ALEKSANDER NOWIŃSKI

SOME NEW SPECIES OF TABULATA FROM THE LOWER PERMIAN OF HORNSUND, SPITSBERGEN

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Four new tabulate corals: *Roemeripora aspinosa* of the order Favositida, *Armalites laminatus* and *Hayasakaia compacta* of the order Syringoporida and *Fuchungopora arctica* of the order Sarcinulida are described from the Sakmarian to Artinskian (Lower Permian) strata of the Treskelodden Formation, Hornsund, Spitsbergen.

Key words: Coelenterata, Tabulata, Lower Permian, Spitsbergen.

Aleksander Nowiński. Polska Akademia Nauk, Zakład Paleobiologii, 02-089 Warszawa, Al. Żwirki i Wigury 93, Poland. Received: June, 1979.

NIEKTÓRE NOWE GATUNKI TABULATA Z DOLNEGO PERMU HORNSUNDU, SPITSBERGEN

Streszczenie. — Opisano cztery nowe gatunki Tabulata (*Roemeripora aspinosa*, *Armalites laminatus*, *Hayasakaia compacta*, *Fuchungopora arctica*) z dolnego permu (sakmarian i artinskian) formacji Treskelodden (V poziom koralowy) z obszaru fiordu Hornsund na Spitsbergenie. Gatunki te występują licznie w dwu rejonach Hornsundu: Treskelen i Hyrnefjellet. Przedstawiono ogólnie bogaty zespół innych faun kopalnych formacji Treskelodden, towarzyszący tabulatom i tworzący tu wraz z nimi osad o charakterze biolitu. Przedstawiono również krótko historię badań nad tabulatami Spitsbergenu. W części systematycznej pracy podano opisy morfologiczne nowych gatunków Tabulata oraz porównania z gatunkami pokrewnymi. Kolekcja Tabulata została zebrana podczas wyprawy Zakładu Paleobiologii Polskiej Akademii Nauk, pracującej na Spitsbergenie w roku 1974. Praca była finansowana z problemu międzyresortowego MR-II-16 Polskiej Akademii Nauk.

INTRODUCTION

The present paper describes four new tabulate coral species recorded in the Lower Permian strata of the Treskelodden Formation, Hornsund, Spitsbergen. The investigated material is a part of a much larger collection of Tabulata assembled by the author during

the 1974 Polish Paleontological Expedition to Spitsbergen led by Professor G. BIERNAT (Institute of Palaeobiology of the Polish Academy of Sciences, Warsaw), and Professor K. BIRKENMAJER (Institute of Geology, Polish Academy of Sciences, Cracow). The remaining tabulate coral species and a general characteristics of the assemblage will be presented in a separate paper. The new species of Tabulata described below occur in the Treskelen and Hyrnefjellet regions of Hornsund area.

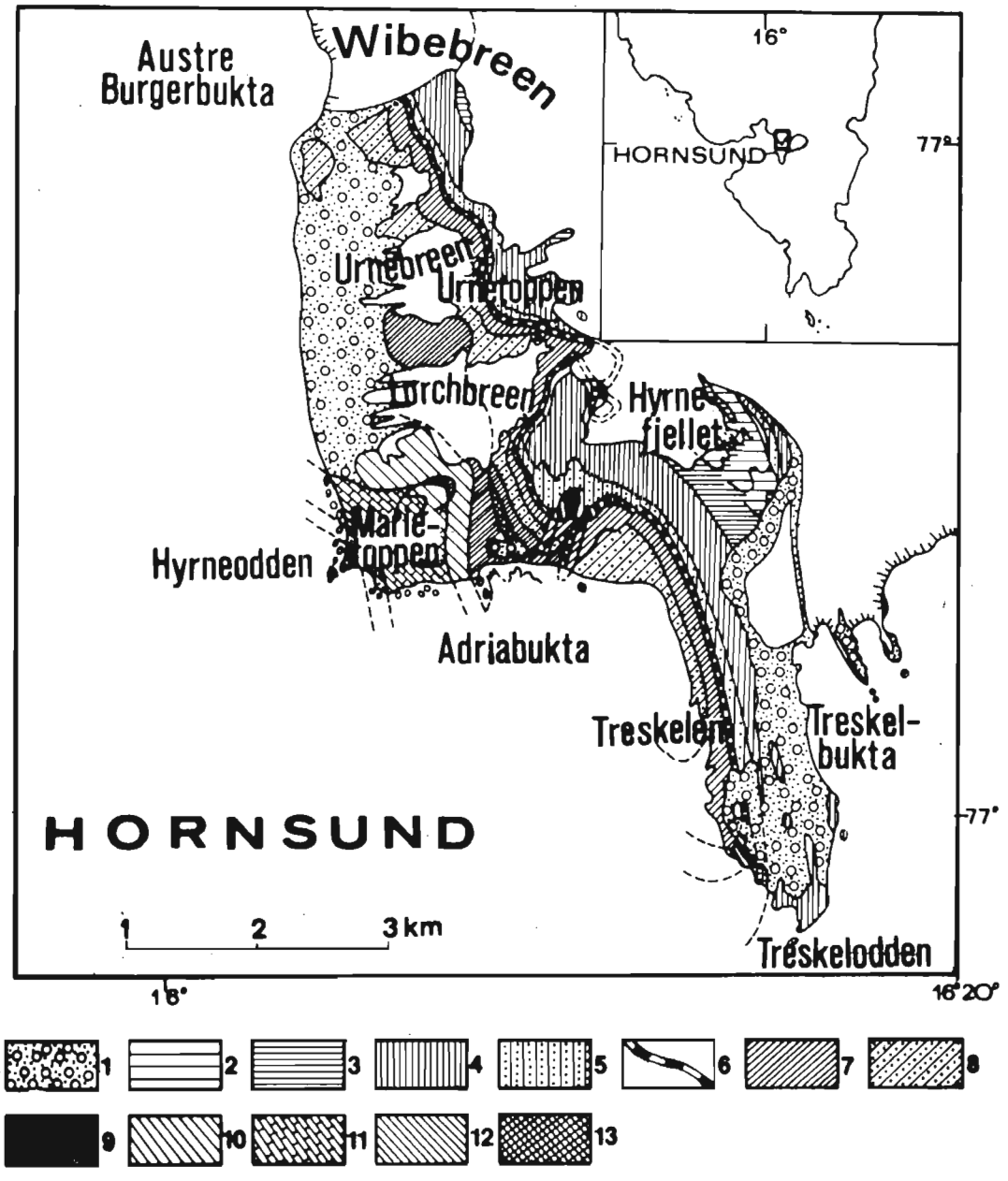

Fig. 1

Geological map of the studied area, north of Hornsund, Spitsbergen (after BIRKENMAJER 1964). 1. moraines, partly outwash; 2. Festningen Sandstone (Hauterivian to Barremian) and Ullaberget Series (Lower Neocomian); 4. Middle to Upper Triassic (Rhaetic including); 5. Lower Triassic; 6. Brachiopod Cherty Limestone (Upper Permian); 7. Treskelodden Beds (Upper Carboniferous to lowermost Permian); 8. Hyrnefjellet Beds (Middle Carboniferous); 9. Adriabukta Series (Visean to Namurian A?); 10. Upper Marietoppen Series (Devonian: Grey Hock Series); 11. Middle Marietoppen Series (Devonian: Stjördalen Division?); 12. Lower Marietoppen Series (Devonian: Keltiefjellet Division?), Heckla Hock Succession; 13. Sofiebogen Formation (Precambrian to Eocambrian).

The Tabulata of Spitsbergen are rather poorly known. Their cursory records usually appeared on occasion of studies intended to present other fossil groups. HOLTEDAHL (1912, 1913) reported a few Late Carboniferous to Early Permian species of the genera *Michelinia* and *Syringopora*. HERITSCH (1939) recorded the genera *Roemeripora*, *Michelinia*, *Syringopora*, *Multithecopora*, and *Hayasakaia* in the Permo-Carboniferous (Passage Beds, Wordiekammen Limestones and Brachiopod Cherts) of the Central Spitsbergen (Isfjorden), and compared the tabulate coral fauna to that of the Urals and Eurasia. PADGET (1954) presented a list of the Permo-Carboniferous coral fauna of the Isfjorden area (Bünsow Land and Tempelfjorden) including a few species of *Roemeripora* and *Syringopora*. Some tabulate coral species were also mentioned by FORBES *et al.* (1958) from the Middle Carboniferous to Lower Permian strata (Passage Beds, Wordiekammen Limestones, and Brachiopod Cherts) of the Central Spitsbergen (Isfjorden). FEDOROWSKI (1967) described the tabulate genera *Roemeripora*, *Michelinia*, *Syringopora*, and *Hayasakaia* from the Lower Permian Treskelodden Formation of Hornsund area.

In southern Spitsbergen, coral-bearing Permo-Carboniferous deposits occur north of Hornsund, between Treskelen and Kopernikusfjellet (fig. 1). The best exposures are between Treskelen and Hyrnefjellet (BIRKENMAJER and CZARNIECKI 1960, BIRKENMAJER 1964).

Table 1

Stratigraphic subdivision and sedimentary cycles of the Treskelodden Formation in Hornsund area (after BIRKENMAJER 1979)

SYSTEMS		EUROPEAN AND RUSSIAN STAGES			STRATIGRAPHIC UNITS		CYCLES	
PERMIAN	LOWER	SAKMARIAN	Pseudoschwagerina	TRESKELODDEN FORMATION	UPPER	V Coral Limestone Horizon	c	B	5
							b	A	
							a		
						IV Clastic Horizon		B	4
						IV Coral Limestone Horizon	c		
							b	A	
							a		
						III Clastic Horizon			3
						III Coral Limestone Horizon			
						II Clastic Horizon		C	2
						II Coral Limestone Horizon			
						I Coral Limestone Horizon		B	
						Grey Conglomerate Horizon		A	
CARBONI-FEROUS	UPPER	Gzelian	Orenburgian	Triticites	LOWER	I Clastic Horizon		C	1
								B	
								A	

The stratigraphic position of the Treskelodden Formation insofar has not ultimately been determined. BIRKENMAJER (1959, 1960*a*, 1960*b*, 1964) and FEDOROWSKI (1965, 1967) attributed these strata to Lower Permian (Sakmarian and partly Artinskian), basing upon lithostratigraphic correlation and Tetracoralla, respectively. According to CZARNIECKI (1964, 1966, 1969), the brachiopod assemblage indicates the Late Carboniferous (Gzelian) age for the whole Treskelodden Formation. The tabulate coral fauna investigated by the present author does not permit any more detailed age attribution of the Treskelodden Formation than to the Late Carboniferous to Early Permian.

The Treskelodden Formation are comprised mostly by clastic sediments (conglomerates, quartzitic sandstones, shales) rich in plant detritus, interbedded with sandy limestones and limestones. BIRKENMAJER (1964) recognized five sedimentary cycles within the formation, each beginning with conglomerates and ending with limestones (Table 1). Hence, there are five distinct coral-limestone horizons rich in corals (Tabulata and Tetracoralla), brachiopods, and other fossils. The average thickness of the Treskelodden Formation approximates 100 m between Treskelen and Hyrnefjellet.

In addition to tabulate corals, the Treskelodden Formation contains solitary and colony corals in masses (HOLTEDAHL 1913, HERITSCH 1939, FEDOROWSKI 1964, 1965, 1967), very abundant brachiopods (GOBBETT 1964, CZARNIECKI 1969), and crinoid ossicles. Less frequent are thus far undescribed bryozoans, molluscs (KARCZEWSKI 1982), trilobites (OSMÓLSKA 1968), foraminifers (LISZKA 1964), algae and plant detritus. The fossil remains are commonly packed so densely, especially in the coral-limestone Horizons IV and V, that the rock becomes a biolithite.

Both the sediment nature and the composition of the fossil assemblage indicate that the depositional environment was a shallow sublittoral zone, rather close to the shoreline.

The present work was done at the Institute of Paleobiology of the Polish Academy of Sciences, Warsaw, abbreviated as ZPAL, where also the collection is housed. Mrs. M. NOWIŃSKA is gratefully acknowledged for technical assistance, Mrs. D. SŁAWIK for drawing the figures, and Mr. S. WOŹNIAK for taking the photographs.

DESCRIPTIONS

Order **Favositida** SOKOLOV, 1962
Suborder **Favositina** SOKOLOV, 1950
Family **Syringolitidae** WAAGEN et WENTZEL, 1886
Genus *Roemeripora* KRAICZ, 1934

Type species: *Roemeripora bohemica* POCTA *in* BARRANDE, 1902.

Diagnosis. — See MIRONOVA (1974).

Remarks. — Characteristics of the genus *Roemeripora* and its comparison to related genera are given by SOKOLOV (1955, 1962), DUBATOLOV (1959), VASSILJUK (1960), HILL and JELL (1970), and MIRONOVA (1974). Thus far, 18 species of the genus are described from Lower Devonian to Lower Permian strata.

Occurrence. — Lower Devonian: Czechoslovakia, Soviet Union (Altai), Australia (Victoria, New South Wales), New Zealand; Lower to Middle Devonian: Soviet Union (Salair), Australia (Queensland), Viet-Nam; Middle Devonian: Soviet Union (Kuznetsk Basin); Lower Carboniferous: France, Soviet Union (Donetsk Basin, Novaya Zemla), China; Middle Carboniferous: Soviet Union (South Urals, Novaya Zemla); Lower Permian: Spitsbergen (Hornsund); Permian: Arctic Archipelago.

Roemeripora aspinosa sp. n.
(pl. 30: 1, 2; fig. 2)

Holotype: ZPAL T. XIII/21; pl. 30:1*a*, *b*.
Type horizon: Coral-Limestone Horizon V; Treskelodden Formation, Lower Permian.
Type locality: Treskelen, Hornsund, Spitsbergen.
Derivation of the name: *Lat. spina* — spine, *aspinosa* — without septal spines.

Diagnosis. — Long corallites irregularly polygonal to rounded in transverse section, 1·5 to 1·8 mm in diameter. Corallite wall 0·05 to 0·1 mm in thickness. Numerous connecting pores 0·2 to 0·3 mm in diameter, 1·5 to 2·5 mm distant from each other. Numerous syringoporoidal tabulae. No distinct vesicular zone at corallite periphery. No septal spines.

Material. — Five almost complete colonies, Treskelen, Coral-Limestone Horizon V (ZPAL T. XIII/21-25); three complete colonies, Hyrnefjellet, Coral-Limestone Horizon V (ZPAL T. XIII/26-28).

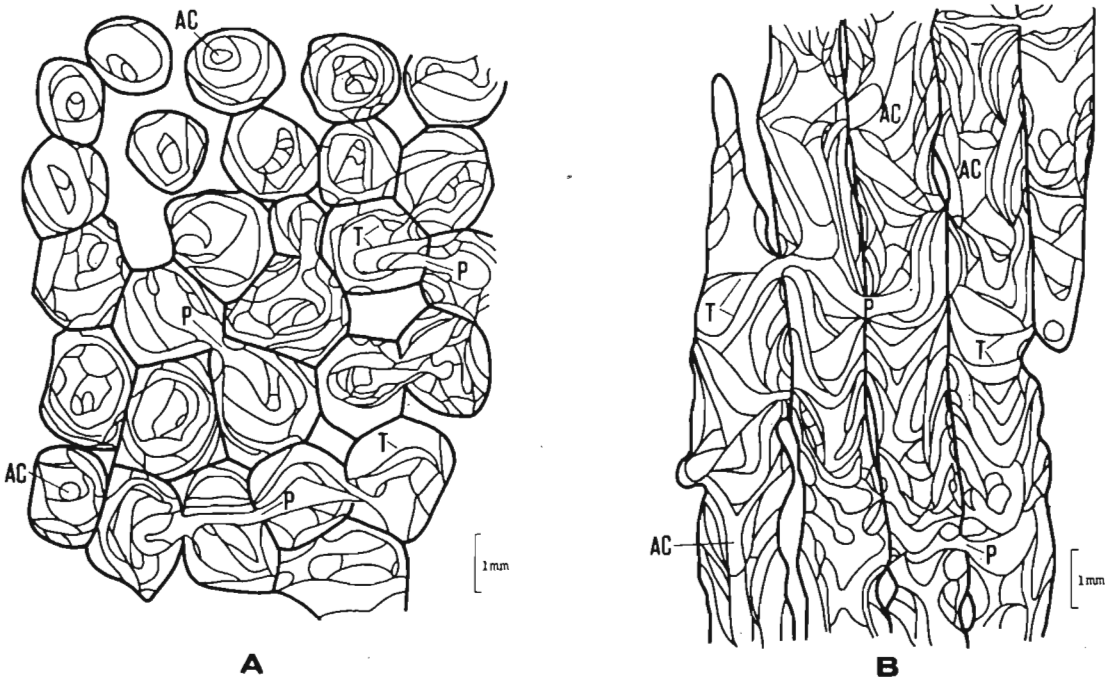

Fig. 2
Roemeripora aspinosa sp. n., Treskelen, Coral-Limestone Horizon V, holotype (ZPAL T. XIII/21); *A* transverse section, *B* longitudinal section; × 7·5. *AC* axial canal, *CP* connecting platform, *CT* connecting tube, *E* epitheca, *P* connecting pore, *SS* septal spine, *T* tabula, *V* visceral chamber, *WC* corallite wall.

Description. — Massive, irregularly oval in shape colonies of 150 to 200 mm in diameter. Corallites long, straight to slightly twisted, arranged parallelly or sometimes radially, perpendicular to the colony surface. Most commonly they are arranged loosely in a colony, with spaces inbetween not more than a corallite diameter. A few corallite walls are attached one to another, and their transverse sections are irregularly oval to rounded in outline. Corallites are arranged very closely in places where the transverse sections become irregularly polygonal to rounded. Corallite diameter 1·2 to 2·0, most commonly 1·5 to 1·8 mm. The corallite wall is thin, variable within the range of 0·04 to 0·2 (most commonly 0·05 to 0·1) mm in thickness, radial in microstructure. The median suture is indistinct. Numerous, circular connecting pores of 0·2 to 0·3 mm diameter. Where the corallites are arranged loosely, connecting pores grade into short, solenia-like tubes with a diameter of 0·3 to 0·5 mm. Connecting pores and tubes are spaced every 1·5 to 3·0, most commonly 1·5 to 2·5 mm. Numerous, funnel-shaped to bent,

syringoporoidal tabulae do not form any distinct vesicular tissue in the peripheral zone of a corallite. Tabulae are clustered into indistinct bunches in the proximity of connecting pores and tubes. The zigzag-shaped axial canal is fairly distinct, present merely in short fragments of corallite tubes. There are septal spines at corallite walls or tabulae.

Remarks. — *Roemeripora aspinosa* sp. n. differs from all its congeners in its weakly integrated colonies and the absence of distinct vesicular tissue in the peripheral zone of the corallites. Furthermore, it resembles representatives of the genus *Syringopora* in morphology and arrangement of the tabulae. *R. aspinosa* most closely resembles *R. terraë-novae* SMIRNOVA from the Lower Carboniferous (Tournaisian) of Novaya Zemla (see SMIRNOVA 1957). This is expressed in the transverse section and diameter of corallites, diameter of connecting pores, morphology and arrangement of tabulae. The difference consists in much larger, irregularly oval colonies of *R. aspinosa*, its thinner corallite walls, connecting pores situated at corallite walls instead of angles, and absence of septal spines from corallite walls and tabulae.

Order **Syringoporida** SOKOLOV, 1962
Family **Syringoporidae** NICHOLSON, 1879
Genus *Armalites* TCHUDINOVA, 1964 (*in* DUBATOLOV, 1963)

Type species: *Armalites novellus* TCHUDINOVA, 1964.

Diagnosis. See TCHUDINOVA (1964).

Remarks. — The diagnosis may be emended by pointing to the common occurrence of connecting elements (pore-canals, tubes) at a single level in adjacent corallites. This feature is also characteristic of the related genus *Roemerolites* (see DUBATOLOV, 1963).

Characteristics of the genus *Armalites* and its comparison to related genera are given by DUBATOLOV (1963), TCHUDINOVA (1964), HILL and JELL (1970).

Thus far, 5 species of the genus *Armalites* are described, all of them from the Lower to Middle Devonian of Kuznetsk Basin and Altai. These are: *A. altaicus* MIRONOVA (1974), *A. khomichevensis* MIRONOVA (1974), *A. suffruticosus* DUBATOLOV (1963), *A. novellus* TCHUDINOVA (1964), and *A. venustus* TCHUDINOVA (1964). The newly erected species *A. laminatus* is the first record of this genus in the Permian.

Occurrence. — Lower Devonian (Siegenian, Emsian): Soviet Union (Altai, Salair); Middle Devonian (Eifelian): Soviet Union (Kuznetsk Basin); Lower Permian: Spitsbergen (Hornsund).

Armalites laminatus sp.n.
(pl. 31:1-3; fig. 3)

Holotype: ZPAL T. XIII/39; pl. 31:1*a*, *b*
Type horizon: Coral-Limestone Horizon V; Treskelodden Formation, Lower Permian.
Type locality: Hyrnefjellet, Hornsund, Spitsbergen.
Derivation of the name: Lat. *lamina* — leaf, *laminatus* — with laminose arrangement of connecting elements situated at a single level in adjacent corallites.

Diagnosis. — Cylindrical corallites of 1·8 to 2·2 mm in diameter, and spaces inbetween not more than a corallite diameter. The corallite wall is 0·4 to 0·6 mm in thickness. Connecting pore-canals and tubes are 2·0 to 3·0 mm distant from one another at a single level in adjacent corallites. Connecting tubes are 0·2 to 0·3 mm in lumen and 0·5 to 0·8 mm in diameter. Numerous and prominent septal spines. Thin, funnel-shaped tabulae, sometimes incomplete and horizontal. Short, funnel-shaped axial canal.

Material. — Five large-sized colony fragments, Treskelen, Coral-Limestone Horizon V

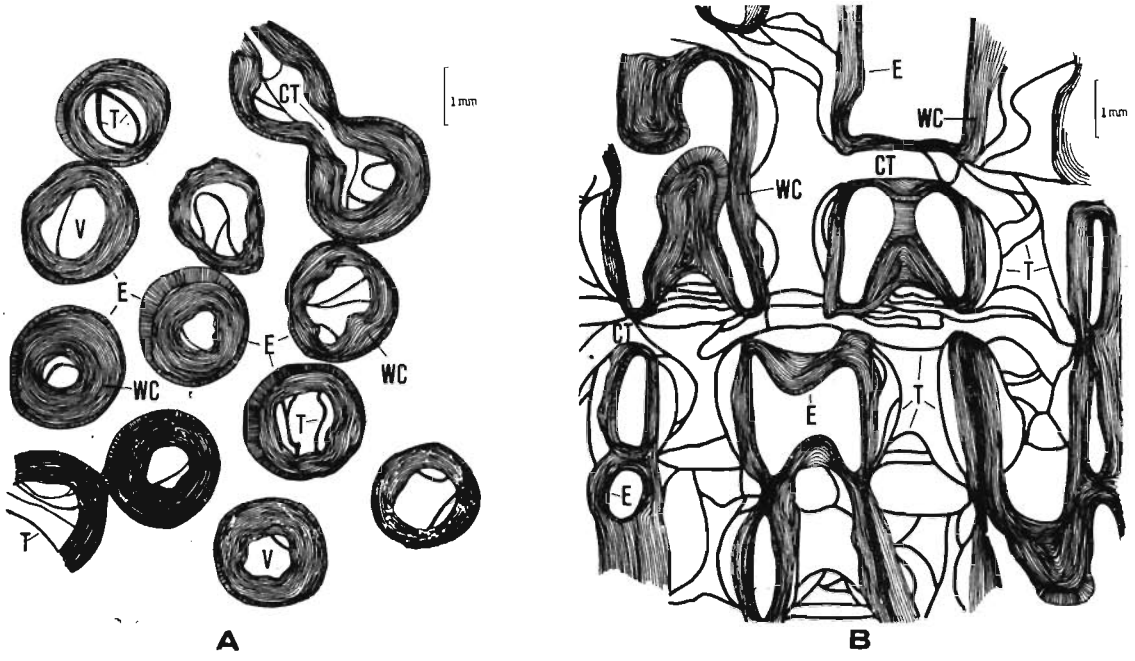

Fig. 3

Armalites laminatus sp. n., Hyrnefjellet, Coral-Limestone Horizon V, holotype (ZPAL T. XIII/44); *A* transverse section, *B* longitudinal section; × 7·5. For explanation of symbols see fig. 2.

(ZPAL T. XIII/39-43); two almost complete colonies, Hyrnefjellet, Coral-Limestone Horizon V (ZPAL T. XIII/44, 45).

Description. — Large-sized, oval in shape, irregular dendroidal colonies. Long, cylindrical corallites straight to slightly twisted, arranged parallelly and fairly closely, with spaces inbetween less than or at most equal to a corallite diameter. Very rarely corallites are attached to one another. Transverse sections are circular to oval, sometimes considerably rounded polygonal in outline, of 1·6 to 2·4 (most commonly 1·8 to 2·2) mm in diameter. The corallite wall very thick, ranging between 0·3 and 0·7 mm but even up to 0·8 mm; most commonly 0·4 to 0·6 mm in thickness. Turbulently concentric-lamellar wall exhibits microstructure of *Multithecopora* or *Syringopora* type. Epitheca is very thick, up to 0·2 mm, radial in microstructure. Large connecting pore-canals occur between corallites very close or attached to one another; well developed connecting tubes comprise interconnections between more distant corallites. The lumen of connecting pore-canals and tubes is circular, of 0·2 to 0·3 (sometimes up to 0·4) mm in diameter. Connecting tubes attain 0·5 to 0·8 mm in total diameter. Their thick wall is concentric-lamellar in microstructure, while the thin epitheca displays radial microstructure. Connecting elements are situated at a single level in a few to more than a dozen neighboring corallites, spaced regularly every 2·0 to 3·0 mm (sometimes every 1·5 mm). This arrangement of connecting elements imposes a laminated appearance of a colony in longitudinal section. Septal apparatus in the form of numerous, long and thick spines arranged in several vertical rows, spaced every 0·2 to 0·3 mm, embedded deeply in stereoplasma of corallite wall, and reaching epitheca. Sparse tabulae thin, funnel-shaped or oblique to horizontal, commonly incomplete; they pass through connecting pore-canals and tubes to adjacent corallites. Short, wide, funnel-shaped axial canals are restricted to intervals between adjacent connecting elements, with a prolongation through connecting elements into an adjacent corallite. There are no septal spines at tabulae.

Remarks. — *Armalites laminatus* sp. n. differs from all its congeners in larger size of its colonies, smaller diameter of corallites, and regular, stratiform arrangement of connecting elements.

Armalites sp.

(pl. 30:3; pl. 31:4)

Material. — A single complete colony, Treskelen, Coral-Limestone Horizon V (ZPAL T. XIII/46).

Description. — Irregularly oval, dendroidal colony approximately 100 mm in diameter. Short corallites, straight to slightly twisted, arranged parallelly, with spaces inbetween less than, or at most, equal to a corallite diameter. Transverse sections are irregularly circular to oval, rarely triangular in outline, with a diameter of 1·5 to 2·0 mm. The corallite wall is very thick, 0·3 to 0·7 (most commonly 0·4 to 0·6 mm) turbulently concentric-lamellar in microstructure. Indistinct, thin epitheca radial in microstructure. Connecting elements include pore-canals and tubes situated commonly at a single level in adjacent corallites, with approximately 4·0 mm space inbetween. Connecting tubes show thick walls approximately 0·8mm in thickness, with concentric-lamellar microstructure similar to that of the corallite wall. Septal apparatus in the form of prominent, thick spines is arranged in several vertical rows at corallite walls. Septal spines embedded deeply in stereoplasma of the corallite wall also occur abundantly in calices. Tabulae are fairly rare, thin, bent to oblique, less frequently funnel-shaped. They locally form a short and large axial canal. No septal spines at tabulae.

Remarks. Proper identification of the specimen is difficult because of the poor state of preservation.

Armalites sp. differs from its previously known congeners, in respect to the very small diameter of its corallites. From *Armalites laminatus* sp. n. it differs in sparser spacing of corallites, smaller corallite diameter, less regular transverse sections of corallites, larger spaces between connecting tubes, scarcity of connecting pore-canals, and weaker development of septal apparatus.

Family **Tetraporellidae** SOKOLOV, 1950

Genus *Hayasakaia* LANG, SMITH et THOMAS, 1940

Type species: *Tetrapora elegantula* YABE and HAYASAKI, 1915

Diagnosis. — See LIN BAO-YUI (1958).

Remarks. — The diagnosis may be emended by pointing to the commonness of the very thick corallite wall and thick tabulae among representatives of the genus *Hayasakaia*, as e. g. in *H. tsungi* SOKOLOV from the Lower Permian of southern China. Some species also show a considerable to complete reduction of vesicular tissue in peripheral zone of corallites.

Characteristics of the genus *Hayasakaia* and its comparison to related genera are given by YABE and HAYASAKA (1915), YOH and HUANG (1932), HUANG (1932), GORSKY (1935), FONTAINE (1955), SOKOLOV (1955, 1962), and LIN BAO-YUI (1958). Thus far, 20 species of the genus *Hayasakaia* are described from Lower Carboniferous to Lower Permian strata.

Occurrence. — Lower Carboniferous: Soviet Union (Novaya Zemla); Upper Carboniferous to Lower Permian: southern Europe, Transcaucasia, China, Iran, Viet-Nam, Spitsbergen (Hornsund).

Hayasakaia compacta sp. n.

(pl. 32:1, 2; fig. 4)

Holotype: ZPAL T. XIII/50; pl. 32:1a, b.
Type horizon: Coral-Limestone Horizon V; Treskelodden Formation, Lower Permian.
Type locality: Treskelen, Hornsund, Spitsbergen.
Derivation of the name: *Lat.* — *compactus* — compact.

Diagnosis. — Long corallites irregularly polygonal in transverse section, 1·3 to 1·6 mm in diameter, either arranged loosely and connected by widely spaced, short tubes, or arranged

closely, thightly packed and connected by widely spaced pores of 0·1 to 0·15 mm in diameter. Corallite wall 0·1 to 0·2 mm in thickness. Thick tabulae typical of morphology of the genus. No vesicular tissue. No septal spines.

Material. — Four almost complete colonies, Treskelen, Coral-Limestone Horizon V (ZPAL T. XIII/50-53).

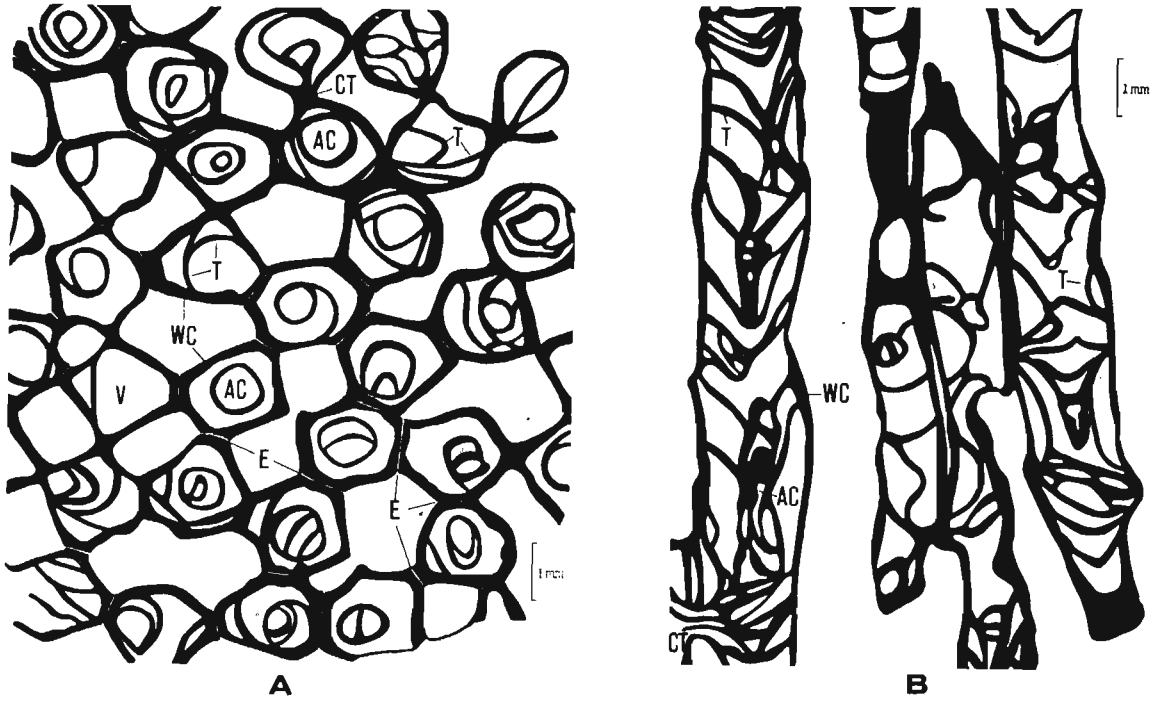

Fig. 4
Hayasakaia compacta sp. n., Treskelen, Coral-Limestone Horizon V, holotype (ZPAL T. XIII/50); *A* transverse section, *B* longitudinal section; × 7·5. For explanation of symbols see fig. 2.

Description. — Irregular to oval, dendroidal colonies up to 150 mm in diameter. Long corallites straight or slightly twisted, irregularly prismatical, rarely cylindrical, arranged parallelly, perpendicular to the colony surface. In some parts of a colony, corallites are arranged loosely, in a way typical of the genus; elsewhere, compact clusters of tightly packed corallites (a dozen to some tens corallites) appear. Transverse sections more or less regularly polygonal (tetragonal to hexagonal) to weakly rounded, with a diameter of 1·2 to 1·8 mm, most commonly 1·3 to 1·6 mm. Corallite wall thick, 0·1 to 0·2 mm in thickness, with indistinct concentric-lamellar microstructure. Median suture very weakly expressed. Scarce connecting tubes very short, indistinct, situated at corallite margins. Connecting pores not numerous, circular, 0·10 to 0·15 mm in diameter, irregularly spaced, present only in corallites attached one to another. Tabulae thick, complete, horizontal to (more commonly) oblique, straight to slightly bent. No distinct peripheral vesicular zone. No septal spines.

Remarks. — The newly erected species most closely resembles *Hayasakaia tsengi* Sokolov from the Lower Permian of southern China (Sokolov 1955). Both the species display a similarly thick corallite wall. The resemblance also consists in thickness and morphology of tabulae, considerable reduction of peripheral vesicular zone, and absence of septal spines. The difference consists in larger corallite diameters, occurrence of both loose and compact clusters of corallites in a single colony, scarcity and poor development of connecting tubes in *H. compacta* sp. n.

Order **Sarcinulida** SOKOLOV, 1955
Family **Gorskyitidae** LIN BAO-YUI, 1963
Genus *Fuchungopora* LIN BAO-YUI, 1963

Type species: *Fuchungopora multispinosa* LIN BAO-YUI (1963).

Diagnosis. — See LIN BAO-YUI (1963).

Remarks. — The diagnosis may be emended by pointing to a considerable thickness of corallite wall sometimes attained by representatives of the genus *Fuchungopora*, as e. g. *F. syringoporoides* described from the Visean of southern China (LIN BAO-YUI, 1963). Thick corallite wall is also typical of *F. arctica* sp. n. (see below). Furthermore, the axial canal may vary in width or even disappear. Thus far, three species of *Fuchungopora* are known, all of them from the Lower Carboniferous of China; these are: *F. multispinosa* LIN BAO-YUI, *F. multitabulata* LIN BAO-YUI, and *F. syringoporoides* LIN BAO-YUI.

Occurrence. — Lower Carboniferous (Visean): southern China; Lower Permian: Spitsbergen (Hornsund).

Fuchungopora arctica sp. n.
(pl. 33:1; fig. 5)

Holotype: ZPAL T. XIII/47; pl. 33:1*a-c*.
Type horizon: Coral-Limestone Horizon V; Treskelodden Formation, Lower Permian.
Type locality: Hyrnefjellet, Hornsund, Spitsbergen.
Derivation of the name: *Lat. arctica* — derived from Arctic regions.

Diagnosis. — Corallites long and straight, with spaces inbetween equal to corallite diameter. Transverse sections irregularly circular to rounded polygonal, with a diameter of 1·5 to 1·8 mm. The corallite wall is 0·2 to 0·3 mm in thickness. Connecting tubes of 0·5 to

Fig. 5
Fuchungopora arctica sp. n., Hyrnefjellet, Coral-Limestone Horizon V, holotype (ZPAL T. XIII/47); *A* transverse section, *B* longitudinal section; × 7·5. For explanation of symbols see fig. 2.

0·8 mm in diameter are spaced every 1·5 to 2·0 mm. Tabulae numerous, funnel-shaped, bent. Septal spines numerous, long, arranged in 20 to 24 vertical rows.

Material. — Three almost complete colonies, Hyrnefjellet, Coral-Limestone Horizon V (ZPAL T. XIII/47-49).

Description. — Irregular to oval, dendroidal colonies up to 200 mm in diameter. Corallites long, straight to slightly twisted, arranged parallelly, perpendicularly to the colony surface, with spaces inbetween variable but rarely exceeding a corallite diameter. Transverse sections are irregularly circular, oval to rounded polygonal (trigonal to pentagonal in outline), with a diameter of 1·4 to 2·0, most commonly 1·5 to 1·8 mm. The corallite wall is thick (0·2 to 0·3 mm), with indistinct concentric-lamellar microstructure. The epitheca is thick, radial in microstructure. Connecting tubes are numerous and well developed, thick, sometimes fairly long, with a diameter of 0·5 to 0·8 mm, spaced irregularly with intervalls of 1·5 to 2·0 mm. Connecting tubes are commonly accompanied by connecting flats, irregular in shape, spaced more or less similarly to the tubes. Tabulae are numerous, fairly thin, funnel-shaped, variable in length, sometimes considerably and irregularly bent. Here and there they form a short axial canal variable in diameter, provided in places with straight and horizontal tabulae. Very numerous septal spines. They are long, pointed, embedded deeply in stereoplasma of corallite wall, arranged densely in 20 to 24 vertical rows.

Remarks. — *Fuchungopora arctica* sp. n. resembles in diameter, form, and spacing of its corallites *F. syringoporoides* from the Visean of southern China (Lin Bao-Yui 1963). It differs from the latter species by a thicker corallite wall and stronger development of the septal apparatus. From the type species *F. multispinosa* the newly erected species differs by a smaller diameter and thicker wall of its corallites, and in absence of vesicular tissue from the corallite periphery.

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EXPLANATION OF THE PLATES 30-33
All figures × 5 unless otherwise indicated

PLATE 30

Roemeripora aspinosa sp. n.
Coral-Limestone Horizon V

1. *a* longitudinal section, × 5; *b* transverse section, × 10; holotype (ZPAL T. XIII/21); Treskelen.
2. Transverse section: (ZPAL T. XIII/26); Hyrnefjellet.

Armalites sp.
Coral-Limestone Horizon V

3. Longitudinal section; (ZPAL T. XIII/46); Treskelen.

PLATE 31

Armalites laminatus sp. n.
Coral-Limestone Horizon V

1. *a* transverse section; *b* longitudinal section; holotype (ZPAL T. XIII/44); Hyrnefjellet.
2. Longitudinal section through juvenile part of the colony; (ZPAL T. XIII/45); Hyrnefjellet.
3. Longitudinal section; (ZPAL T. XIII/39); Treskelen.

Armalites sp.
Coral-Limestone Horizon V

4. Transverse section; (ZPAL T. XIII/46); Treskelen, Coral-Limestone Horizon V.

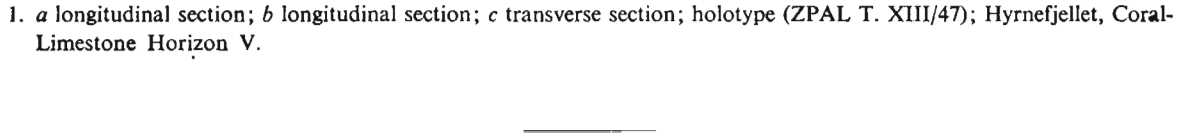
PLATE 32

Hayasakaia compacta sp. n.
Treskelen, Coral-Limestone Horizon V

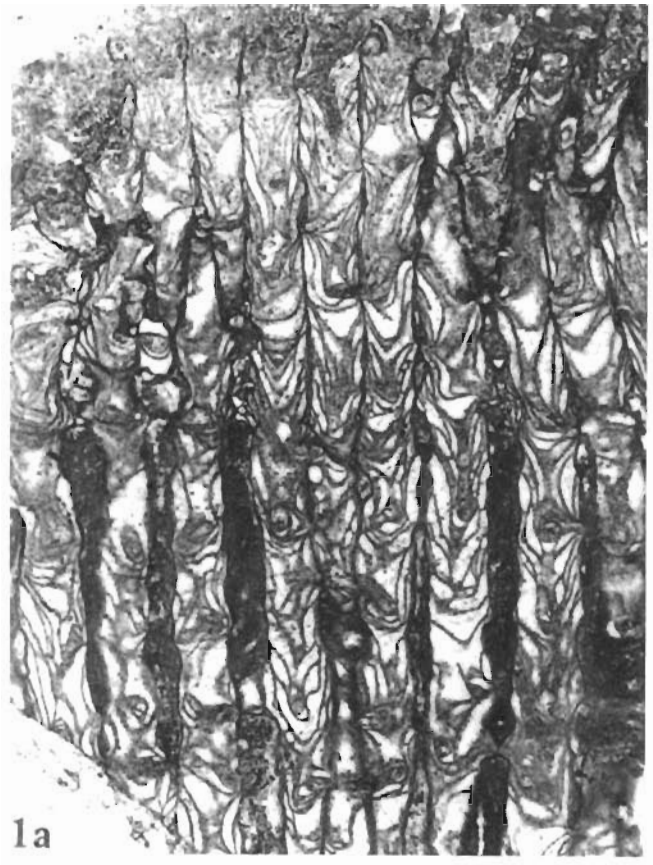
1. *a* longitudinal section; *b* transverse section; holotype (ZPAL T. XIII/50).
2. *a* transverse section through a compact cluster of corallites; *b* longitudinal section through juvenile part of a colony; (ZPAL T. XIII/51).

PLATE 33

Fuchungopora arctica sp. n.
Coral-Limestone Horizon V



1. *a* longitudinal section; *b* longitudinal section; *c* transverse section; holotype (ZPAL T. XIII/47); Hyrnefjellet, Coral-Limestone Horizon V.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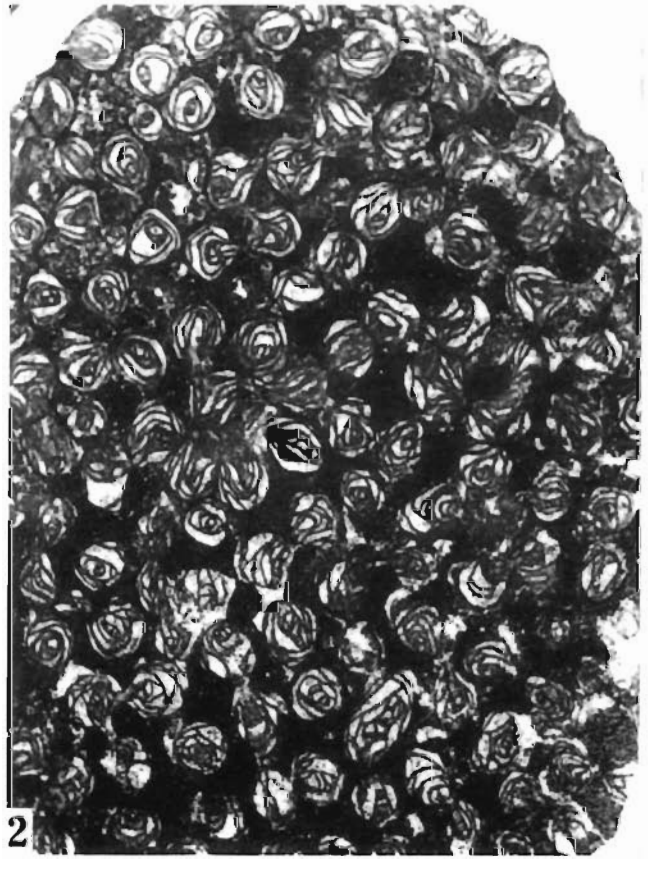
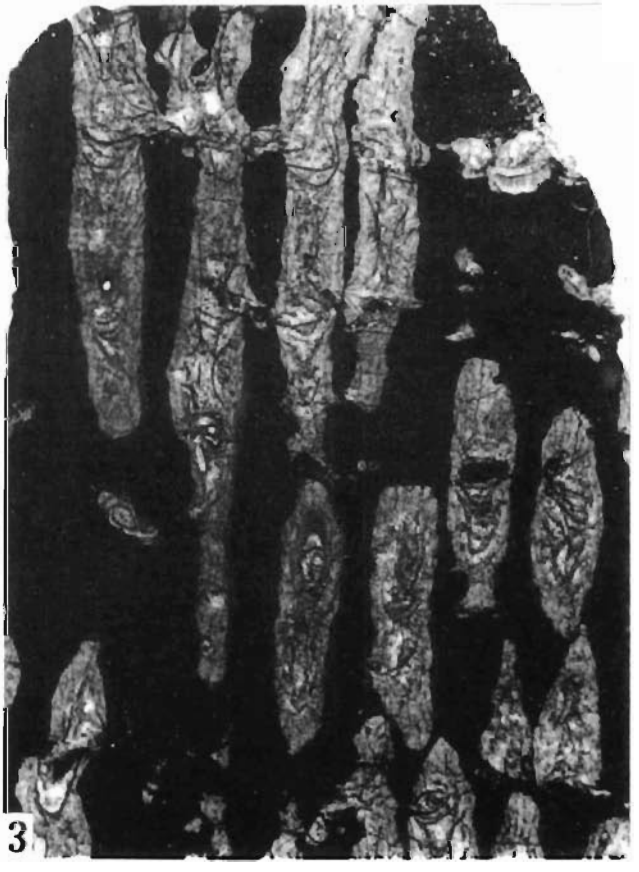
1b


2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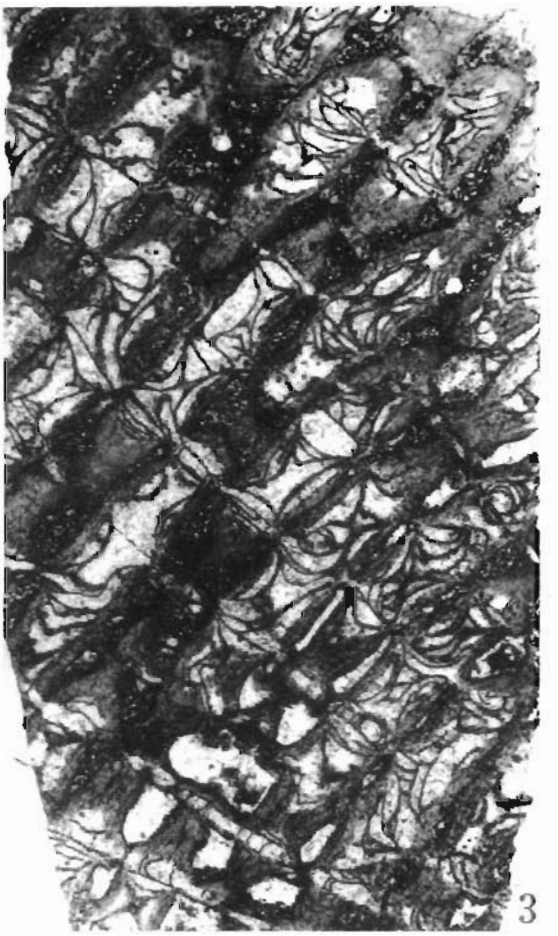
1a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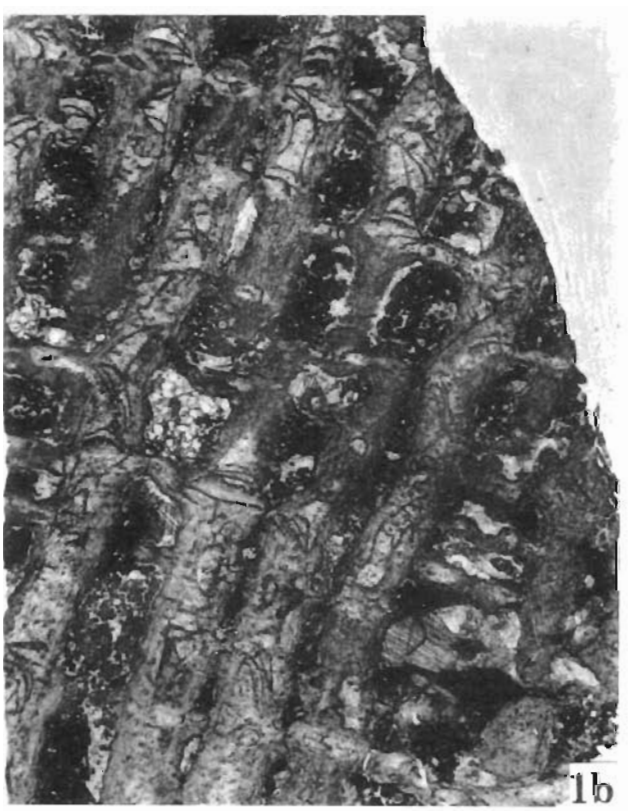
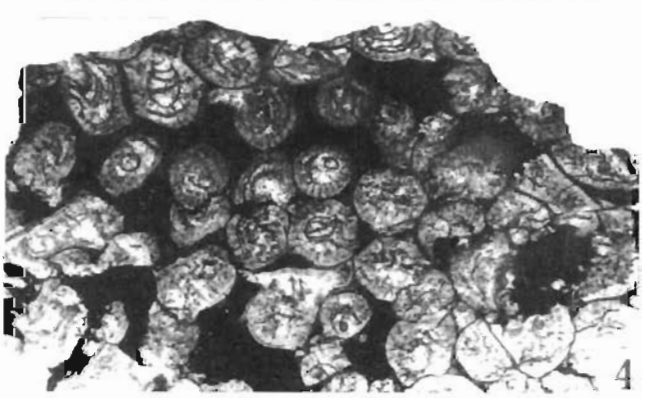

1b


2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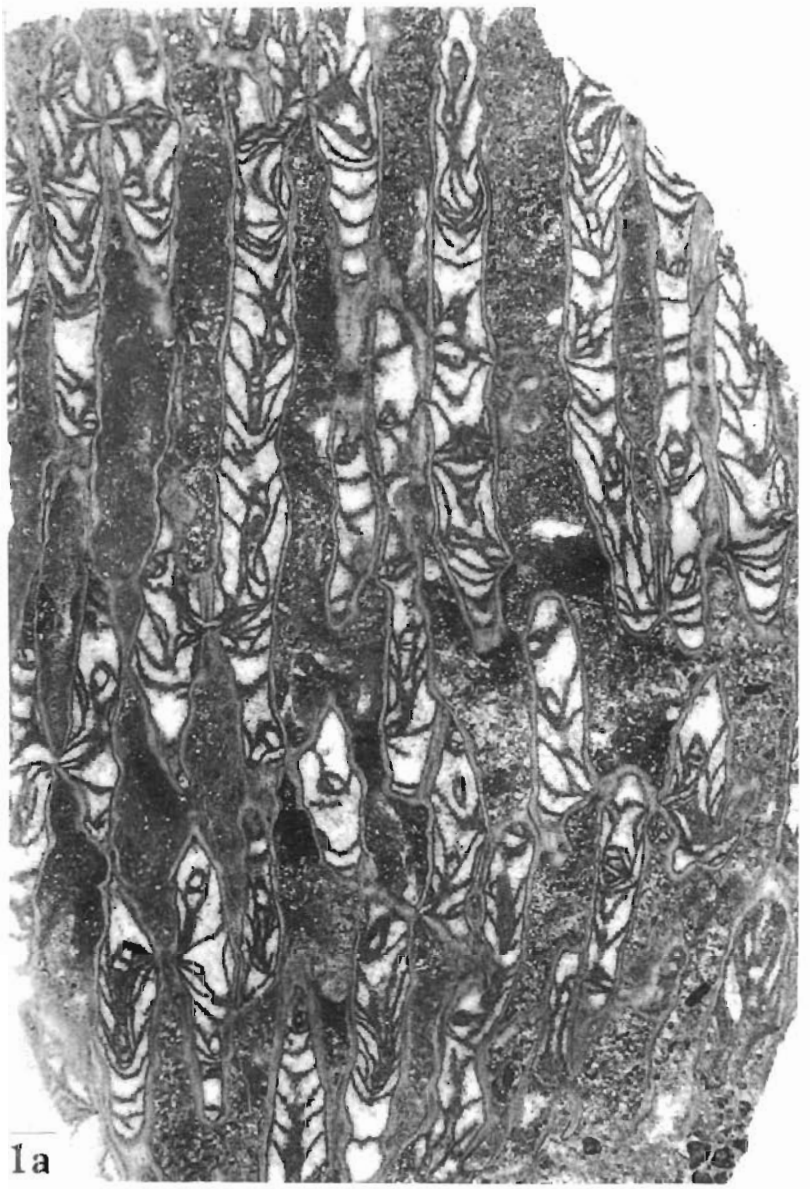

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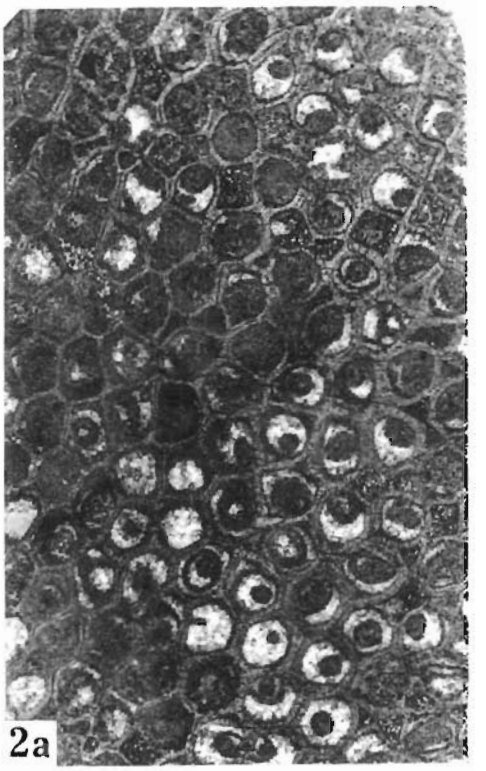

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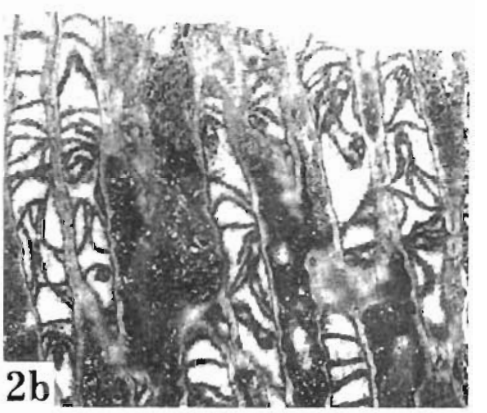

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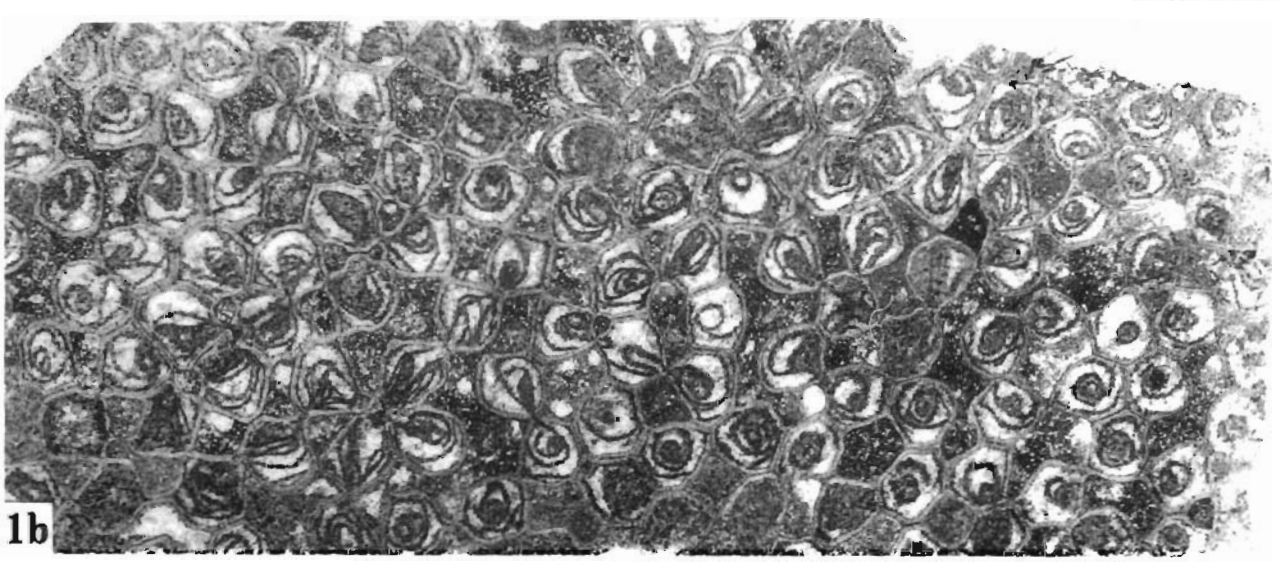

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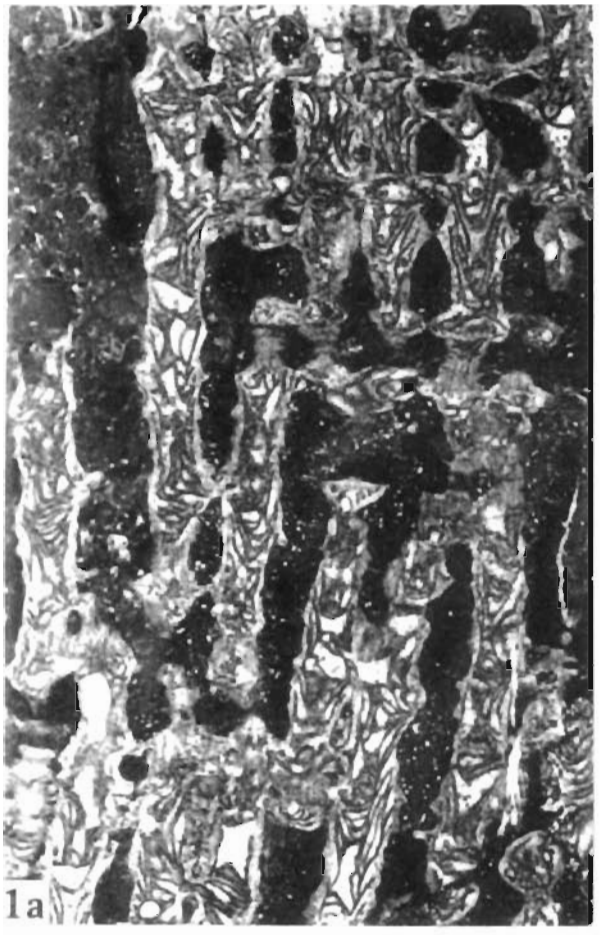
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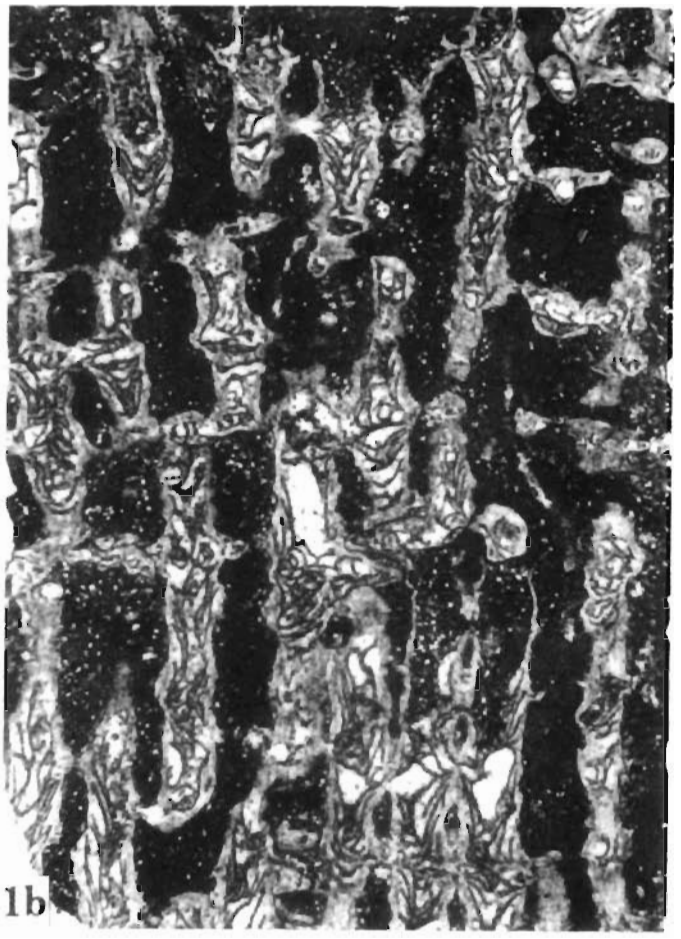
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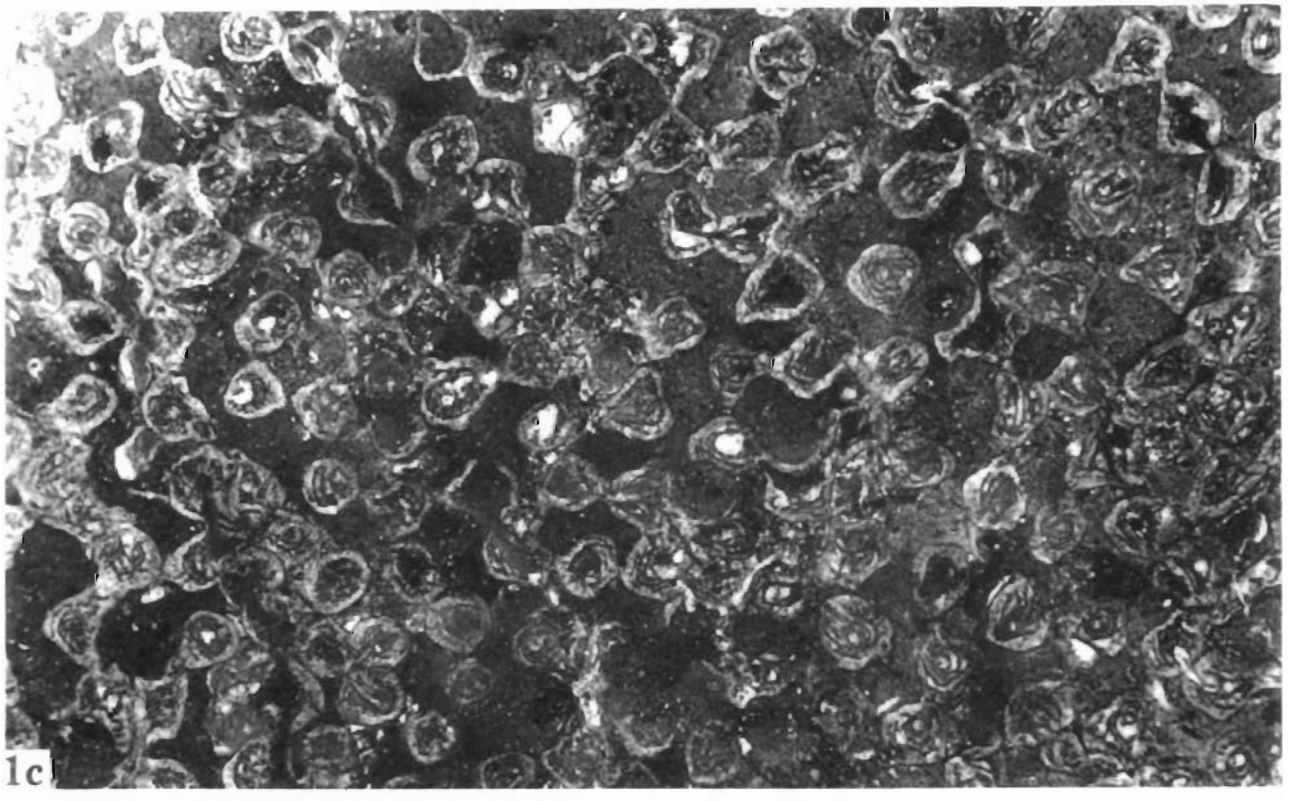
1c