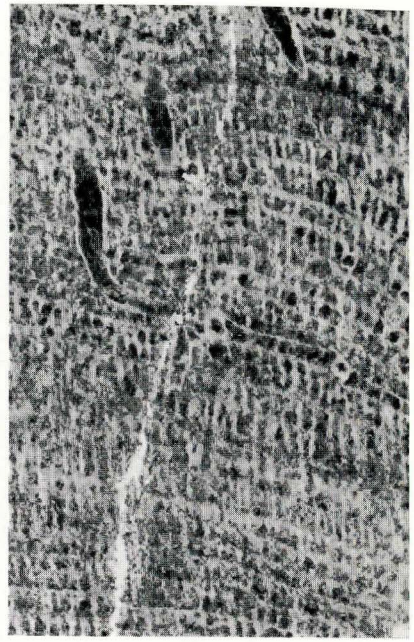

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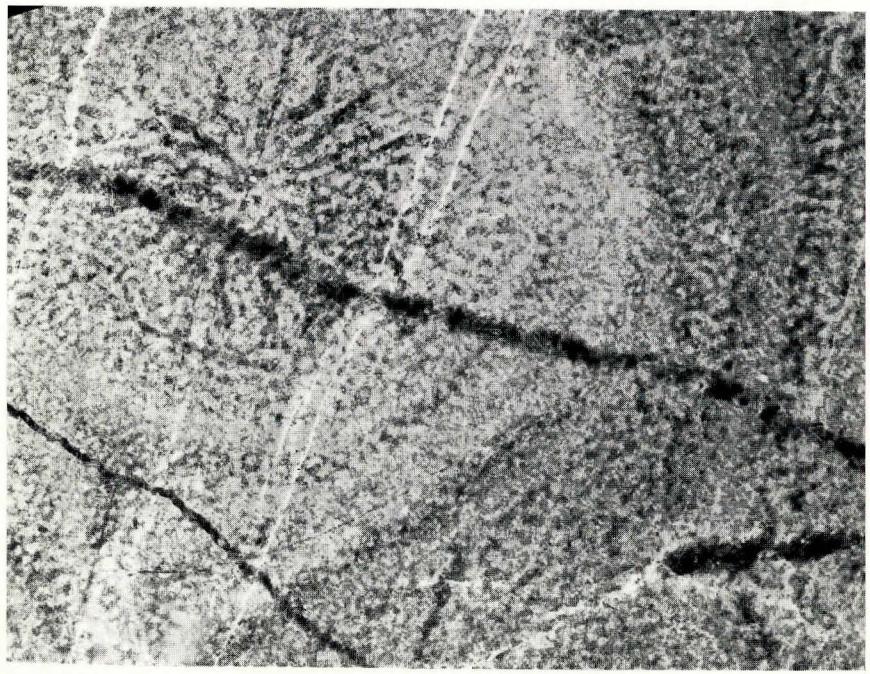

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TABLA — PLATE 2

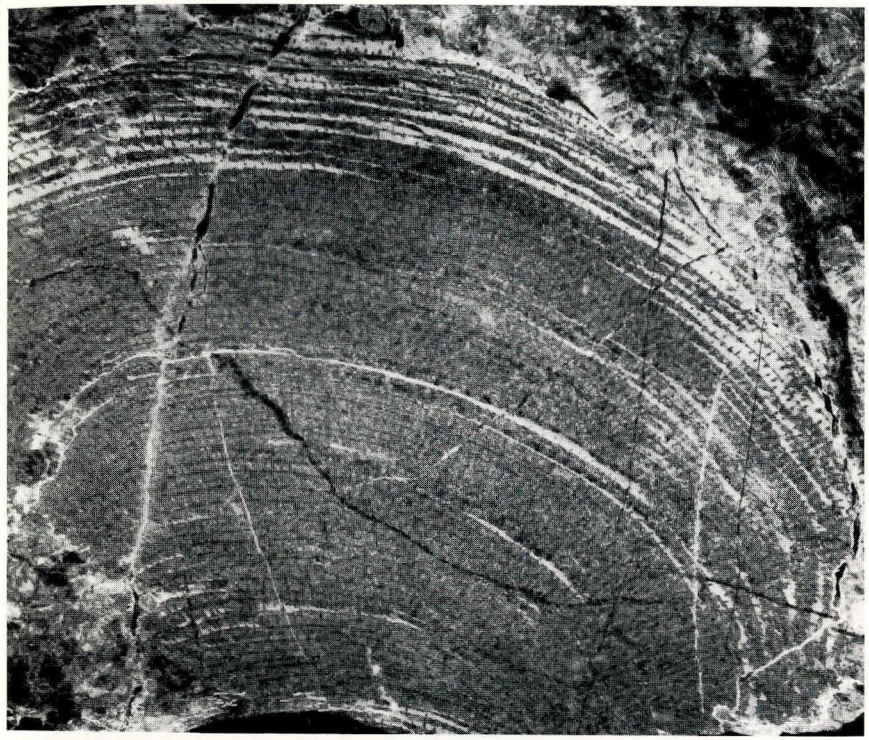
Sl. 1—3, Fig. 1—3. *Actinostroma stellulatum* Nicholson

1. podolžni presek — longitudinal section; 7230/D6b, Komatevra, × 8
2. podolžni presek — longitudinal section; 7267/D17b, Virnikov Grintavec, × 8
3. prečni presek — transverse section; 7230/D6e, Komatevra, × 8

TABLA — PLATE 3

Sl. 1—2, Fig. 1—2. *Actinostroma verrucosum* (Goldfuss)

1. radialni presek — radial section; 5493/D20a, Komatevra, × 4
2. tangencialni presek — tangential section; 5493/D20, b, × 4



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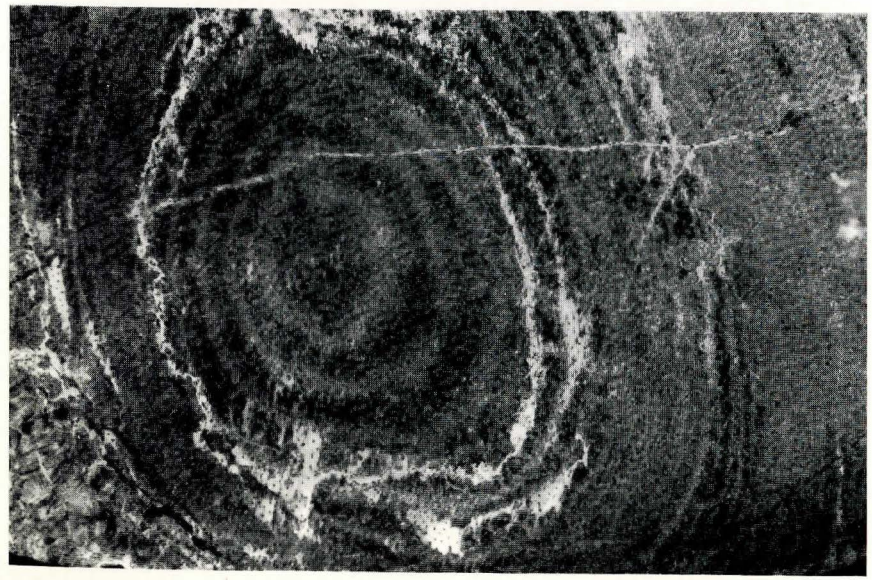

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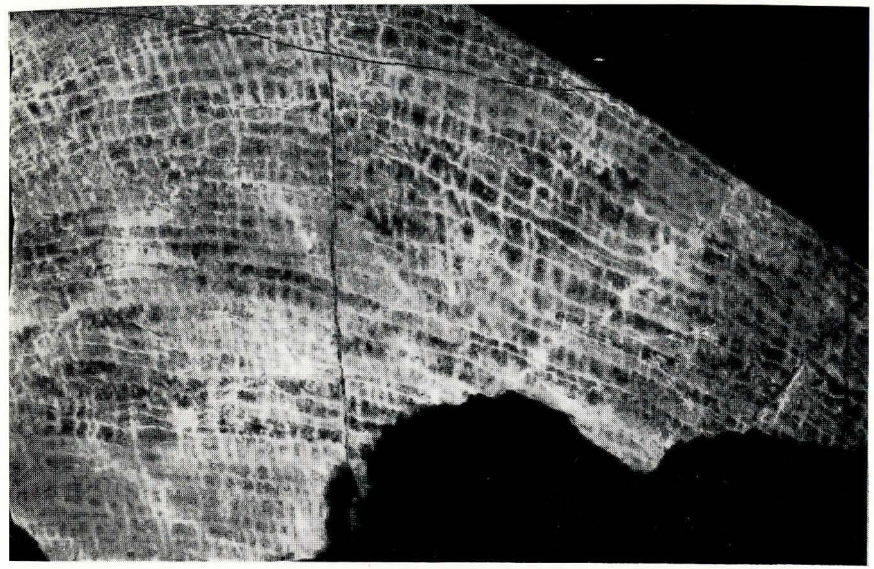

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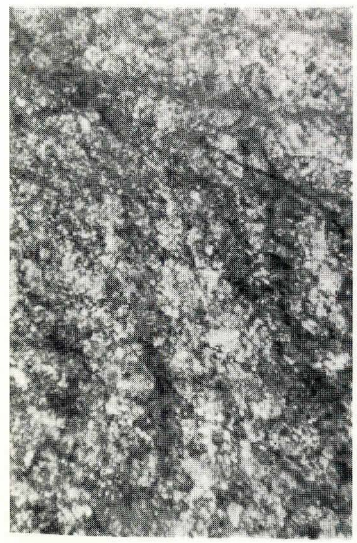

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2

TABLA — PLATE 4

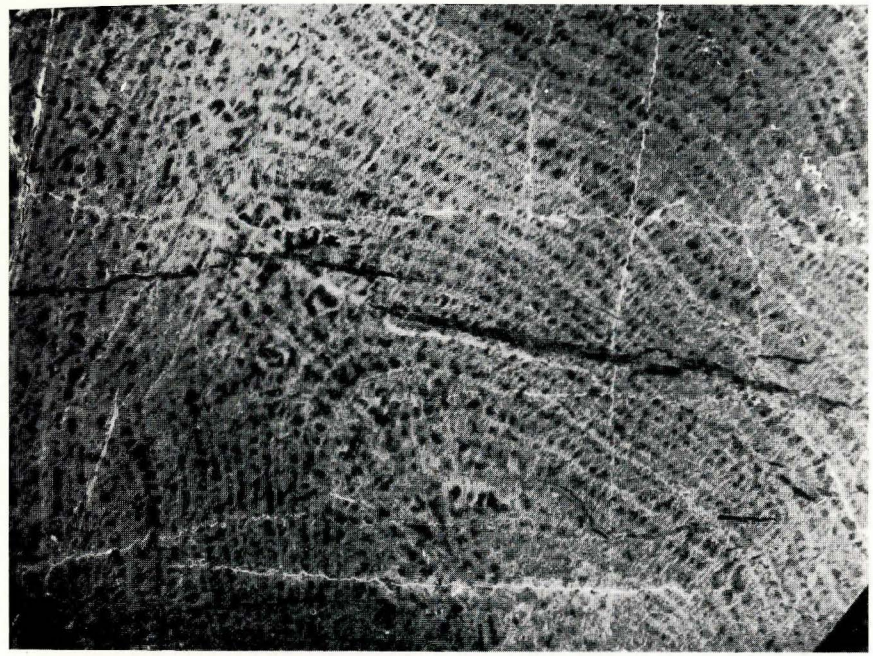
Sl. 1—3, Fig. 1—3. *Anostylostroma lozvense* Yaworsky

1. podolžni presek — vertical section; 7275/D1, Zgornje Jezersko, × 4
2. prečni presek — transverse section; 7275/D1, × 4
3. kompaktna mikrostruktura podolžnega skeleta — compact microstructure of radial section; 7275/D1, × 20

TABLA — PLATE 5

Sl. 1—3, Fig. 1—3. *Anostylostroma carnicum* Vinassa de Regny

1. podolžni presek — longitudinal section showing astrorhizal structure; 7267/D 19 a, Virnikov Grintavec, ×4
2. del istega podolžnega skeleta— part of the same vertical section; × 8
3. prečni presek — transverse section; 7267/D 19 b, × 4



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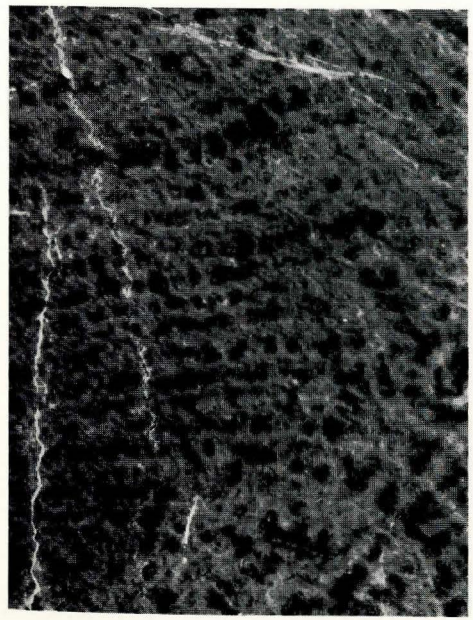

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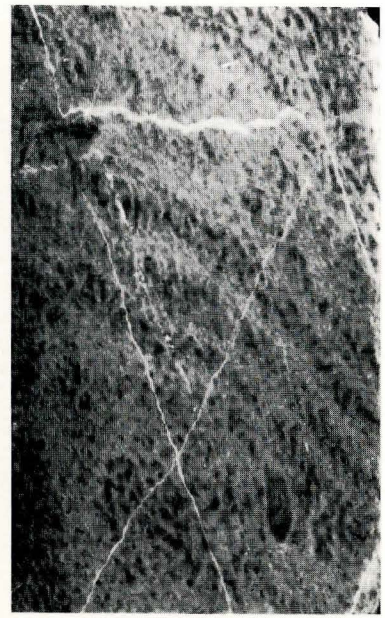
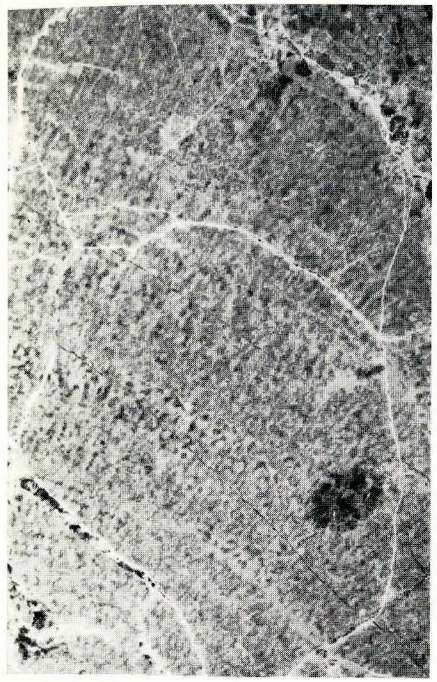


3

TABLA — PLATE 6

Sl. 1—3, Fig. 1—3. *Stromatopora concentrica* Goldfuss

1. podolžni presek — longitudinal section; 5492/12c, Komatevra, × 4
2. del istega podolžnega cenosteja — part of the same longitudinal coenosteum; × 8
3. prečni presek, nekoliko poševen — transverse something oblique section; 5492/12b, × 8



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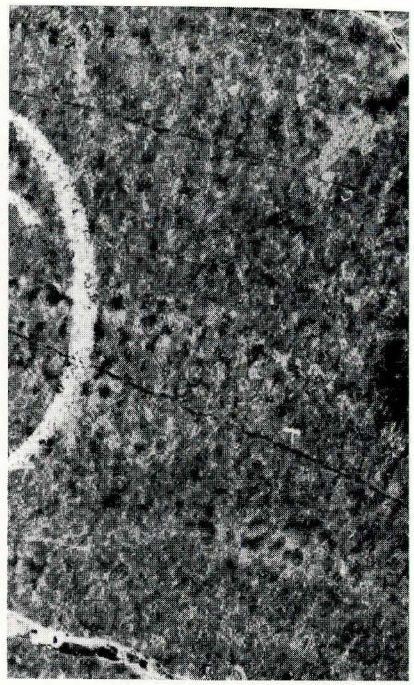

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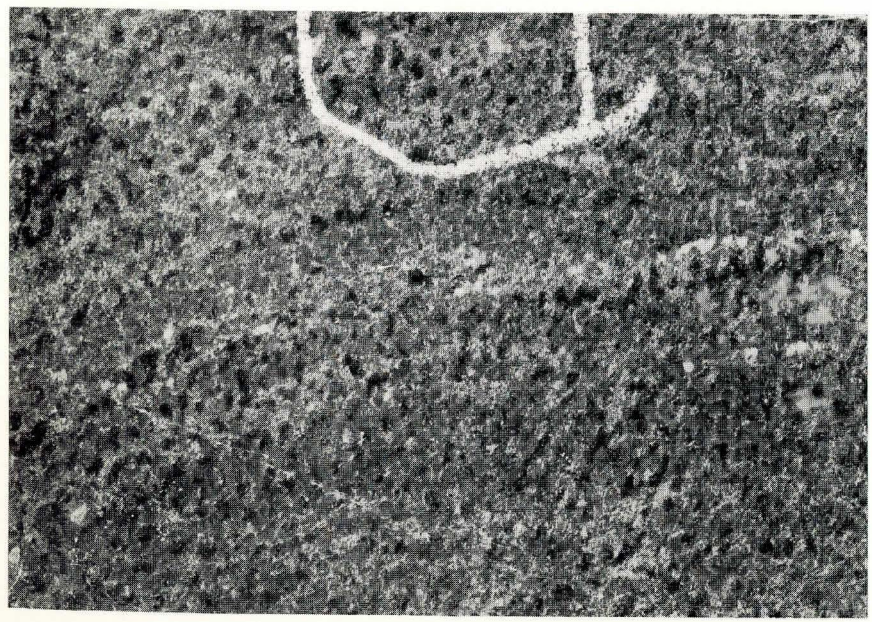

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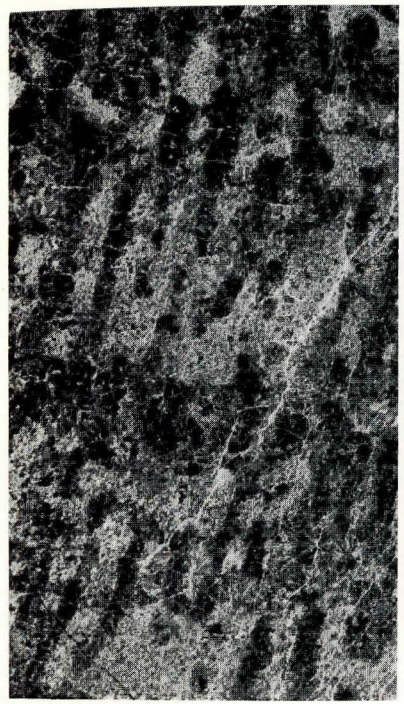

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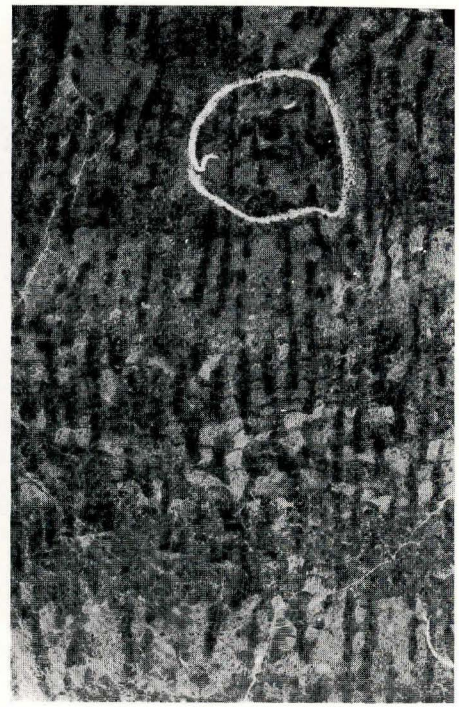

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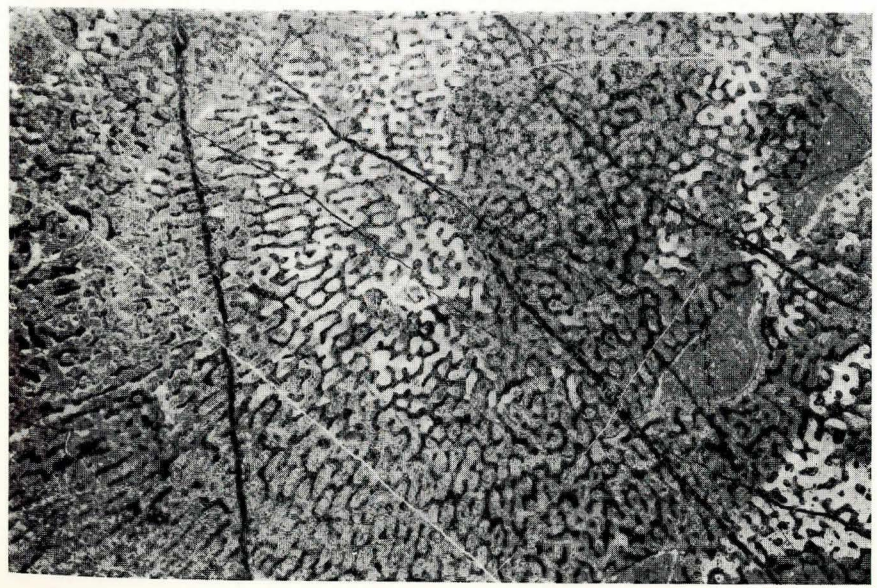


3

TABLA — PLATE 7

Sl. 1—2, Fig. 1—2. *Stromatopora* sp.

1. podolžni presek — longitudinal section; 5493/2a, Komatevra, × 8
2. isti vzorec — the same specimen; × 4

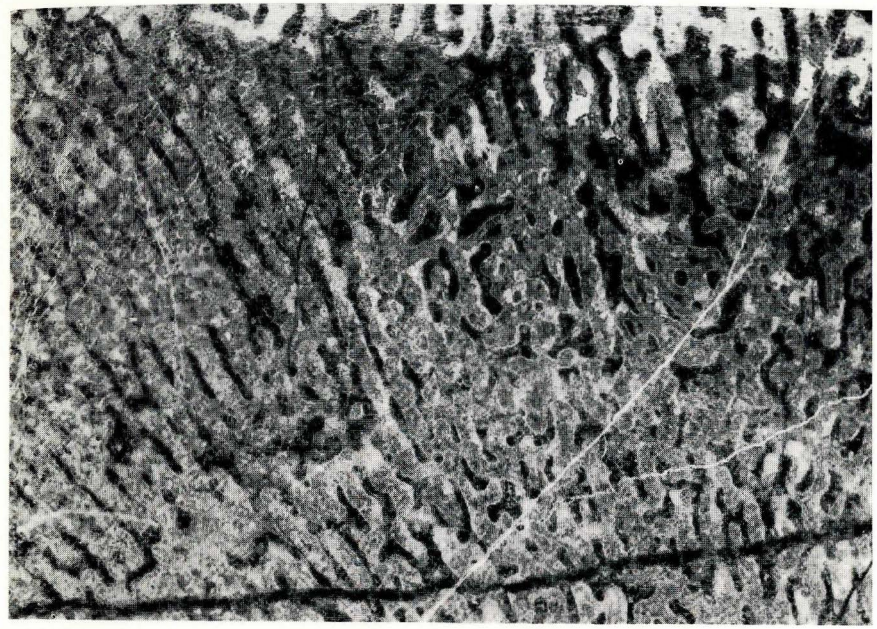
Sl. 3, Fig. 3. *Taleastroma pachytexta* (Lecompte)

radialni (levo podolžni, desno prečni) presek — radial (left longitudinal, right transverse) section; 5493/D22, Komatevra, × 4

TABLA — PLATE 8

Sl. 1—2, Fig. 1—2. *Taleastroma pachytexta* (Lecompte)

1. podolžni presek — longitudinal section; 5493/D22, Komatevra, × 8
2. prečni presek — transverse section; 5493/D22, Komatevra, × 8



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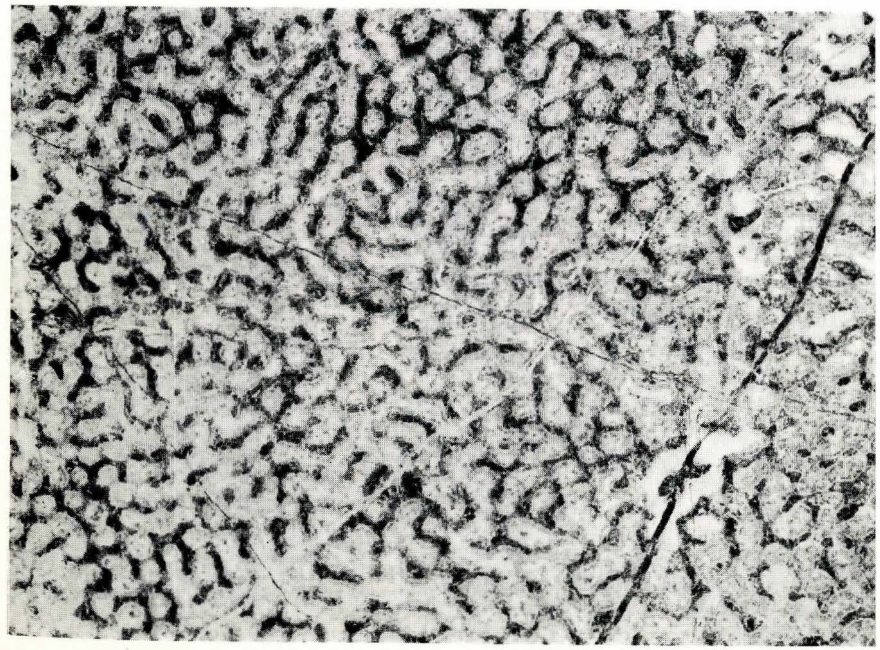

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TABLA — PLATE 9

Sl. 1—2, Fig. 1—2. *Stachyodes yaworskii* nom. nov.

1. radialni, nekoliko poševni presek — radial, something oblique section; 7273/D11c, Zgornje Jezersko, × 8
2. zbrusek s prečnim in podolžnim presekom cenostejev — thin section with longitudinal and transverse section of coenostea; 7273/D11b, Zgornje Jezersko, × 8

Sl. 3—4, Fig. 3—4. *Stachyodes venusta* Yaworsky

3. radialni presek — radial section; 7273/D11c, Zgornje Jezersko, × 8
4. radialni presek dveh cenostejev — radial section of two coenostea; 7273/D11c, Zgornje Jezersko, × 8

Sl. 5, Fig. 5. Zbrusek s *Stachyodes yaworskii* nom. nov., *Stachyodes venusta* Yaworsky; 7273/D11c., × 4

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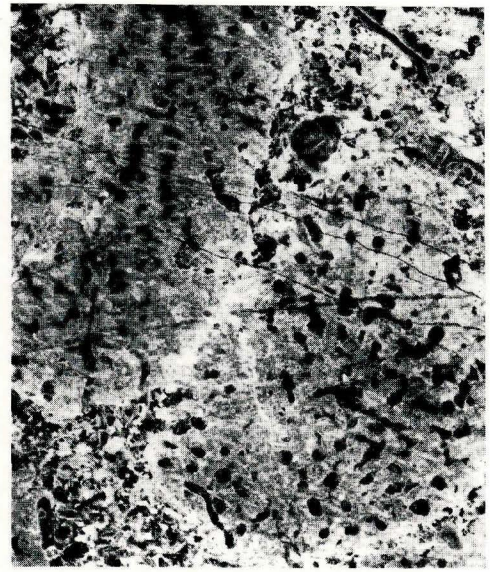

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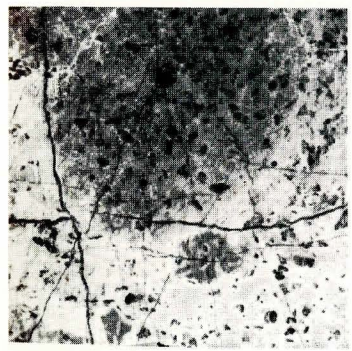

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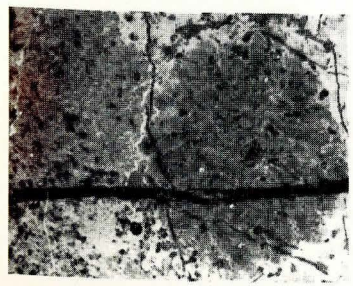

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TABLA — PLATE 10

Sl. 1—2, Fig. 1—2. *Stromatoporella laminata* (Bargatzky)

1. radialni presek — radial section showing concentric laminae; 5492/5a, Komatevra, × 4
2. podolžni presek — longitudinal section; 5492/19d, Komatevra, × 4

1

2

TABLA — PLATE 11

Sl. 1—2, Fig. 1—2. *Stromatoporella laminata* (Bargatzky)

1. podolžni presek — longitudinal section; 5492/19 d, Komatevra, × 8
2. prečni presek — transverse section; 5492/19 f, Komatevra, × 8

1

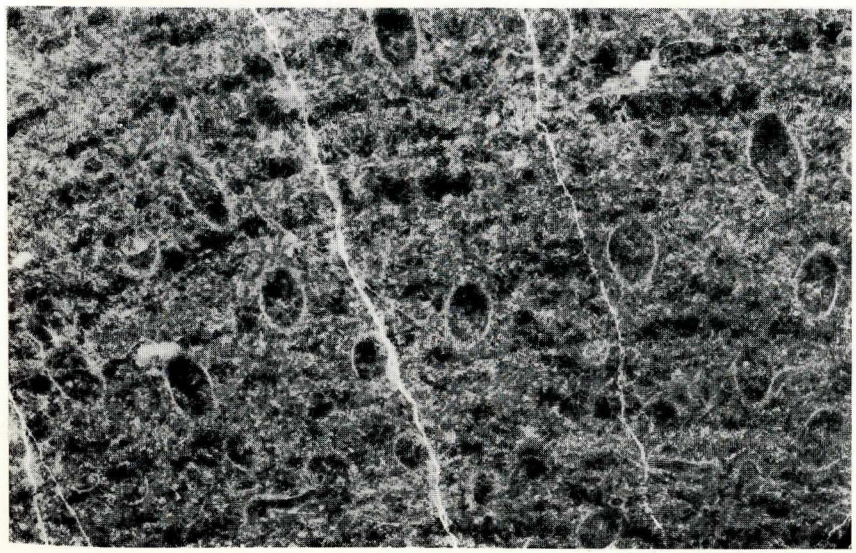

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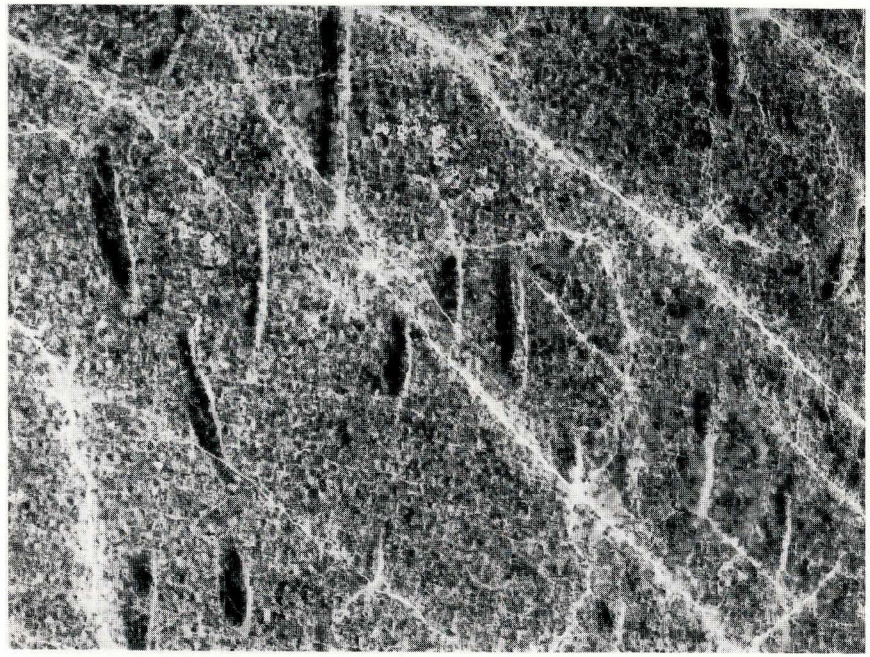
TABLA — PLATE 12

Sl. 1—3, Fig. 1—3. *Stromatoporella* cf. *solitaria* Nicholson

1. podolžni presek — longitudinal section; 5492/23 b, Komatevra, × 8
2. prečni presek — transverse section; 5492/23 a, Komatevra, × 8
3. mikrostruktura melanosferična, tudi ordinicelularna — melanospheric microstructure, here and there ordinicellulae or even short microlaminae; 5492/23 b, × 40



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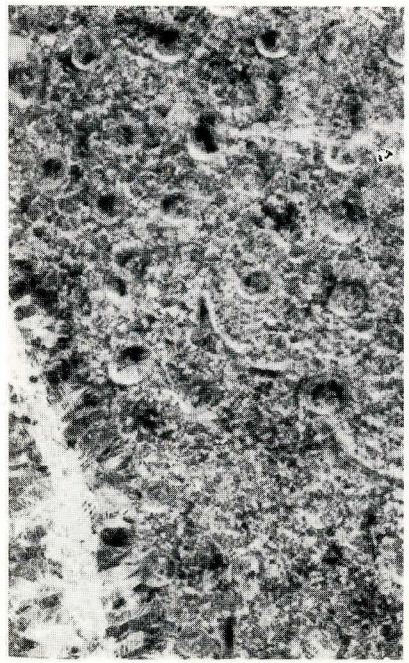

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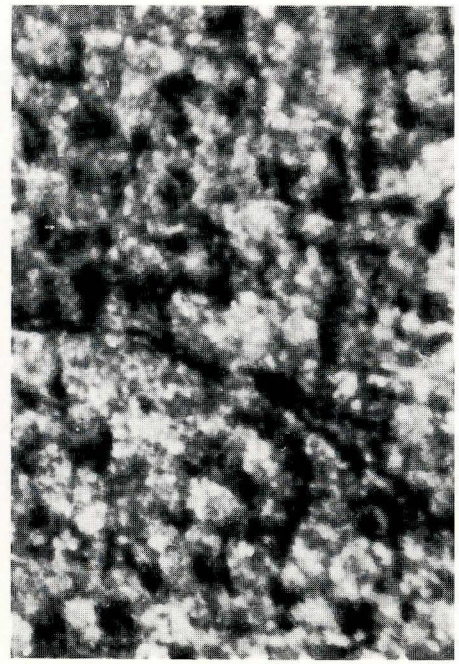


3

TABLA — PLATE 13

Sl. 1, Fig. 1. *Actinostroma stellulatum* Nicholson

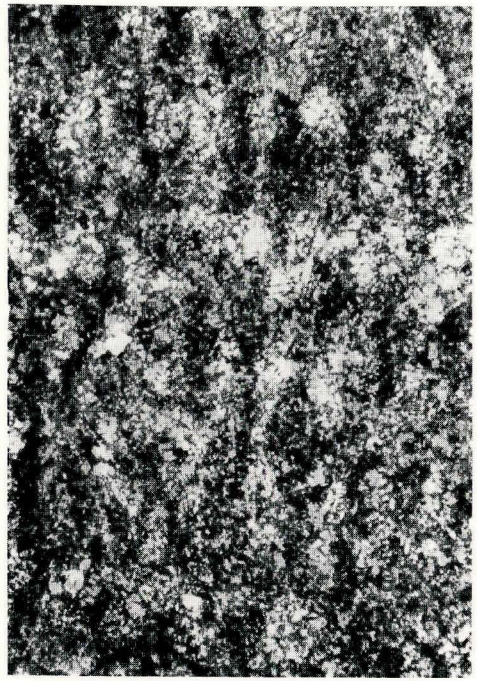
mikrostruktura kompaktna, nekoliko gobasta, vertikalni presek — compact microstructure slightly flocculent and fibrous, laminae destroyed a little; 7267/D17b, vertical section, × 40

Sl. 2, Fig. 2. *Stromatopora* sp.

celularna močno melanosferična mikrostruktura, vertikalni presek — cellular strongly melanospheric microstructure; 5493/2a, vertical section, × 40

Sl. 3, Fig. 3. *Taleastroma pachytexta* (Lecompte)

»sestavljena« mikrostruktura, v sredi elementa homogena, na periferiji celularna ali melanosferična, prečni presek — »composite« microstructure, showing compact tissue in axial parts of elements, and cellular or melanospheric tissue in peripheral parts of elements; 5493/D22, transverse section, × 40



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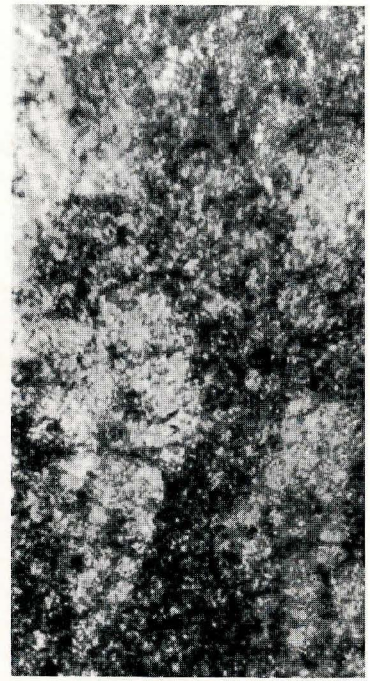

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TABLA — PLATE 14

Sl. 1, Fig. 1. *Stromatoporella laminata* (Bargatzky)

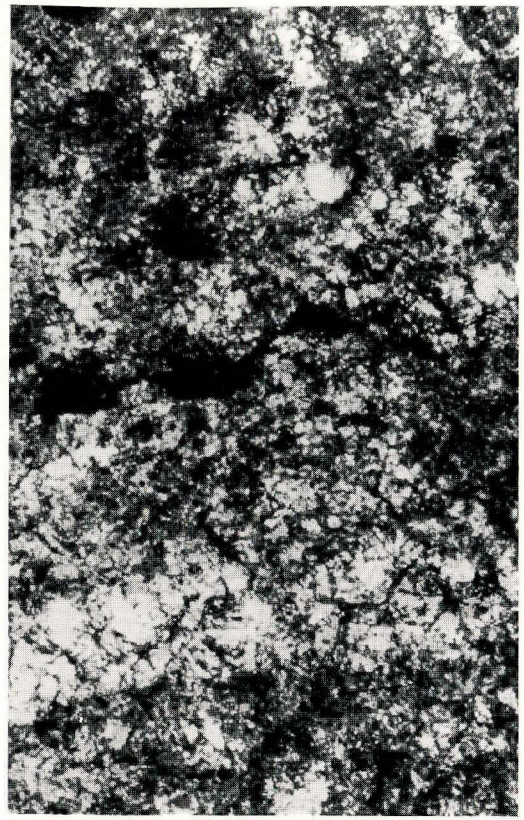
mikrostruktura v glavnem melanosferična in vlaknata, v laminah pa se kažejo ordinicelule z drobnimi celulami, podolžni presek — microstructure melanospheric and fibrous, in laminae also ordinicellular with very small cellulae; 5492/19 d, Komatevra, longitudinal section, × 40

Sl. 2, Fig. 2. *Stromatopora concentrica* Goldfuss

celularna mikrostruktura spremenjena v melanosferično, podolžni presek — cellulae are altered into melanospheres; 5492/12 c, Komatevra, longitudinal section, × 40

Sl. 3, Fig. 3. *Stachyodes yaworskii* nom. nov.

progasta mikrostruktura, na levi še ohranjene celule in melanosfere, radialni presek — striated microstructure; 7273/D 11 c, Zgornje Jezersko, radial section, × 40



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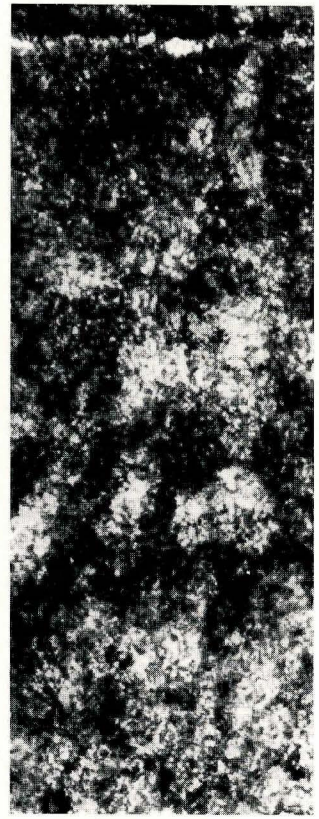

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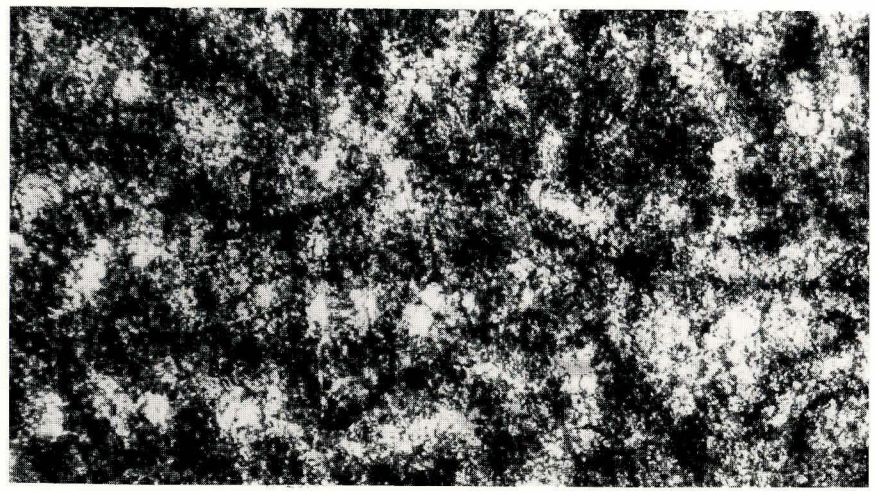

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