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TABULATA AND CHAETETIDA FROM THE DEVONIAN AND CARBONIFEROUS OF SOUTHERN POLAND

(TABULATA I CHAETETIDA Z DEWONU I KARBONU POŁUDNIOWEJ POLSKI)

BY

ALEKSANDER NOWIŃSKI

(WITH 21 TEXT-FIGURES AND 27 PLATES)

WARSZAWA — KRAKÓW 1976

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CONTENTS

ABSTRACT

The results of studies on Tabulata and Chaetetida from the Givetian, Frasnian and Visean of the Cracow-Silesian Upland (Cracow Region) and from the Visean of south-western part of the Holy Cross Mountains (Gałęzice) are presented. Fourty-one species of Tabulata (orders: Favositida, Syringoporida, Auloporida) including eighteen new species, and six species of Chaetetida (family Chaetetidae) including three new species are described. Following new species are designated: *Squameofavosites megasquamatus* sp. n., *S. (Dictyofavosites) pachyfavositoides* sp. n., *Emmonsia czarnieckii* sp. n., *Michelinia aseptata* sp. n., *Palaeacis orlei* sp. n., *Thamnopora striatoporoides* sp. n., *Alveolitella rarispinosa* sp. n., *Crassialveolites polonicus* sp. n., *Natalophyllum dubiensis* sp. n., *Tyrganolites frasnianus* sp. n., *Syringopora sinusoidea* sp. n., *S. subreticulata* sp. n., *S. tenuitheca* sp. n., *S. pachysiphonata* sp. n., *Multithecopora polonica* sp. n., *M. spinosa* sp. n., *Syringoporella longituba* sp. n., *Sinopora polonica* sp. n., *Cyclochaetetes tuberculosus* sp. n., *Chaetetella (Chaetetiporella) heterozoa* sp. n., *Ch. (Chaetetiporella) rotaiformis* sp. n. It has been stated here that only two types of asexual reproduction occur in Tabulata: (1) intracalicular budding, and (2) longitudinal division. Three variants of intracalicular budding have been studied in details: (a) intravisceral budding realized by wall outgrowths or invaginations in the wall of parent calices, (b) mural budding, and (c) extravisceral budding. The comparison of described Tabulata and Chaetetida assemblages with contemporaneous assemblages of Europe and Asia indicates that: (1) the Givetian assemblage of Dębnik anticline is mixed and rather poor in species; (2) the Frasnian assemblage of Dębnik anticline displays great similarity to West-European tabulate corals, (3) the Visean assemblage from the Holy Cross Mountains (Gałęzice), except of a few local components, is close to the West-European assemblages. The assemblages of Chaetetida from the Visean of the Holy Cross Mountains (Gałęzice) have many species common with East-European assemblages (Moscow Basin).

INTRODUCTION

The Tabulata from the Devonian and Lower Carboniferous of the Silesian-Cracow Upland have been only little studied. A few species of Tabulata were described or mentioned without illustrations from numerous outcrops of the Dębnik anticline by GÜRICH (1903) and ZARĘCZNY (1889). Four species of Tabulata have been described by STASIŃSKA (1973) from the Lower Carboniferous of the Holy Cross Mts. (Dalnia hill near Kielce). In the region of Gałęzice, the Lower Carboniferous Tabulata and Chaetetida have not been so far described.

The present paper has been prepared on the basis of a rich material of relatively well-preserved colonies, collected by the writer in natural outcrops and artificial exposures of the Silesian-Cracow Upland and the Holy Cross Mts., between 1969 and 1972. The Devonian Tabulata were collected from many Givetian and Frasnian outcrops of the Dębnik anticline (the environs of Dębnik, Żbik and Paczółtowice in the Cracow Region). The Lower Carboniferous (Visean) assemblages of Tabulata and Chaetetida come from the Carboniferous Limestone outcrops in the western part of the Dębnik anticline (including the slopes of the Eliaszówka stream valley and the Czerna and Czatkowice villages), from the Uppermost Culm of the environs of Zalas (the Orlej gorge) and from the Carboniferous Limestone of the western part of the Chęciny-Klimontów anticlinorium (Ostrówka and Todowa Grząba hills in the village Gałęzice) in the southern part of the Holy Cross Mts. Part of the material from the Carboniferous of Gałęzice and from the environs of Zalas has been made available to the writer by Dr. S. CZARNIECKI (Institute of Geological Sciences of the Polish Academy of Sciences, Cracow) and part of the those from the Carboniferous of the Dębnik anticline by Dr. J. FEDOROWSKI (Poznań University).

The collection described includes more than 2500 colonies of which more than 2000 thin sections were made. The Devonian specimens of the Tabulata are generally well-preserved. Exceptionally well-preserved (a characteristic features of this assemblage) are the remains of the representatives of the genera *Thamnopora* and *Natalophyllum*, in which all elements of the internal structure of skeleton, primarily its unusually distinct microstructure, are well visible. The colonies of the genus *Scoliopora*, which are strongly recrystallized and whose internal structure is to a considerable extent obliterated, display the poorest state of preservation. Mechanical deformations of colonies (a lateral compression of the stipes, a deformation of the original form of massive colonies) were observed in many instances. Very frequent, particularly, in the genus *Thamnopora*, is a characteristic destruction of the axial parts of stipes, observed sometimes over a considerable length of the colony. The Carboniferous colonies of Tabulata and Chaetetida (except for the specimens from Zalas) are very well-preserved. However, some colonies (in particular large colonies of *Syringopora*) are strongly compressed and crumbled.

The comparative studies have been conducted on the basis of the Devonian Tabulata from the Holy Cross Mts., and the Devonian-Carboniferous Tabulata and Chaetetida from the USSR. In 1973, the writer stayed for three weeks in the USSR where he had an opportunity to study vast collections of Tabulata and Chaetetida from the Devonian and Carboniferous of the European part of the USSR, that is, from the Ural, Donetsk and Kuznetsk basins and Novaya Zemlya, which are housed at the Palaeontological Institute of the Soviet Academy of Sciences in Moscow and the Polytechnical Institute in Donetsk.

The present paper was prepared between 1970 and 1974 in the Institute of Palaeozoology (Polish Academy of Sciences) in Warsaw, where the collection described is housed. Part of the Lower Carboniferous Tabulata materials, coming from Dr. S. CZARNIECKI's collection, is housed at the Museum of the Institute of Geological Sciences (Polish Academy of Sciences) in Cracow.

ACKNOWLEDGEMENTS

The present writer's particularly warm thanks are extended to Dr. A. STASIŃSKA (Institute of Palaeozoology of the Polish Academy of Sciences) for several years of her work aimed at introducing him into the morphological problems of the tabulate corals, as well as for many discussions and a critical review of the manuscript of the present paper. Heartfelt thanks are also due to Professor Z. KIELAN-JAWOROWSKA, Professor R. KOZŁOWSKI and Dr. E. RONIEWICZ from the same Institute for their friendly hints helpful in the course of the present work. The writer is also indebted to Dr. J. FEDOROWSKI from the Poznań University and Dr. S. CZARNIECKI from the Institute of Geological Sciences (Polish Academy of Sciences) in Cracow for their collections of Tabulata kindly handed him for description, for valuable discussion of problems concerning stratigraphy sedimentology and blastogeny. The writer's special gratitude is due to Dr. I. I. TCHUDINOVA from the Palaeontological Institute in Moscow and

Dr. N. P. VASSILJUK from the Polytechnical Institute in Donetsk, USSR, for their careful and kind assistance afforded during his stay in the USSR, for making available their collections for the purpose of comparisons, for aid in collecting the literature and, finally, for their advice and discussions in the domain of the morphology and taxonomy of the Tabulata. Thanks are also expressed to Mrs D. SŁAWIK for drawing the figures, Miss M. CZARNOCKA and Miss E. MULAWA for taking the photographs and Mr. Z. STRĄK for making thin sections (all from the Institute of Palaeozoology in Warsaw).

ABBREVIATIONS

The following abbreviations have been used in the present paper:

ZPAL — Institute of Palaeozoology (Zakład Paleozoologii) Polish Academy of Sciences, Warsaw,
ZNGKr — Institute of Geological Sciences (Zakład Nauk Geologicznych), Polish Academy of Sciences, Cracow,

Abbreviations used in dimension tables:

H — height of a colony,
D — diameter of a colony (or of a stipe),
c-c — spaces between corallites,
d — diameter of corallites,
dv — diameter of the visceral chamber of corallites,
thw — thickness of a corallite wall,
dp — diameter of connecting pores,
p-p — spaces between connecting pores,
ds — diameter of connecting tubes,
s-s — spaces between connecting tubes,
t-t — spaces between tabulae,
dax — diameter (or dimensions of the transverse section of an axial canal).

Abbreviations used in Text-figures:

AC — axial canal,
B — bud chamber,
CO — contraction between bud chamber and visceral chamber of a parent calice,
CT — connecting tube,
E — epitheca,
EC — ephebic corallite,
I — invagination in the wall of a parent calice,
N — epitheca of an ephebic corallite (neotheca)
P — connecting pore,
PC — parent corallite,
PEL — periepithecal layer,
PVL — perivisceral layer,
PT — proturberance on the wall of a parent corallite,
SQ — squamula,
SS — septal spine,
T — tabula,
VEG — visceral chamber of an ephebic corallite,
VPC — visceral chamber of a parent calice,
WB — wall of a bud-chamber,
WC — wall of an adult corallite,
WD — wall disturbances (microstructural),
WEC — wall of an ephebic corallite,
WO — wall outgrowths.

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GENERAL PART

GEOLOGICAL AND GEOGRAPHICAL SETTING OF THE CORAL-BEARING STRATA

The Cracow-Silesian Upland

In the Cracow-Silesian Upland, the fauna of the Tabulata occurs in the Middle and Upper Devonian (Dębnik anticline) and Lower Carboniferous (the environs of Zalas in the margin of the Dębnik anticline, Text-fig. 1*A*, *B* and 2*A*, *B*).

Devonian

The Devonian deposits of the Dębnik anticline are outcropped on the surface between the villages Paczółtowice, Żbik, Siedlec and Dubie and in Dębnik (Text-fig. 1*B* and Zaręczny, 1889, 1890, 1894, 1953; Gürich, 1903; Jarosz, 1909, 1914, 1917, 1918, 1926; Siedlecki, 1954). Lithological studies on the Devonian of Dębnik were conducted by Zaręczny (1889, 1890, 1894), who also presented its detailed stratigraphic division based on the brachiopod fauna and by Gürich (1903), Jarosz (1909, 1914, 1917, 1918, 1926), Rutkowski (1927, 1928), Czarnocki (1923) and Siedlecki (1954) — see also Table 1. In the area of the Dębnik anticline, there occurs an almost complete section of the Middle and Upper Devonian deposits beginning with the lowermost Eifelian (Klimek & Koszarski, 1955) up to the Upper Frasnian (Jarosz, 1926; Passendorfer, 1956; Pajchlowa, 1968, 1970; Zajączkowski, 1964, 1968).

The Middle Devonian is developed in a dolomitic-calcareous and calcareous facies. A series of deposits (assigned to the Eifelian) consists of pyrite-bearing marls, limestones, platy dolomites and non-fossiliferous black shales. It is overlaid by what is known as "dolomites from Zbrza" containing remains of *Amphipora ramosa* Phill. and *Stringocephalus burtini* Defr., assigned to the Givetian. The fauna is here represented by little differentiated Stromatoporoidea, Tabulata, Tetracoralla, Brachiopoda, Gastropoda and Lamellibranchiata.

The Upper Givetian is developed in a calcareous coral-stromatoporoid facies. The lower part of the section contains dark, sometimes bituminous limestones (at Siedlec and Dubie — see profile at Text-fig. 4*A*) with a rich fauna of the Tabulata and Stromatoporoidea, rare Tetracoralla, as well as with *Stringocephalus burtini* Defr., and *Amphipora ramosa* Phill. They are overlaid by a thick series of dark and black stromatoporoid limestones (many outcrops in the village Dębnik, among others: Czarna Góra, hill, Karmelicki quarry, Czerwona Góra hill) with a poor fauna of the Stromatoporoidea and Tetracoralla and very rare Tabulata. The Upper Givetian fauna of the Dębnik anticline is marked by a decisive quantitative predominance of the Coelenterata over assemblages of the Brachiopoda, Gastropoda and Lamellibranchiata. In addition to Tabulata (Table 3), there also occur abundant Stromatoporoidea (Gü-

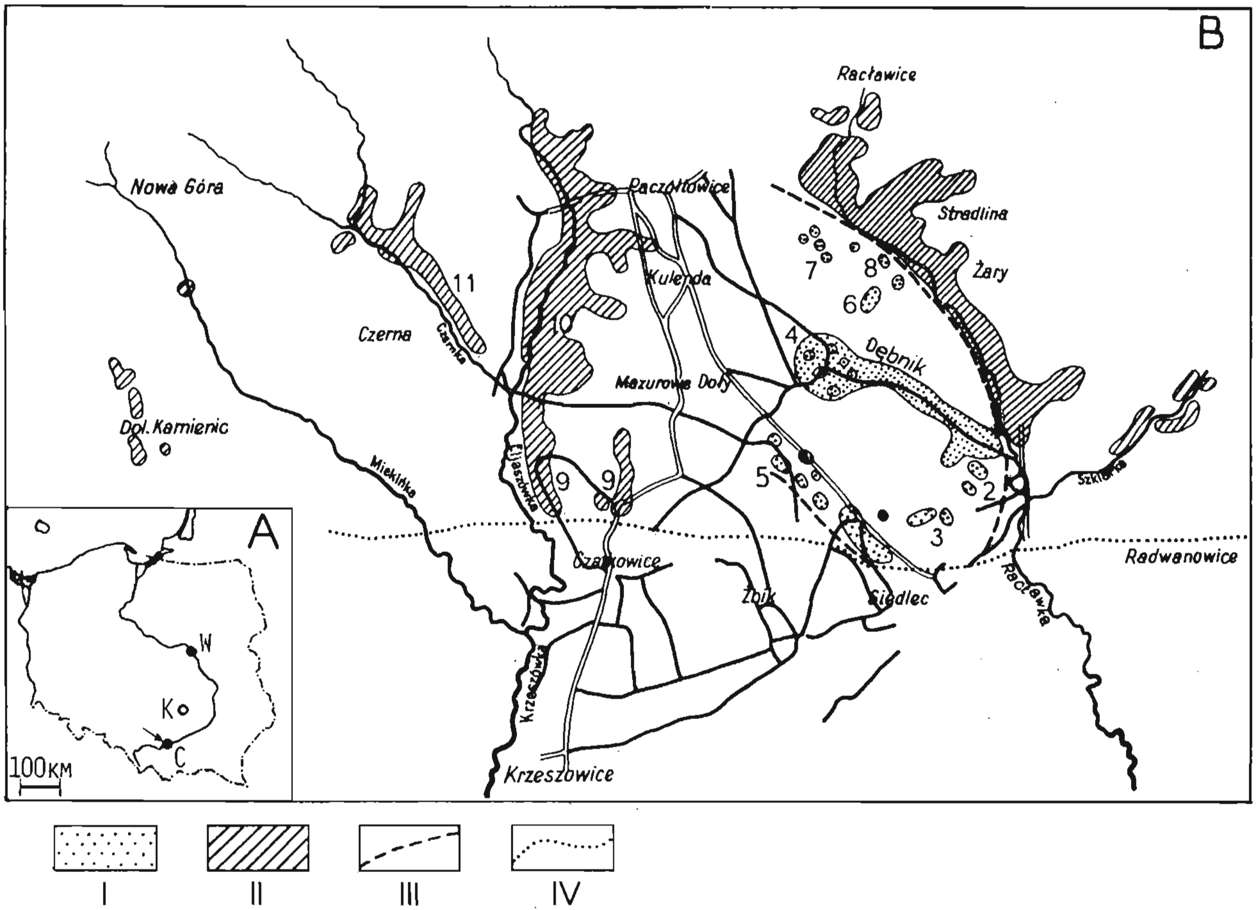

Fig. 1
A — General map of Poland: W — Warsaw, K — Kielce, C — Cracow (the area presented in Fig. *B* indicated by arrow). *B* — Map of the occurrence of the Devonian and Lower Carboniferous outcrops in the Dębnik anticline, Cracow Region (according to JAROSZ, 1926 and SIEDLECKI, 1954; simplified). I — Devonian outcrops. II. Lower Carboniferous outcrops (Carboniferous limestone). III. The Devonian-Carboniferous boundary. IV. Northern edge of the Krzeszowice graben, (1) dolomites of Zbrza (Lower Givetian), (2) Upper Givetian coral-stromatoporoid limestones of the environs of Dubie, (3) Upper Givetian coral-stromatoporoid limestones of the environs of Siedlec, (4) Upper Givetian stromatoporoid limestones of Dębnik, (5) Frasnian limestones of the environs of Żbik, (6) Middle and Upper Frasnian limestones of the Rokiczany Dół — ravine, (7) Middle and Upper Frasnian limestones of the Żarnówczany Dół — ravine and Łątczany Dół — ravine, (8) limestones of stromatoporoid rocks, (9) Tournaisian and Visean limestones of the Czatkowice forest, (10) Visean limestones outcropping on the slopes of the Eliaszówka River valley, (11) Middle and Upper Visean limestones from quarries „near the mill" and on the slopes of the Czernka River valley (see pp. 11–14).

RICH, 1903) and Tetracoralla of the genera *Amplexus*, *Ceratophyllum*, *Fascicularia* and *Philipsastrea*.

The Upper Devonian developed in a calcareous and calcareous-marly brachiopod facies (black and grey limestones and marly limestones with a rich fauna of brachiopoda, less numerous Gastropoda and rare Tabulata, Stromatoporoidea and Tetracoralla), included the entire Frassnian and most of the Famennian. In the southern part of the area under study, the Upper Devonian occurs in the environs of Żbik and in the northern part — in many outcrops south-east of the village Paczółtowice (Rokiczany Dół, Żarnówczany Dół and Łętczany Dół).

The lowermost Frasnian is developed in the form of dark and black platy limestones (the environs of Żbik and Łom Tumidalski's) with *Spirifer archiaci bisellata* GÜRICH. In the so called "beds upon Żbik" the Middle and Upper Frasnian is represented in the bottom by spotted limestones with *Philipsastrea pentagona* GOLDF. and in the top by the limestones containing *Leiorhynchus laevis* GÜRICH. In the northern part of the Dębnik area the equivalents of these beds are limestones with *Leiorhynchus laevis* GÜRICH and *L. cracoviensis* GÜRICH, overlaid by marly limestones with *Manticoceras intumescens* (at Łątczany Dół, Żarnówczany Dół and Rokiczany Dół). The Frasnian of the Dębnik anticline is marked, in contrast to the Givetian, by a predominance of the Brachiopoda and Gastropoda. In addition to the Tabulata (Table 3), there occur few Stromatoporoidea, including the genus *Stachyodes* and Tetracoralla, including *Phillipsastrea* (GÜRICH, 1903).

Table 1

Stratigraphic division of the Devonian of the Dębnik anticline (according to GÜRICH, 1903; JAROSZ, 1926; RUTKOWSKI, 1927; PAUL, 1938 and KLIMEK KOSZARSKI, 1955), see pp. 11—13.

<table>
<tr><th colspan="4">Stratigraphy</th><th>SOUTHERN AREA</th><th>NORTHERN AREA</th></tr>
<tr><td rowspan="5">UPPER DEVONIAN</td><td rowspan="2">Famennian</td><td>Upper</td><td rowspan="5">Beds from Żbik</td><td>Limestones with Spirifer archiaci orbeliana and Productus praelongus
Limestones with Spirifer verneuli tenticulum</td><td>Limestones (stromatoporoid rocks) with Spirifer verneuli tenticulum and Productus praelongus</td></tr>
<tr><td>Lower</td><td>Beds with Spirifer murchisoni</td><td>Limestones from Palkowa Góra with Spirifer murchisoni globosa and Spirifer murchisoni angustirostris</td></tr>
<tr><td rowspan="3">Frasnian</td><td rowspan="2">Upper</td><td>Leiorhynchus beds with Leiorhynchus laevis</td><td>Marly limestones from Łątczany Dół and Żarnówczany Dół quarries with Manticoceras intumescens</td></tr>
<tr><td>Spotted limestones with Philipsastrea</td><td>Leiorhynchus beds from Żarnówczany Dół and Rokiczany Dół quarries with Leiorhynchus laevis and Leiorhynchus cracoviensis</td></tr>
<tr><td>Lower</td><td>Limestones with Spirifer archiaci bisellata</td><td>Black platy limestones from Tumidalski quarry with Spirifer archiaci bisellata</td></tr>
<tr><td rowspan="5">MIDDLE DEVONIAN</td><td rowspan="4">Givetian</td><td rowspan="2">Upper</td><td colspan="2"></td><td>Black stromatoporod limestones from Dębnik</td></tr>
<tr><td colspan="2">Coral-stromatoporoid limestones from Siedlec and Dubie with Stringocephalus burtini</td><td>Gray-green Dębnik limestones with a poor fauna</td></tr>
<tr><td rowspan="2">Lower</td><td rowspan="2">Dolomites from Zbrza</td><td colspan="2">Laminated dolomites locally with cherts</td></tr>
<tr><td colspan="2">Dolomites with Amphipora ramosa and Stringocephalus burtini</td></tr>
<tr><td>Eifelian</td><td colspan="4">Pyrite bearing marls
Limestones
Platy dolomites
Black shales</td></tr>
</table>

No Tabulata have been found in the overlaying Famennian sediments and in the transitional (Strunian) beds to the Lower Carboniferous deposits.

Carboniferous

In the Cracow Region, the Lower Carboniferous deposits are exposed in many natural outcrops in the margin of the Dębnik anticline (Text-fig. 1*A, B*) and in the few small outcrops in the environs of the Zalas and Głuchówka villages (Text-fig. 2*A, B*).

Lower Carboniferous of the Dębnik anticline. — The Lower Carboniferous deposits of the Dębnik anticline occur, mostly in the neighborhood of the Devonian deposits, in the area between the villages Racławice, Paczółtowice, Nowa Góra, Czatkowice, Siedlec and Radwanowice (see Text-fig. 1*B*, see also ZARĘCZNY 1890 1894, 1953; JAROSZ, 1909, 1914, 1917, 1926; SIEDLECKI, 1954). Natural outcrops of these deposits, observed in the valleys of the Szklarka, Racławka, Czernka and Eliaszówka streams, as well as in ravines of Czatkowice, morphologically form an irregularly shaped horseshoe surrounding the elevated area of Dębnik and extending its arms towards the Krzeszowice trough. The earliest stratigraphic-lithological data concerning the Lower Carboniferous of this area are given by ZEJSZNER (1850), ZARĘCZNY (1890, 1894, 1953) and LIMANOWSKI (1903). Its detailed stratigraphic division was carried out by JAROSZ (1909, 1914, 1917, 1926), RUTKOWSKI (1927), PAUL (1938) and ZAJĄCZKOWSKI (1964, 1968).

The Lower Carboniferous deposits of the western margin of the Dębnik anticline, developed in the Carboniferous Limestone facies (brachiopod biofacies), are most similar to the Dinantian of Belgium. They represent in this area a continuous and most complete profile beginning with the Strunian, through the Tournaisian, up to the Upper Visean (D_2 zone), inclusively. The Lower Carboniferous of the Dębnik area is similar to the Devonian deposits of this region and its thickness, including the transitional beds, is estimated at about 1.400 m. It occurs in two tectonic units; that of Dębnik (the Strunian, Tournaisian, the reduced Lower and the Middle Visean) and in the overthrust Czerna — Czatkowice — Racławice unit (the Strunian, Tournaisian and the whole Visean). The Strunian (stromatoporoid series) is developed in the form of grey limestones, dolomites and shales with layers of Stromatoporoidea, Brachiopoda and few Gastropoda. These deposits maintain a sedimentary continuity with the Upper Famennian. The Tournaisian is represented by dark and grey coral limestones with the Tetracoralla, grey-brown limestones with crinoids, bituminous brachiopod limestones and shales, with flints. Tabulata have not been found in the Strunian and Tournaisian. In addition to Brachiopoda there also occur many Stromatoporoidea (in the Strunian), Tetracoralla (in particular in the Upper Tournaisian), abundant Crinoidea and very rare Trilobita. The Lower Visean (V1a-V1b, JAROSZ's zone d) is developed in the form of light-grey and dark limestones (Czatkowice quarry and the Upper Eliaszówka River) and, locally, breccias (a quarry above the road at Paczółkowice) with Tetracoralla. The Middle Visean (V2a-V3a, JAROSZ's zone e) is represented by light-grey, partly oolitic, limestones with Tabulata and many Tetracoralla and Brachiopoda (Eliaszówka, the quarries at Czatkowice and Czerna owned by WÓJCIK and KULENDA). The Upper Visean (V3b-V3c, JAROSZ's zone f) is represented by grey and marly limestones with Foraminifera intercalated by mottled limestones and layers of clays with Brachiopoda of the genus *Gigantoproductus*. In addition to Brachiopoda, the Visean contains fairly numerous Tetracoralla. Not very numerous Tabulata (Table 3) are limited to the Lower and Middle Visean only.

Lower Carboniferous of the environs of Zalas. — The Lower Carboniferous occurs in a few outcrops near Zalas and Głuchówka, situated about 10 km south of Krzeszowice

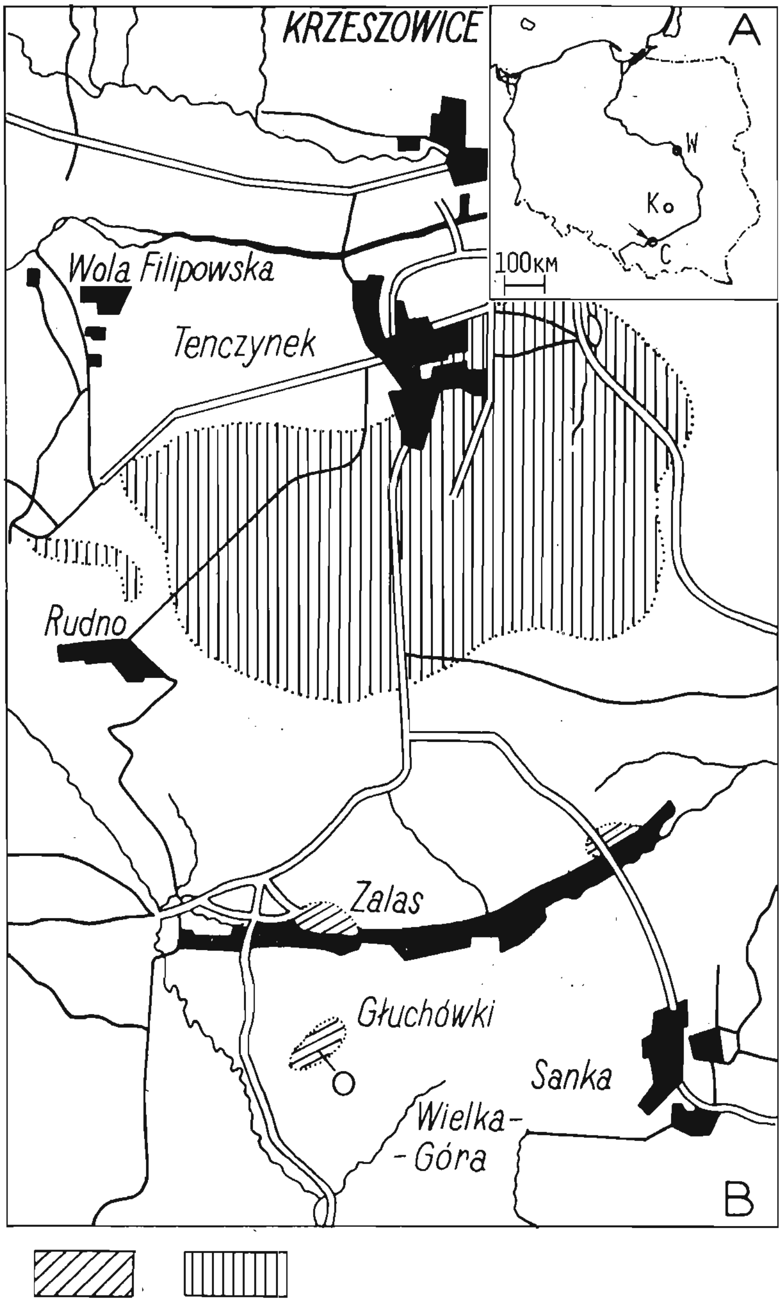

Fig. 2

A — General map of Poland: W — Warsaw, K — Kielce, C — Cracow (the area presented in Fig. *B* indicated by arrow). *B* — Map of the occurrence of the Carboniferous deposits in the environs of Zalas (according to MICHAEL 1907 & SIEDLECKI, 1954). I. Lower Carboniferous (Culm) outcrops. II. Upper Carboniferous (coal measures) outcrops, O — Upper Visean outcrops of black shales in the Orlej River gorge (see pp. 14 and 16).

(Text-fig. 2*B*) and represents an easternmost cropping of the Lower Carboniferous of the margin of the Upper Silesian Coal Region (PETRASCHEK, 1919; MICHAEL, 1927; NOWAK & ZERNDT, 1935; DŻUŁYŃSKI, 1954; CZARNIECKI, 1956; PIŁAT, 1957; CZARNIECKI & ŁYDKA, 1958; PAJCHLOWA, 1968, 1970, and ZAJĄCZKOWSKI, 1964). The Lower Carboniferous of the environs of Zalas, developed in a typical Culm facies, is limited in this region to the Uppermost Visean (D_2 zone). Lithologically, there are black and dark clayey and sandy shales with inclusions of limestones and tuffites, as well as with breccias and conglomerates containing porphyrite debris. Locally, there also occurs an abundant fauna of Tabulata, Tetracoralla, Bryozoa, Brachiopoda, Gastropoda, Lamellibranchiata, Cephalopoda, Trilobita, Blastoidea and Crinoidea, as well as plant remains.

The Holy Cross Mountains

In the Holy Cross Mts., the fauna of Tabulata and Chaetetida occurs in the Lower Carboniferous (Visean) deposits at the environs of Gałęzice (Text-fig. 3*A*, *B*). The deposits are situated in the north-western limb of the Chęciny anticline and form a three-kilometer long chain of five separate hills (Text-fig. 3*B*). Two areas of the Lower Carboniferous, one called Ostrówka Hill and the other consisting of two small hills called Todowa Grząba and Jaźwiny, occur in the north-western part of the village Gałęzice and three areas, Dąbrówka, Besówka and Stokówka, in its south-eastern part (CZARNOCKI, 1916, 1922, 1923, 1928, 1948; SUJKOWSKI, 1933; KWIATKOWSKI, 1959, and ŻAKOWA, 1962, 1964, 1967, 1971). The Tetracoralla were described by FEDOROWSKI (1971), the Gastropoda by GROMCZAKIEWICZ-ŁOMNICKA (1973), the Trilobita by OSMÓLSKA (1962, 1967, 1968, 1970) and the goniatites by CZARNIECKI (1974).

This region was strongly involved in the Caledonian, Variscan and Alpine movements, which resulted in the formation in this area of several dislocations, reduction in thickness, and frequent horizontal discontinuities of the Tournaisian and Visean horizons. In this region, there also occurs an incomplete section of the Lower Carboniferous (Table 2), which consists of the Upper Tournaisian with index species of Brachiopoda, Trilobita and sporomorphs assemblages and the Upper Visean with an index fauna of Brachiopoda and goniatites (zones Go_a, Go_b, Go_g and Go_{g1}). The Lower Tournaisian (*Gattendorfia* zone) has not been identified and the lack of the Lower Visean has been explained by tectonic phenomena. Likewise, the presence of the transitional Strunian beds is not quite certain. Lithologically, the Lower Carboniferous of Gałęzice is developed mostly in the Culm facies (the Upper Tournaisian and Uppermost Visean). The facies of Carboniferous Limestone is limited only to lower horizons of the Upper Visean (Go_a and Go_b). The thickness of the entire series of the Lower Carboniferous reaches about 300 m.

The Upper Tournaisian, developed in the clastic Culm facies, discordantly overlies (a tectonic contact) a strongly reduced calcareous-marly Famennian or Givetian. The deposits of this age are developed as dark and black clayey and siliceous shales with intercalations of sandstones, tuffites and with concretions of phosphorites, radiolarites and lyddites. They contain a not very abundant fauna of Brachiopoda, Trilobita, as well as a micro- and macroflora (ŻAKOWA, 1962, 1971). No Tabulata are known from the Upper Tournaisian of Gałęzice.

The Upper Visean discordantly overlies the Upper Tournaisian (a tectonic contact). The lower part of the Upper Visean is developed in the form of dark, grey and, locally, pinkish organodetrital and organogenic, crinoidal, bituminous and, less frequently, marly limestones (northern slopes of the Ostrówka hill in a narrow-gauge railway cutting — Text-fig. 4*B*, Todowa

Table 2

Stratigraphic division and litology of the Lower Carboniferous of the Dębnik anticline, Orlej and Gałęzice (standard zones after VAUGHAN, 1905; DELÉPINE, 1940; DEMANET, 1958), see pp. 15, 16 and 19.

System	Series	Substage	England Avonian ZONES		DĘBNIK ANTICLINE (according to GÜRICH, 1903; JAROSZ, 1926; RUTKOWSKI, 1927; PAUL, 1938; PAJCHLOWA, 1970)	ORLEJ (according to CZARNIECKI, 1956; PAJCHLOWA, 1970)	THE GAŁĘZICE REGION: goniatite zones	Facies	Thickness	(according to KWIATKOWSKI, 1959; ŻAKOWA 1962, 1964, 1967, 1971; PAJCHLOWA, 1970)
LOWER CARBONIFEROUS	Visean	Upper	Dibunophyllum			Culm series (about 120 m. thick): black and darkcolored, clayey and sandy shales with intercalations of limestones and tuffites, breccias and conglomerates (D_2 zone); abundant Tabulata, Tetracoralla, Bryozoa, Brachiopoda, etc.	Gog	Culm of Lechówek	more than 160 m.	Sandstones, mudstones and claystones; shales and tuffites — in the bottom — limestones from the Gałęzice valley with micro- and macroflora
							Gob	Carboniferous limestone	up to 50 m.	Gray marly and bituminous, organodetrital and organogenic, crinoidal limestones from Todowa Grząba and the railroad cut on Ostrówka hill, with a very abundant solitary and colonial Tetracoralla, Tabulata, Chaetetida, Bryozoa, Brachiopoda, Foraminifera, etc.
				D_2	Foraminiferan limestones, claystones and marly limestones from the Czernka River valley and from quarries situated near the "Czerwona ściana" mill.		Goa			
		Lower and Middle		D_1						
			Seminula	S_2	Light-gray limestones from the Czernka river and the Kamieniec valleys; light-colored limestones from the Eliaszówka river valley		Lacking?			
			Upper Caninia	S_1 / C_2	Light-gray limestones from the Racławka river valley (the quarry over the road)					
	Tournaisian	Upper	Lower Caninia	C_1	Dark-gray crinoid limestones from the Szklarka valley, Racławice, Paczółtowice and Stradlina and the Czatkowice Forest.			Terrigenous series	more than 60 m.	Cherty and clayey rocks with few intercalations of sandstones, tuffites, mudstones with concretions of phosphorites and radiolarites with siderite and pyrite from the region of Ostrówka, foothills of Besówka and Stokóweczka, with a rather poor fauna of the Brachiopoda (*Orbiculoidea tornacensis*), as well as micro- and macroflora.
		Lower	Zaphrentis	Z_2	Bituminous limestones with flints and dark-colored shales from quarries of the Szklarka River, from ROEMER's quarry and Stradlina					
				Z_1	Dark-gray limestones from quarries: Kacper Górecki's and Józef Palka's		unidentified			
					?					
	Etroeungtian	Transitional beds	Kleistopora	K_2			occurs probably			
				K_1	Limestones from stromatoporoid rocks and the highermost beds from Żbik beds unit (assigned by JAROSZ, 1926 to the Famennian, 400 m. thick)			Calcareous-marly series	?	Limestones and marls with a rich fauna (northen slope of Ostrówka hill near Todowa Grząba)
DEVONIAN	Famennian									

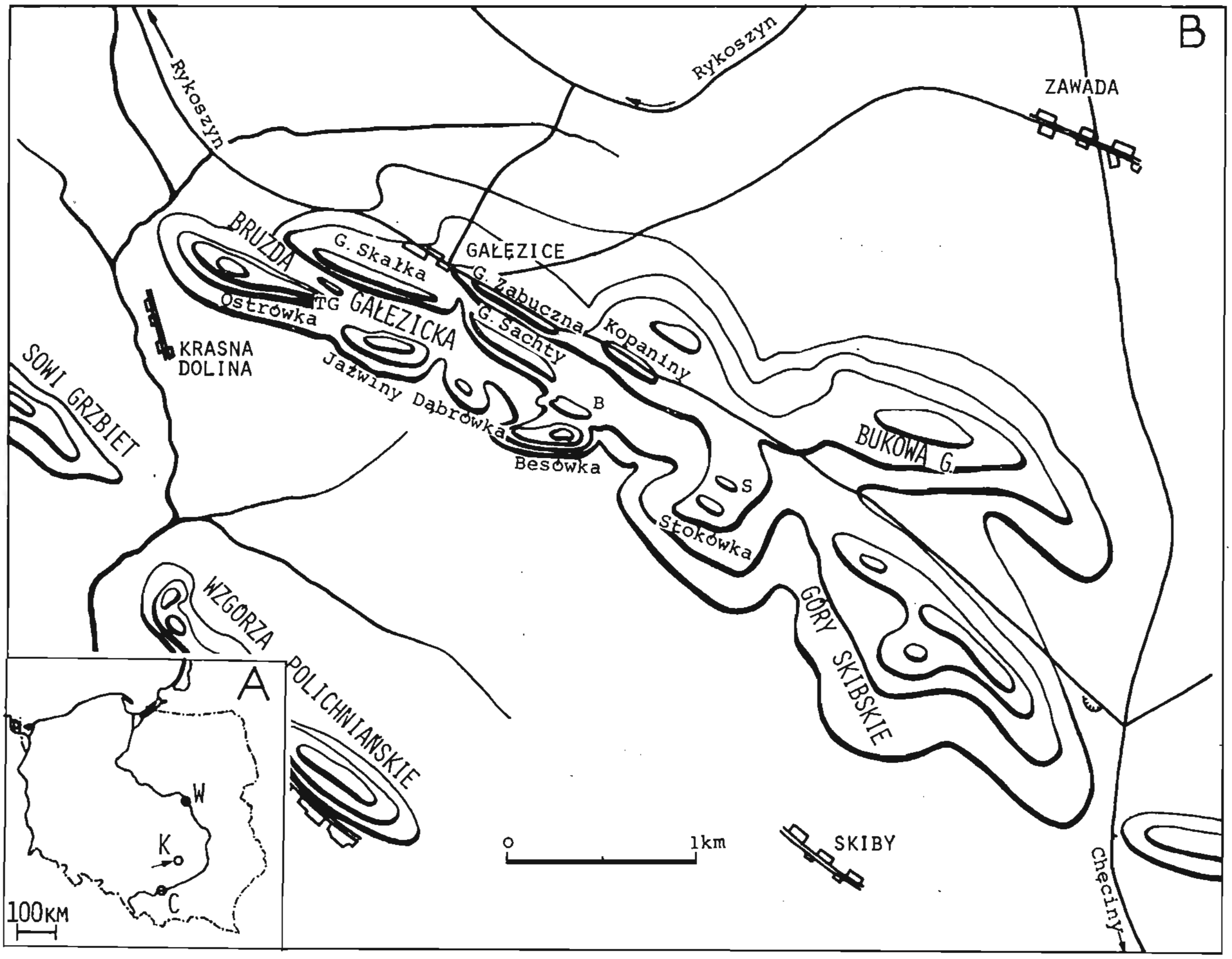

Fig. 3

A— General map of Poland: W — Warsaw, K — Kielce, C — Cracow (the area presented in Fig. *B* indicated by arrow). *B* — Map of the occurrence of the Upper Visean deposits in the Region of Gałęzice (Holy Cross Mts.); *TG* — Todowa Grząba, *B* — Besóweczka, *S* — Stokóweczka (see p. 16).

Grząba, Besówka, Besóweczka and the north-western slope of the Stokóweczka hill) containing a rich assemblage of benthonic fauna. The Coelenterata are represented by a relatively rich assemblage of the Tabulata and Chaetetida (in the railway cutting on the Ostrówka hill and in Todowa Grząba, see Table 3), very numerous coral colonies and solitary corallites. Few Stromatoporoidea and Conulariida are also present here. The assemblage of the Coelenterata is accompanied by a very rich fauna of the Foraminifera, Porifera, Bryozoa, Brachiopoda, Trilobita, Ostracoda, Crinoidea (locally occurring abundant stems), Echinoidea, fish remains, algae and micro- and macroflora. The Carboniferous Limestone is accordantly overlaid by the Uppermost Visean deposits developed in the clastic Culm facies (*Goniatites granous* zone). They occur in the whole Gałęzice valley except for the environs of Besówka and Besóweczka. The Culm of Gałęzice is developed in the bottom in the form of claystones and clayey shales containing intercalations of mudstones, sandstones, siliceous rocks, tuffites and limestones with a rich fauna of Brachiopoda, Bryozoa, Gastropoda, Lamellibranchiata, Cephalopoda,

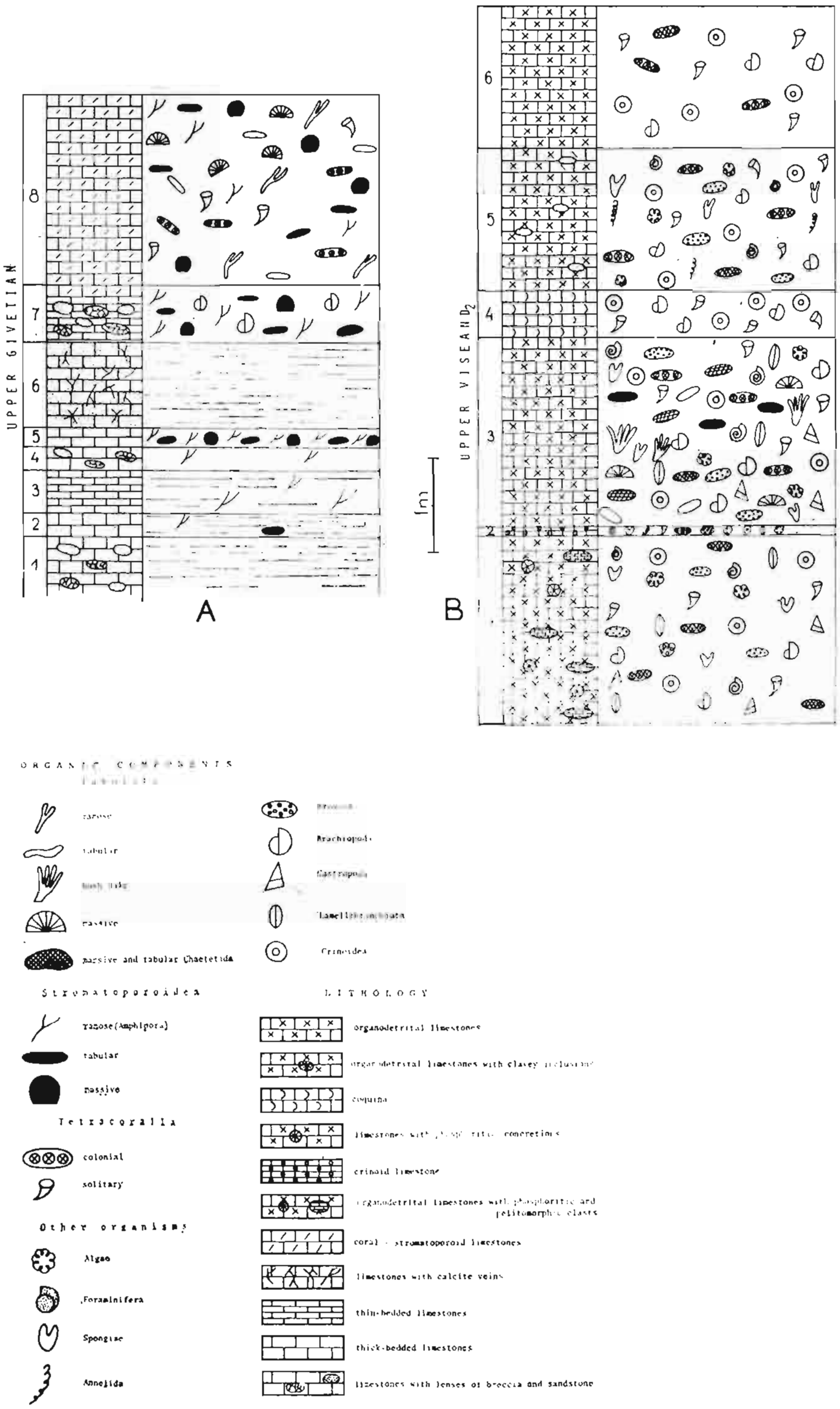

Fig. 4
Lithological and palaeontological profiles: *A* — Upper Givetian coral-stromatoporoid limestones from the rocky hillock in the forest between Dubie and Siedlec (for explanations, see p. 11), *B* — Upper Visean coral limestones from the railway cut on the Ostrówka Hill, Gałęzice (for explanations see p. 16).

Trilobita and Crinoidea (stems), as well as with macroflora (including *Calamites*) and microflora. No Tabulata have been found in these deposits. The top of the clastic series contains siltstones, mudstones, sandstones and shales and tuffites with flora (Go_{g1} zone).

TABULATA ASSEMBLAGES AND ACCOMPANYING FAUNA

Devonian

In the Devonian strata of the Dębnik anticline, the Tabulata occur not very numerously and their vertical range is not uniform. The most numerous and taxonomically the most varied assemblage of this fauna (Table 3) occurs in the Upper Givetian (at Dubie and Siedlec) and together with other Coelenterata (Stromatoporoidea and Tetracoralla), forms coral-stromatoporoid biostromal limestones. In the uppermost Givetian and in the Frasnian of this area, the Tabulata are very rare and their assemblages are strongly reduced as compared to the Givetian and Frasnian assemblages from the Holy Cross Mts. and classical assemblages of these stages from Western Europe (England, Belgium) and Central Asia (Kuznetsk Basin).

Only four species of the Tabulata have been cited from the Devonian of the Dębnik anticline: *Striatopora cristata* BLUMENBACH from the lower part of the Upper Givetian (GÜRICH, 1903), also mentioned by ZARĘCZNY (1888, 1889, 1894, 1953) as *Pachypora cristata* (BLUMENBACH); *Alveolites suborbicularis* LAMARCK from the upper part of the Upper Givetian (GÜRICH, 1903); *Favosites (Calamopora) filiformis* F. A. ROEMER from the upper part of the Upper Givetian (ZARĘCZNY, 1889, 1894, 1953); *Alveolites ramosa* F. A. ROEMER, cited on the whole from the Frasnian (GÜRICH, 1903). *Favosites filiformis* F. A. ROEMER has not been identified by the writer in the outcrops discussed.

Upper Givetian. — The Upper Givetian assemblage of Tabulata of the Dębnik anticline displays a considerable generic differentiation (ten genera of three families: Pachyporidae, Alveolitidae and Coenitidae). Most common are the representatives of *Thamnopora*, *Alveolites*, *Crassialveolites*, *Caliapora* and *Scoliopora*, of which *Thamnopora boloniensis* (GOSS.), *Alveolites suborbicularis* LAM., *Caliapora battersbyi* (M.-EDW.), *Scoliopora denticulata* (M.-EDW.) and *Crassialveolites polonicus* sp. n. occur abundantly. Not numerous are representatives of the genera *Placocoenites* (*P. medius* [LEC.]), *Natalophyllum* (*N. giveticum* RADUG., *N. dubiensis* sp. n.) and *Tyrganolites* (*T. eugeni* TCHERN.). Representatives of the genus *Syringopora* are met with only exceptionally. The assemblage of Tabulata coming from the coral-stromatoporoid facies is represented by colonies of different morphological type, from branching *(Thamnopora, Scoliopora)*, through massive *(Alveolites, Crassialveolites, Caliapora)* up to tabular and encrusting *(Placocoenites, Tyrganolites* and some species of *Alveolites)*.

The entire fauna of Tabulata is redeposited, particular colonies being overturned and displaced, broken, with torn-off proximal ends or crumled to pieces. Completely preserved colonies are rare. In the case of branching colonies, the degree of mechanical destruction is particularly high. On the other hand, no traces of abrasion have ever been observed. A destruction of the axial part of a colony, sometimes over a considerable stretch, is recorded in the representatives of the genera *Thamnopora*, *Scoliopora*, *Crassialveolites* and *Natalophyllum*. A lateral damage of a colony in the form of very irregular, jagged depressions and pockets occurs in the *Alveolites* and *Caliapora*.

The Tabulata are accompanied by a relatively abundant Stromatoporoidea and Tetracoralla, by rare Brachiopoda (mostly of the genus *Stringocephalus*), very few, small, fragmentary stems of the Crinoidea and traces of algae. The most abundant are the Stromatoporoidea, including colonies (identified by Dr. J. KAŹMIERCZAK) with ramose *(Amphipora)*, columnar (*Stachyodes*) and massive *(Trupetostroma, Parallelopora, Clathrocoilona, Stromatopora)* coenostea. Less numerous are both solitary and colonial Tetracoralla cited by GÜRICH (1903) and SIEDLECKI (1954). Similarly as in the case of the Tabulata, the accompanying fauna is reworked.

The phenomenon of a mutual overgrowing or encrusting one colony by another is very frequently observed in the Upper Givetian. The massive Stromatoporoidea overgrow or cover completely all types of the Tabulata and Tetracoralla colonies or are overgrown themselves by massive and platy Tabulata colonies or by the Stromatoporoidea.

At the end of the Givetian (Czarna Góra outcrop), there occurred a strong impoverishment in the coral fauna, as compared with lower situated coral-stromatoporoid limestones (at Dubie and Siedlec). The Stromatoporoidea, in particular the *Amphipora* occurring abundantly in the form of banks, are the predominant element in this assemblage. Very numerous are also thin-valved Brachiopoda which, occurring in the form of layers, locally form coquina. The assemblage of Tabulata is very poor and limited only to very rare, fascicular forms of the genus *Thamnopora* (mostly *T. striatoporoides* sp. n.) and small fragments of *Aulopora*. The Tetracoralla occur rarely and only as solitary forms. Similarly as in the underlaying coral-stromatoporoid limestones (at Dubie and Siedlec), the fauna of Tabulata and the accompanying fauna are redeposited, broken and not segregated, but not displaying traces of rolling. Likewise, there occurs the phenomenon of overgrowing and covering of the colonies of Tabulata, solitary Tetracoralla and sticks of *Amphipora* by massive Stromatoporoidea, as well as the destruction of the axial parts of the stipes of the Tabulata and internal parts of massive colonies of the Stromatoporoidea.

Frasnian. — In the Frasnian of the Dębnik anticline, the Tabulata occur rarely, and are represented by seven genera of the families Favositidae, Pachyporidae, Coenitidae, Alveolitidae and Auloporidae. Quantitatively slight predominance is displayed in the assemblage by the representatives of *Cladopora, Alveolites* and *Alveolitella*, with *Cladopora gracilic* LEC., *Alveolites taenioformis* SCHLÜT., *Alveolitella fecunda* (LEC.) and *A. rarispinosa* sp. n. as the most frequent species. Less numerous are *Squameofavosites (Dictyofavosites) pachyfavositoides* sp. n., *Alveolitella ramosa* (F. A. ROEMER), and *Aulopora* sp. Representatives of the genera *Thamnopora* and the species *Tyrganolites frasnianus* sp. n. are very rarely recorded. The same as in the Upper Givetian, Frasnian colonies are morphologically strongly differentiated. However, in contradistinction to the Upper Givetian, a slight prevalence of fascicular-digitate and an almost complete lack of tabular colonies is observed in the Frasnian. All Frasnian assemblages of Tabulata are marked by small colonies (up to 50 mm in diameter), except for the *Squameofavosites (Dictyofavosites) pachyfavositoides* sp. n. whose reach 15 cm. The Frasnian fauna of Tabulata is redeposited, its colonies are overturned, broken and, locally, with their axial parts destroyed. However, the degree of mechanical damage is not great and there are no traces of abrasion. Large colonies of the *Dictyofavosites* and massive coenostea of the Stromatoporoidea are rarely observed in their life position.

The Tabulata are accompanied by few Stromatoporoidea, Tetracoralla and Brachiopoda, rare fragmentary stems of the Crinoidea and fine, indeterminable fragments of the organic detritus. The most numerous are Brachiopoda, locally abundant and occurring in the form of thin banks. The Tabulata are absent from the brachiopod beds. The fauna accompanying the Tabulata is also redeposited, broken, crumbled, but not segregated and not abraded. The phenomenon of partial or complete overgrowing occurs here. Remarkable is the overgrowing of the stipes of the *Cladopora* by the genera *Alveolites* and *Alveolitella.*

Table 3

Distribution of the Tabulata and Chaetetida in the Devonian and Lower Carboniferous of the Dębnik anticline and in the Lower Carboniferous of Gałęzice, Holy Cross Mountains

	Stratigraphy	Devonian						Lower Carboniferous					
		Upper Givetian			Frasnian			Visean					
		Lower		Upper	Middle	Middle-Upper		Middle	Middle-Upper	Upper D_2—D_3			
	Location	CRACOW REGION										Holy Cross Mountains	
	Species	Dubie	Siedlec	Czarna Hill	Rokiczany Dół	Żbik	Żarnówczany Dół	Eliaszówka	Czerna	Czatkowice	Orlej	Gałęzice	Todowa Grząba
TABULATA	*Squameofavosites megasquamatus* sp. n.											+	
	S. (Dictyofavosites) pachyfavositoides sp. n.					+	+						
	Emmonsia czarnieckii sp. n.											+	
	Michelinia aseptata sp. n.											+	
	Michelinia teniusepta (PHILLIPS)											+	
	Palaeacis orlei sp. n.										+		
	Thamnopora boloniensis (GOSSELET)	+	+										
	Thamnopora striatoporoides sp. n.			+									
	Thamnopora sp.	+	+	+									
	Cladopora gracilis LECOMPTE				+	+	+						
	Cladopora sp.				+	+	+						
	Alveolites suborbicularis LAMARCK	+	+										
	Alveolites taenioformis SCHLÜTER					+	+						
	Alveolites sp.	+	+										
	Alveolitella fecunda (SALEE) sensu LECOMPTE						+						
	Alveolitella ramosa (F. A. ROEMER)					+							
	Alveolitella rarispinosa sp. n.				+	+							
	Crassialveolites polonicus sp. n.	+	+										
	Caliapora battersbyi (MILNE-EDWARDS & HAIME)	+	+										
	Placocoenites medius (LECOMPTE)	+											
	Scoliopora denticulata (MILNE-EDWARDS & HAIME)	+	+										
	Scoliopora aff. *muricata* TCHUDINOVA	+											
	Natalophyllum dubiensis sp. n.	+											
	Natalophyllum giveticum RADUGUIN	+											
	Tyrganolites eugeni TCHERNYCHEV	+											
	Tyrganolites frasnianus sp. n.					+							
	Syringopora ramulosa GOLDFUSS								+			+	+
	Syringopora reticulata GOLDFUSS							+		+		+	
	Syringopora geniculata PHILLIPS								+	+			
	Syringopora subgeniculata SOKOLOV								+	+			
	Syringopora hyperbolo-tabulata CHI									+			
	Syringopora lipoensis CHI								+				
	Syringopora pachysiphonata sp. n.											+	
	Syringopora subreticulata sp. n.							+					
	Syringopora sinusoidea sp. n.							+					
	Syringopora tenuitheca sp. n.												+
	Syringopora sp.	+											
	Multithecopora polonica sp. n.											+	
	Multithecopora spinosa sp. n.											+	
	Syringoporella longituba sp. n.											+	
	Aulopora sp.			+	+	+							
	Cladochonus sp.											+	
	Sinopora polonica sp. n.											+	
CHAETETIDA	*Cyclochaetetes tuberculosus* sp. n.											+	
	Chaetetella repens SOKOLOV											+	
	Chaetetella cellulata SOKOLOV											+	
	Chaetetella (Chaetetiporella) heterozoa sp. n.											+	
	Chaetetella (Chaetetiporella) rotaiformis sp. n.											+	
	Chaetetella sp.											+	
	Chaetetipora confluens STRUVE											+	

Carboniferous

Visean of the margin of the Dębnik anticline. — In the Lower Carboniferous, the Tabulata very rarely occur in the margin of the Dębnik anticline. As compared with the Tabulata assemblages of the same age from Gałęzice (see below) and with the classical Visean assemblages from Ural and Kuznetsk Basin, this assemblage of corals is strongly reduced. Only one species of the Tabulata, *Syringopora reticulata* GOLDFUSS from the Eliaszówka and the Czernka valley has been cited (ZARĘCZNY, 1894, 1953).

In both the Middle Visean (the slopes of the Eliaszówka valley and Wójcik's Quarry at Czerna) and the lowermost part of the Upper Visean (the quarry at Czatkowice), the Tabulata occur rarely. This assemblage is very poor in genera (*Syringopora* and *Roemeripora* only) but, at the same time, rich in species (nine species, Table 3). There appears a marked predominance of the representatives of the genus *Syringopora*, with *S. reticulata* GOLDF., *S. geniculata* PHILL., and the new species *S. sinusoidea* as the most numerous species. Less numerous are *S. ramulosa* GOLDF., *S. subgeniculata* SOK. and *S. subreticulata* sp. n. Quite rare are *S. lipoensis* CHI and *S. hyperbolo-tabulata* CHI. Representatives of the genus *Roemeripora* occur very rarely (this genus is now being investigated).

The assemblage of the Tabulata in the Middle Visean, that is, in the Eliaszówka valley and in Wójcik's Quarry, as well as in the lowermost part of the Upper Visean (the Czatkowice quarry) is represented mostly by large (more than 15 cm in diameter) colonies fairly uniform in morphology. These are irregularly spherical, ellipsoidal, hemispherical or somewhat flattened forms. Most colonies occurs in their life position, only few of them being overturned and displaying a small degree of abrasion. No traces of rolling have been found. Some colonies have their internal structure partly destroyed. Local losses inside the colony and on its surface are shaped like irregular, jagged depressions and pockets filled by the sediment surrounding the colony. Individual colonies are very widely spaced, both vertically and horizontally.

In some places of the outcropped Visean section, the Tabulata assemblages are accompanied by an abundant fauna of the Tetracoralla, mostly by the genera *Dibunophyllum*, *Lithostrotion* and *Palaeosmilia* (identified kindly by Dr. J. FEDOROWSKI) and by the Brachiopoda, mostly of the genera *Productus*, *Seminula*, and *Chonetes* (JAROSZ, 1926; SIEDLECKI, 1954). Fairly frequent are also the Foraminifera, and stems of Crinoidea.

The Upper Visean (Culm) of Orlej. — The Tabulata occur fairly numerously in the black shales of the Upper Visean of Orlej, but this assemblage is very poor both in genera and species (Tabulata have not so far been known from this area and are now in the initial stage of studies). In this locality, the most numerous are poorly preserved, fascicular colonies of *Aulopora* and *Cladochonus*. Less frequent are flat and triangular colonies of several corallites of *Palaecis* (mostly *P. orlei* sp. n.). The Tabulata are reworked and the remains of colonies are irregularly scattered and mixed. The degree of mechanical destruction is not high and mostly noticeable in the fascicular colonies of the *Cladochonus* and *Aulopora*. No traces of rolling have been observed. The destroyed fragments of colony are filled with the surrounding sediment.

The Tabulata are accompanied by a rich fauna of Tetracoralla, Bryozoa (mostly *Fenestella*), Brachiopoda (CZARNIECKI, 1956), Gastropoda (GROMCZAKIEWICZ-ŁOMNICKA, 1973), Lamellibranchiata, abundant Crinoidea mostly stems locally occurring in great concentrations, few Trilobita and plant remains. The fauna though redeposited displays neither a strong mechanical destruction (except for the stems of the Crinoidea), nor selection. The overgrowing of thick parts of the stems of Crinoidea by Tabulata is very frequent.

Upper Visean of Gałęzice. — The Upper Visean assemblages of Tabulata and Chaetetida from Gałęzice are rich and strongly differentiated (Table 3), their generic composition being similar to that of such assemblages from the Visean of England and the European part of the USSR.

Relatively numerous Tabulata, with accompanying Chaetetida, occur in the Upper Visean of Gałęzice in one layer only, observed in the railway cut on Ostrówka Hill (Text-fig. 3*B*; Table 3). On Todowa Grząba hill, the Tabulata occur very rarely in the form of single, large colonies of *Syringopora*. The Upper Visean assemblage of Tabulata from Gałęzice includes eight genera of the families: Favositidae, Micheliniidae, Syringoporidae, Multithecoporidae, Moniloporidae and Sinoporidae. In this assemblage, slightly predominant are the representatives of the genera *Michelinia*, *Syringopora* and *Multithecopora*, with *Michelinia tenuisepta* (PHILLIPS), *Syringopora ramulosa* GOLDFUSS, *S. reticulata* GOLDFUSS, *Multithecopora polonica* sp.n. and *M. spinosa* sp.n. as the most frequent species. Less numerous are representatives of the genera *Squameofavosites* (*S. megasquamatus* sp.n.), *Emmonsia* (*E. czarnieckii* sp.n.) and *Sinopora* (*S. polonica* sp.n.). *Syringoporella longituba* sp.n. is rare, while *Michelinia aseptata* sp.n., *Syringopora pachysiphonata* sp.n. and *Cladochonus* sp. — very rare.

The colonies of Tabulata are represented at Gałęzice by various morphological types and strongly vary in size. Here cccur fascicullar *(Cladochonus)*, spherical, hemispherical, ellipsoidal and irregular colonies *(Squameofavosites, Emmonsia, Michelinia)* as well as bushlike, irregularly spherical, ellipsoidal and sometimes flattened *(Syringopora, Multithecopora, Syringoporella, Sinopora)*. The size of colonies fluctuates within limits of 8 mm in diameter (massive, spherical, as in the *Emmonsia*) and 20 cm in height (irregular, bushlike, as in the *Syringopora* and *Multithecopora*). Single colonies of the *Syringopora* reaching 40 cm in height are also observed sometimes.

The Upper Visean assemblage of the Chaetetida from the railway cut on the Ostrówka hill (Table 3) is poor and only slightly differentiated. In this locality, there occur three genera (including the subgenus *Chaetetiporella*) assigned to the family Chaetetidae. Markedly predominant are the following representatives of the genus *Chaetetella*: *C. repens* Sokolov, *C. (Chaetetiporella) rotaiformis* sp.n. and *C. (Chaetetiporella) heterozoa* sp.n. Less numerous are the representatives of the genus *Cyclochaetetes* (*C. tuberculosus* sp.n.) and the species *Chaetetipora confluens* Struve. The assemblage of the Chaetetida is represented by not very large massive, hemispherical (in *Chaetetella* (*Chaetetiporella*) *rotaiformis* sp.n., *Chaetetipora confluens* Struve), more frequently strongly flattened (in *Chaetetella repens* SOKOLOV and *C. cellulata* SOKOLOV) or crusty, strongly twisted and folded (*Cyclochaetetes tuberculosus* sp.n., *Chaetetella repens* SOKOLOV and *C. (Chaetetiporella) heterozoa* sp. n.) colonies which are predominant in the assemblage.

The entire fauna of the Tabulata and Chaetetida occurring at Gałęzice is reworked, even large colonies of *Syringopora* being overturned and displaced. The degree of mechanical destruction of organic remains is considerable. Most bushlike colonies *(Syringopora, Multithecopora, Sinopora)* are broken or, locally, crumbled. In many cases, there occurs a mechanical damage of surfaces of massive colonies, the breaking of calices and crumbling of delicate skeletal elements (in particular tabulae of corallites in the peripheral zones of colonies in *Michelinia, Squameofavosites, Chatetella* and *Chaetetipora)*. Fine, spherical colonies of *Squameofavosites* and *Emmonsia* and hemispherical ones are undamaged. No traces of rolling have been observed. The destroyed parts of colonies are filled with sediment and organic detritus. The assemblage of Tabulata and Chaetetida displays no segregation. The colonies of Tabulata nad Chaetetida, along with the assemblages of accompanying fauna, are mixed and scattered at random.

The assemblage of Tabulata and Chaetetida is accompanied by abundant Foraminifera, Porifera, Conularida, Tetracoralla, Stromatoporoidea, Annelida, Bryozoa, Brachiopoda, Lamellibranchiata, Gastropoda, Trilobita, Ostracoda, Crinoidea, Echinoidea, Conodonta, algae and micro- and macroflora. Among them, a predominant group is formed by both solitary and colonial Tetracoralla strongly differentiated taxonomically, with an assemblage of the *Caninia-Clisiophyllum* as the most numerous of them. Fairly numerous are also *Cyathaxonia, Rotiphyllum, Allotropiophyllum,* very small *Hexaphylla* and others. Less numerous are large (up to 50 cm in diameter) bushlike colonies of *Lithostrotion* and *Disphyllum* (FEDOROWSKI, 1971). The Brachiopoda occur abundantly (KWIATKOWSKI, 1959). The remains of Crinoidea stems, occurring abundantly and locally forming an organic detritus, represent the main component of the Upper Visean limestone. Common are Foraminifera, flat colonies of Bryozoa and accumulation of algae. Less frequent are Spongiae (mostly irregular accumulations of spicules), not described Lamellibranchiata, and Gastropoda of the genera *Straporollus, Mourlonia, Euconospira, Portolockiella, Platyceras, Naticopsis, Turbonitella* (GROMCZAKIEWICZ-ŁOMNICKA, 1973), detached carapaces of the Ostracoda and Trilobita (OSMÓLSKA, 1962, 1970). Similarly as the Tabulata and Chaetetida, the entire accompanying fauna occurring in both the Tabulata-bearing beds and in the remaining parts of the profile (Text-fig. 4*B*), is reworked, displays a considerable degree of mechanical destruction. The phenomenon of an overgrowing of some organisms by others frequently occurs in the Upper Visean assemblages.

STRATIGRAPHIC SIGNIFICANCE OF THE TABULATA AND CHAETETIDA

Upper Givetian. — In view of the possibility of the occurrence of *Stringocephalus burtini* DEFR. not only in the Givetian (LECOMPTE, 1951; DVOŘÁK & HAVLIČEK, 1963; CHLUPAČ, 1967), but also still in the lowermost Frasnian (ERBEN & ZAGORA, 1967), the presence of this species does not determine unequivocally the age of the deposits in the area of Dębnik as Givetian, while the presence of the assemblage of the Tabulata species — does. Such a conclusion is based on the occurrence in this area of *Caliapora battersbyi* (MILNE-EDWARDS & HAIME), *Natalophyllum giveticum* RADUGUIN and *Tyrganolites eugeni* TCHERNYCHEV which are characteristic of the Givetian only (MILNE-EDWARDS & HAIME, 1851, 1853, 1860; SCHLÜTER, 1889; RADUGUIN, 1938; LECOMPTE, 1939; TCHERNYCHEV, 1951; SOKOLOV, 1955; DUBATOLOV, 1959; TCHUDINOVA, 1964; YANET, 1972) and on the presence of *Scoliopora* aff. *muricata* TCHUDINOVA, whose typical representatives, described from the Kuznetsk Basin, occur in this stage only (TCHUDINOVA, 1964). Givetian age of the limestones from Dębnik may also be confirmed by the presence of *Stromatopora* ex gr. *mononensis* GALL. & ST. JEAN. Its typical representatives are known from the Lower Givetian of the USA (GALLOWAY & ST. JEAN, 1957) and from the Upper Givetian of the Holy Cross Mts., Poland (KAŹMIERCZAK, 1971).

Frasnian. — Frasnian age of the limestones of the Dębnik region is confirmed by the abundant occurrence of *Cladopora gracilis* LECOMPTE and *Alveolites ramosa* (F. A. ROEMER), characteristic for the Frasnian of Europe (F. A. ROEMER, 1851-1856, 1855; FRECH, 1885, 1894; GÜRICH, 1903; LECOMPTE, 1939; SOKOLOV, 1952; ERMAKOVA, 1960). The Frasnian age of these limestones is also indicated by the presence of fairly numerous *Stromatopora undata* RIABININ, known from the Frasnian only (RIABININ, 1941, 1955; STEARN, 1961, 1962, 1969; KAŹMIERCZAK, 1971).

Visean. — No Tabulata species, characteristic of this stage, occur in the Visean of both the Cracow and Gałęzice area. In the peripheral area of the Dębnik anticline, Visean age of the deposits is in part indicated by the presence of *Syringopora subgeniculata* SOKOLOV, *S. hyperbolo-tabulata* CHI and cosmopolitan *S. geniculata* PHILLIPS, which, although known from the Tournaisian through the Visean, are the most characteristic of the Visean (STUCKENBERG, 1895; CHI, 1933; SOKOLOV, 1947; BASSLER, 1950; VASSILJUK, 1950, 1960).

At Gałęzice, Visean age of the deposits is confirmed in full only by some species of the Chaetetida, accompanying the Tabulata, such as *Chaetetella repens* SOKOLOV, *C. cellulata* SOKOLOV and *Chaetetipora confluens* STRUVE (STRUVE, 1898; SOKOLOV, 1950; VASSILJUK, 1950, 1960).

COMPARISON WITH TABULATA ASSEMBLAGES FROM OTHER AREAS

Upper Givetian. — As compared with contemporaneous Tabulata from other regions and localities of Poland (The Holy Cross Mts. and the Sudetes, Miastko 1 borehole, North-western Poland), the U. Givetian assemblage of the Tabulata from the Dębnik anticline (Table 3) is, in its generic composition, and number of species, most similar to that of Miasto 1 borehole (STASIŃSKA, 1969). However, as opposed to Dębnik, the U. Givetian of Miastko 1 borehole lacks East-European elements, i. e. *Scoliopora muricata* TCHUDINOVA and *Tyrganolites eugeni* TCHERNYCHEV. As compared with the Tabulata from the Holy Cross Mts. (GÜRICH, 1896; SOBOLEV, 1904; STASIŃSKA, 1954, 1958; PAJCHLOVA, 1972), the assemblage from Dębnik is less numerous specifically. This concerns primarily the representatives of the genera *Thamnopora* and *Alveolites* which, in the Holy Cross Mts., are strongly differentiated and occur abundantly. With a similar generic differentiation, the assemblage of Dębnik anticline includes considerably less species (mostly of *Thamnopora* and *Alveolites*) than the contemporaneous assemblages of the Tabulata of Europe and Central Asia and displays a mixed character.

As compared with the contemporaneous assemblage of Tabulata from the Dinant Basin, Belgium (LE MAITRE, 1937; LECOMPTE, 1939; BASSLER, 1950), the assemblage from Dębnik is marked by a similar, although less numerous, generic composition (no *Favosites* and *Trachypora* are recorded, and *Syringopora* and *Aulopora* are very rare), with a simultaneous considerable reduction in the number of species (mostly of the genera *Thamnopora, Alveolites* and *Coenites*). On the other hand, a considerable similarity is displayed to the assemblages of the Tabulata from western Germany and France.

In comparison with the contemporaneous assemblages of Tabulata from the European part of the USSR (East-European Platform, Ural and Kuznetsk Basin) (BOGATYREV, 1899; BULVAUKER, 1934; RADUGUIN, 1938; BASSLER, 1950; SOKOLOV, 1952, 1955; DUBATOLOV, 1959, 1963, 1964; TCHUDINOVA, 1964), the assemblage from Dębnik displays the greatest similarity to that from Ural, smaller to that from the Kuznetsk Basin and the smallest to that from the East-European Platform. This similarity is expressed primarily in the presence, in the Givetian of the Dębnik anticline, of species which are characteristic of the European part of the USSR, i. e., *Scoliopora muricata* TCHUDINOVA, *Natalophyllum giveticum* RADUGUIN and *Tyrganolites eugeni* TCHERNYCHEV, as well as in the fact that in all these regions, the same as in Dębnik, the representatives of the genus *Syringopora* are extremely rare.

Frasnian. — As compared with other regions of Poland, the Frasnian assemblage of the Tabulata of the Dębnik anticline (Table 3) displays, with a similar generic, a different specific composition. Generically, it is more differentiated than the assemblage from the Holy Cross Mts. (GÜRICH, 1896; SOBOLEV, 1904; STASIŃSKA, 1954, 1958; PAJCHLOVA, 1968) which lacks *Squameofavosites* and *Tyrganolites* and includes only one species of the genus *Alveolitella,* while the Dębnik assemblage is less numerous specifically *(Alveolites).* It differs from the Tabulata from the Sudetes (STASIŃSKA, 1958; GUNIA, 1962, 1968; PAJCHLOVA, 1972) in its generic composition (its predominance of the genus *Alveolitella* and the lack in the Sudetes, of *Squameofavosites, Cladopora* and *Tyrganolites*) and in a smaller number of species *(Thamnopora, Alveolites).*

In comparison with the European assemblages, of the same age, that of Dębnik anticline is marked by the presence of West-European and almost complete lack of East-European and Central Asian species. A certain influence of Tabulata fauna from eastern territories might be indicated by the presence of *Tyrganolites frasnianus* sp. n., as the genus *Tyrganolites* has so far been known only from the European and Asian areas of the USSR. The assemblage from Dębnik differs from the Tabulata of the Dinant and Namur Basins, Belgium (ASSELBERGHS, 1936; LECOMPTE, 1939; BASSLER, 1950) in a smaller number of genera (no *Thecostegites* and *Cladochonus*) and species (for *Thamnopora* and *Alveolites*). In regard to the Tabulata assemblages of the European part of the USSR and Central Asia (PEETZ, 1901; BASSLER, 1950; SOKOLOV, 1952, 1955; DUBATOLOV, 1959, 1963, 1964; TCHUDINOVA, 1964), the assemblage of the Dębnik anticline displays the greatest similarity to the Tabulate of Ural, while its analogies to the Frasnian assemblages of the East-European Platform and Kuznetsk Basin are rather remote.

Visean. — The Tabulata assemblage from the margin of the Dębnik anticline (Table 3) is very poor generically but strongly differentiated specifically (many representatives of *Syringopora* and very rare of *Roemeripora*) and displays a strong influence of the East-European (Donetsk and Moscow Basins, Ural) and Asian (China) fauna of the Tabulata as indicated by the presence of *Syringopora subgeniculata,* S. *hyperbolo-tabulata* and *S. lipoensis.* The assemblage of the Tabulata from Gałęzice (Table 3) is marked by a considerable generic and small specific differentiation and displays certain characters of an endemic assemblage (a decisive predominance of new species). Except for new species, this assemblage is most similar to the Visean ones from Western Europe (England, France, Belgium, Germany), with a simulatenous only small influence of the East-European (Donetsk and Moscow basins, Ural) and Asian (China) Tabulata of the genus *Sinopora.*

As compared with the assemblage of Belgium (BASSLER, 1950), the Tabulata of Gałęzice are strongly differentiated both generically and specifically (only *Michelinia, Cleistopora* and *Syringopora* occur in Belgium) and have a different generic and specific composition than the Northern-French (DELEPINE, 1930; BASSLER, 1950) assemblage which lacks the genera *Squameofavosites, Emmonsia, Multithecopora* and *Syringoporella.*

In regard to the Tabulata assemblages of the European part of the USSR (Donetsk and Moscow Basins, Ural), the Polish assemblages of both the margin of the Dębnik anticline and of Gałęzice are most similar to that of Donetsk Basin (LEBEDEV, 1924-1927; FOMICHEV, 1931, 1955; VASSILJUK, 1950, 1952, 1953, 1957, 1960, 1961), the assemblage of Gałęzice being much more numerous generically than that of Donetsk Basin which lacks the genera *Squameofavosites, Emmonsia, Michelinia, Syringoporella, Cladochonus* and *Sinopora.* As compared with the assemblages from the Moscow Basin (STRUVE, 1989; GORSKY, 1932; SOKOLOV, 1939, 1941, 1946, 1950) and Ural (STUCKENBERG, 1895; BASSLER, 1950; SOKOLOV, 1950), the Tabulata from Gałęzice are considerably more numerous both generically and specifically (only *Syringopora* and *Cladochonus* occur in the Moscow Basin). Except for the cosmopolitan species, the assemblage of Gałęzice displays no closer relationships to the assemblage of species from Ural.

The Visean assemblage of the Chaetetida from Gałęzice, not very numerous generically and specifically (Table 3), displays considerable analogies to that of the Moscow Basin (SOKOLOV, 1950).

BLASTOGENY

GENERAL REMARKS

Among the investigators of blastogeny in the Tabulata, KOCH (1883) was one of the first who studied the budding in the representatives of the genera *Favosites*, *Syringopora* and *Sarcinula*. The longitudinal division of corallites was studied in the genus *Multisolenia* by FRITZ (1937). A longitudinal tetrameric division was found in the representatives of the order Tetradiida by OKULITCH (1936) and BASSLER (1950). The longitudinal division was also described by LECOMPTE (1939, 1952) in the representatives of the genera *Alveolites* and *Scoliopora*. A review of studies on blastogeny was given by SOKOLOV (1955, 1962), who also prepared a classification of so far described types and ways of the vegetative reproduction in the Tabulata. SCHARKOVA (1971) described the development of a colony in the Theciidae (genera: *Somphopora*, *Thecia* and *Antherolites*), Favositidae (genera: *Palaeofavosites* and *Favosites*) and Alveolitidae (genera: *Alveolites*, *Placocoenites* and *Scoliopora*), while STASIŃSKA (1958, 1967) studied the buddings and development of colony in the genera *Kozlowskiocystia*, *Aulopora*, *Favosipora* and *Flecheria* of the order Auloporida, in *Catenipora*, *Halysites* and *Cystihalysites* of the order Halysitida and in *Favosites*.

As a result of the studies conducted so far the following types of the asexual reproduction have been distinguished in the Tabulata: (1) an intermural budding (also called intercalicular or extracalicular, sometimes also intermediate or epithecal budding); (2) a basal budding; (3) an intracalicular budding carried out in two ways, as a marginal budding and as a parricidal budding *sensu lato*; (4) a lateral budding which occurs as a typical lateral budding and as a basal lateral budding; (5) a stolonal (syringoporoidal) budding; (6) a longitudinal division which occurs in the forms of a complete longitudinal division, an incomplete longitudinal division and a septal division also called a septal budding.

Among the vegetative types of reproduction mentioned above, only the intracalicular budding and the longitudinal division have been described accurately. According to SWANN (1947), the intracalicular budding is effected by separating of a young corallite inside its parent calice (e. g., in *Favosites*). SOKOLOV (1955, 1962) maintained that this type of budding is very rare in the Tabulata and that it took place as what is known as a peripheral budding in the representatives of the genus *Pachyfavosites*. According to SHARKOVA (1971), the budding of this type occurs in *Favosites* in which it is effected by invagination of the wall in the corner of the parent calice (in *Palaeofavosites*) or by the folding of the wall of the parent calice (in *Favosites*). According to STASIŃSKA (1958), the genus *Kozlowskiocystia* displays an intracalicular budding within the dissepimentarium.

In many authors' opinion, the longitudinal division, occurring inside the parent calice, is a frequent type of vegetative reproduction in the Tabulata. This finding served OKULITCH (1936) as a basis for assigning all Tabulata, along with the Heliolitoidea and Chaetetida (in which he also observed the longitudinal division), to a separate subclass called Schizocoralla. The reproduction of this type is marked by the formation and fusion inside of the parent calice of septal processes, as a result of which the parent calice becomes subject to a partial or complete division and forms several descendant individuals (FRITZ, 1937; OKULITCH, 1936; BASSLER, 1950; SHARKOVA, 1971). According to SOKOLOV (1955, 1962) such a mode of reproduction does not occur in Tabulata in its typical form.

The remaining types of reproduction mentioned above are known from very cursory observations, and therefore, arouse considerable doubts. This concerns in particular what is known as an "intermural" budding, mentioned by many authors as allegedly occurring in the representatives of the Favositidae, Pachyporidae, Alveolitidae and Coenitidae. In this process, buds supposedly appear at the contact of adjoining corallites (KOCH, 1883), between adjoining corallites (calices), or between lateral surfaces of parent polyps adjoining each other at the moment when the wall in this place is not yet developed (SOKOLOV, 1955; 1962; DUBATOLOV, 1969). According to SOKOLOV, a bud thus being developed does not belong to any of the two adjoining parent corallites (zooids) and its formation is to a considerable extent epithecal. The present writer has not found such a budding in the colonies of the Favositidae and Pachyporidae. In the earliest developmental stages, the bud has always appeared in the corner of a parent calice, and its formation and development have always been of the nature of the intracalicular budding. The observations made so far were probably conducted on later developmental stages of a bud or on early stages of a young corallite. In these stages, the bud has already been completely separated by its own wall and epitheca (it is a young corallite) and looks in transverse sections as if being formed between the walls of two corallites adjoining each other. In addition, the suggested epithecal character of such budding, is hardly acceptable as no coenenchyma occurs in the Tabulata.

The basal budding which, according to SOKOLOV (1955, 1962) and DUBATOLOV (1969) occurs in the basal parts of flat colonies, e. g., in the Alveolitida, is not, in the present writer's opinion, a separate type of budding, but it signs only the place in which the blastogenic processes occur in the colony and it more or less concerns all representatives of the Tabulata. Various types of vegetative reproduction (different modes of intracalicular budding, the longitudinal division) may occur in the basal (young) parts of the colony. One definite type of blastogeny is characteristic for a given taxonomic group or for an initial stage of development of a colony.

According to SOKOLOV (1955, 1962) and DUBATOLOV (1969), the lateral budding, whose many types supposedly occur (including the lateral budding proper, the lateral basal budding etc.) in dendroid colonies (mostly in the representatives of the order Auloporida), takes the following course: buds appear as new outgrowths of the parent calices and then, as young individuals, grow parallel to them. In this budding, the most important thing is the place of the appearance of a bud. It is still uncertain if the bud is formed inside or outside the calice. Sketchy descriptions of this budding hint at the formation of buds (as outgrowths of the parent calice) on the epitheca, the more so as the "intermural" budding, discussed above, was examined by HILL (1935) as one of the instances of lateral budding. For the reasons presented above, the epithecal character of lateral budding seems to be rather unacceptable.

The syringoporoidal (stolonal) budding (OLIVER, 1968), which allegedly occurs on connecting elements (tubes, plates and connecting bridges) in the Syringoporida has never been described.

Two main types of the vegetative budding may be distinguished as a result of the present writer's studies and on the basis of an analysis of other investigators' observations conducted so far: (I) the intercalicular budding; (II) the longitudinal division which has always been observed within the parent calice and which has some characters in common with type I;

(I) *The intracalicular budding*

Depending on the place of the appearance of a bud in relation to the wall of the parent calice and depending on the extant to which it occupies the space of the visceral chamber, the writer distinguishes the following three variants of intracalicular budding: (1) the intravisceral budding; (2) the mural budding, and (3) the extravisceral budding.

The intravisceral budding (Text-fig. 5A, B) is marked by the formation of the bud within the peripheral zone of an appropriate visceral chamber of the parent calice. The bud appears here mostly in the corner of the parent calice and, separating itself from the latter by its own wall, it simultaneously closes a small part of the peripheral zone of its visceral chamber. The chamber of the bud is formed, therefore, at the cost of part of the visceral chamber of the parent calice. The intravisceral budding may take place in two ways:

—— by the formation of two mural processes and their fusion in the corner of parent calice (e. g., in the representatives of the genus *Michelinia*; Text-fig. 5A);

— by the thinning-down of wall in the corner of parent calice, resulting in the formation in this place of a deep invagination towards the epitheca in which a bud appears (e. g., in the representatives of the genera *Thamnopora*, *Palaeofavosites* and *Favosites*; Text-fig. 5B). Two short mural processes, which subsequently fuse with each other, may be also formed simultaneously in the corner of parent calice in addition to this invagination.

A fundamental difference between the two ways of intravisceral budding consists in the fact that the budding resulting from the formation of a depression takes place at the cost of the thickness of wall in the corner of parent calice, while the budding by the formation of processes takes place at the cost of the space of the visceral chamber of the parent calice, the wall remaining in this place of the same thickness. In the process of intravisceral budding, the neotheca becomes part of the mural processes only after their complete development or directly after their complete fusion (after the separation of the bud from the visceral chamber of the parent calice).

The mural budding is marked by the appearance of the bud on the wall of parent calice, mostly in its corner (Text-fig. 5C). In transverse sections of the corallite, the bud has always been visible inside its wall, mostly close to the epitheca. The visceral chamber of parent calice does not participate in the formation of the chamber of bud and, after the formation of a young corallite, the parent calice does not in principle diminish its size. The neotheca (the median suture) becomes part of the wall, separating the visceral chamber of parent calice from the chamber of bud, directly after its appearance. The growth of neotheca takes place simultaneously in two directions (from both median sutures of walls which form the corner). An undulation of the epitheca of parent calice, with its convexity facing the visceral chamber of an adjoining, corallite, is frequently observed in transverse sections, in the place where the bud appears. The mural budding occurs in the representatives of such genera as, e. g., the *Squameofavosites*, *Emmonsia*, *Favosipora* and probably in most representatives of the family Favositidae.

The extravisceral budding (Text-fig. 5D) takes place, much the same as the intravisceral, one within the limits of the visceral chamber of parent calice. However, in contrast to the latter, the bud is formed here at the end of a deep depression in the visceral chamber resulting from a strong lateral swelling of the wall of parent corallite directed externally (without a change in its thickness). After the formation of a bud, the young corallite separates itself laterally from the parent individual by the neotheca and, subsequently, by its own wall. In further developmental stages, the young corallite forms its own epitheca and separates from the parent individual. The space of parent calices does not decrease in the process of extravisceral budding.

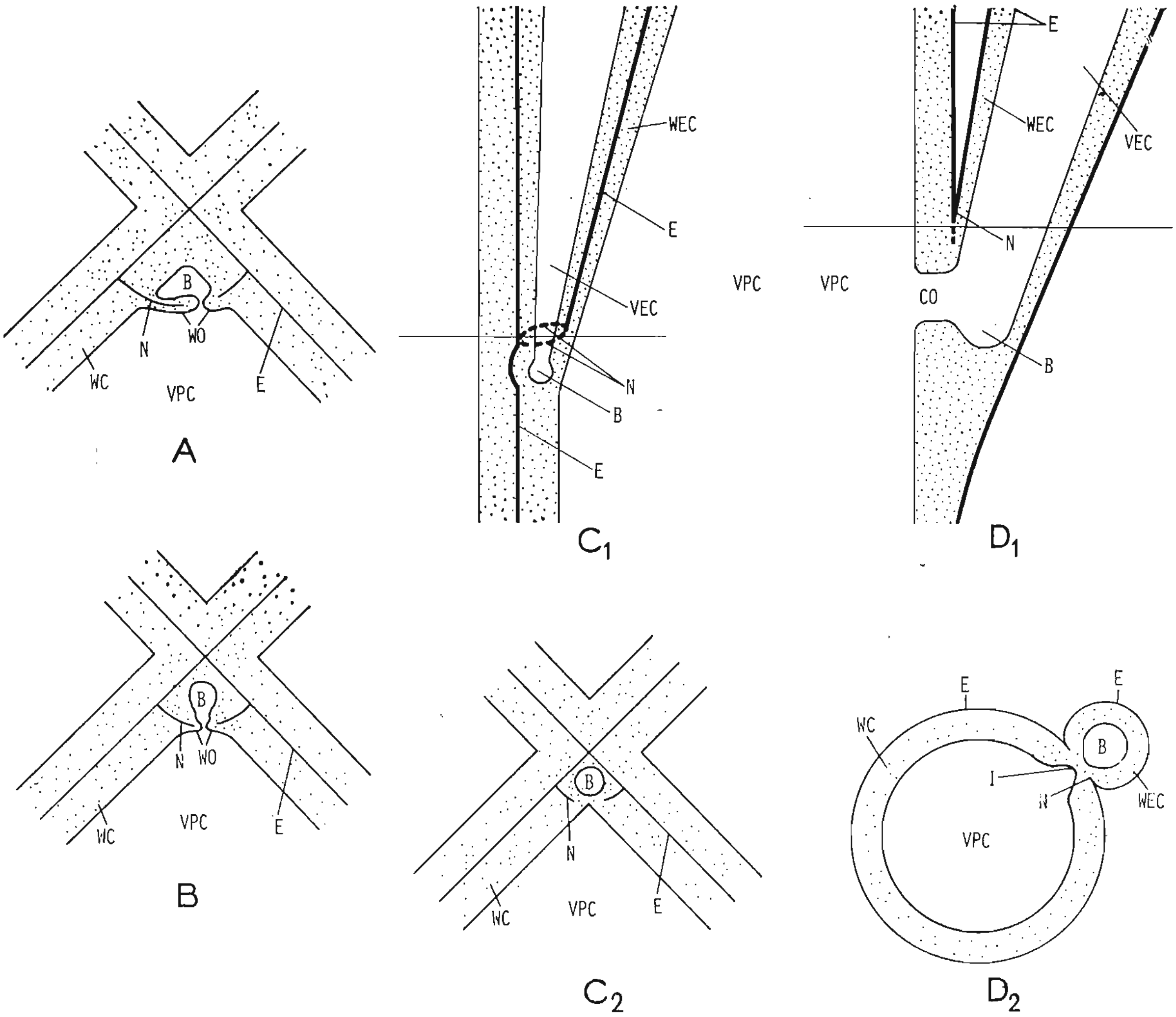

Fig. 5
Scheme of intracalicular budding in the Tabulata. *A* — intracalicular-intravisceral budding occurring by the formation of two mural processes and their fusion in the corner of a parent calice; transversal section in the hystero-nepionic stage. *B* — intracalicular-intravisceral budding occurring by the appearance of a bud in the lateral concavity on the wall of a parent calice; transversal section in the hystero-nepionic stage. *C* — intracalicular-mural budding occurring on the wall in the corner of a parent calice: (1) longitudinal section, (2) transversal section in the hystero-nepionic stage. *D* — intracalicular-extravisceral budding, occurring in the lateral invagination on the wall of a parent calice: (1) longitudinal section, (2) transversal section in the hystero-nepionic stage. *a*, *b*, and *c* — section lines in the consecutive preblastic hystero-nepionic and hystero-neanic stages (for description see pp. 27-29).

The budding of this type occurs in the representatives of such genera as, e. g., *Syringopora*, *Multithecopora*, *Sinopora* and probably of all the genera in which what is known as a "lateral budding" has ever been described, that is, those of the order Auloporida.

The intravisceral and mural buddings are characterized by massive colonies of the Tabulata in which calices (corallites) contact each other laterally with all their walls. The extravisceral budding occurs, on the other hand, in dendroid colonies, whose calices (corallites) are loosely distributed in a colony and, apart from definite connecting elements (tubes, plates, bridges) do not contact each other with their walls.

(II) *The longitudinal division*

The longitudinal division, which has always been observed within the limits of parent calice, displays certain characters in common with the intracalicular, in particular intravisceral budding, taking place by the formation and fusion of mural processes. This type of vegetative reproduction is marked by the fact that the gradually developing mural processes, formed in parent calice and called here septal projections or septa, fuse with each other mostly in the middle of its visceral chamber, longitudinally dividing the latter and, consequently, the entire parent calice into two or more descendant individuals. The longitudinal division may be either complete (when the entire parent calice is subject to division into descendant individuals), or incomplete (when only part of parent calice is divided). The longitudinal division is observed in its classical form in the representatives of the order Tetradiida (OKULITCH, 1936; BASSLER, 1950; SOKOLOV, 1955, 1962). Studies on the budding of this type have not been conducted by the present writer.

EARLY GROWTH STAGES

Four, consecutive developmental stages, leading to the formation of a young corallite are observed in all the representatives of the Tabulata in which the intracalicular budding occurs. Quantitative and qualitative differences occurring during their blastogeny process between these stages are, in the present writer's opinion, sufficiently distinct to justify the need of their separation. Due to the fact that the developmental stages of the Tabulata display certain similariteis to those occurring in the Tetracoralla, the terminology used in the description of blastogeny in the latter is employed here by the writer. In addition, he has separated an initial, or what is known as a "preblastic" stage, which occurs prior to the appearance of a bud and which precedes the later developmental stages of the corallite.

The preblastic stage includes all morphological and structural changes occurring in skeletal elements of the part of parent calice in which the bud is to be formed and terminates at the moment of its appearance. The morphological changes include those in the thickness of wall, formation and development of outgrowths and depressions in the wall of a parent calice, changes and disturbances in the formation and distribution of the elements of septal apparatus, connecting plates and pores, etc. The structural changes mostly result from various disorders in the microstructure of the wall of parent calice in the place where bud is formed and from a temporary local atrophy of epitheca, of its folding and changes in its thickness.

The hystero-nepionic stage begins at the moment of the appearance of bud and includes its whole development (changes in shape and size), the process of its separation from the visceral chamber of parent calice and, finally, the formation of neotheca. This stage terminates as soon as the bud separates itself from the parent calice by its own epitheca and wall, that is, when it transforms in a young corallite. In transverse sections of parent calices, the complete separation of the bud is marked by the formation of a continuous line of median suture, connected with median lines of adjoining walls of parent calice and separating the wall of the young corallite from that of parent calice.

The hystero-neanic stage begins at the moment of a complete separation of the young corallite from parent calice and terminates as soon as this corallite acquires features characteristic of a given genus. This stage includes, among other things, the following morphological changes: a gradual increase in the thickness of young corallite wall, an increase in the number of corners and walls (in the case of genera having polygonal corallites), an increase in the diameter of corallite and changes in the outline of its visceral chamber as viewed in transverse sections. In addition, an appropriate order of the appearance and development of the connecting pores, tabulae and elements of septal apparatus is observed in this stage.

The ephebic stage includes the period of development from the acquiring by the young corallite of diagnostic characters of a genus to the acquiring of those of a species, in particular up to the moment of reaching a mean diameter of an adult corallite characteristic for a given species. In this stage, a further increase is observed in diameter, number of corners and walls of the corallite (in the case of genera having polygonal corallites) and thickness of walls. It also includes the assumption of the final shape and size of the transverse section of visceral chamber and the development of septal apparatus (if it occurs at all) and a characteristic arrangement of tabulae and spacing of connecting pores.

An accurate process of intracalicular budding in the representatives of the genera *Squameofavosites*, *Emmonsia*, *Michelinia*, *Thamnopora* and *Syringopora* is described below.

EXAMPLES OF ASEXUAL REPRODUCTION

SQUAMEOFAVOSITES

This genus displays the mural intracalicular budding (on the wall of calice). This process, observed in well-preserved colonies of *Squameofavosites megasquamatus* sp. n., runs as follows (Text-figs. 6 and 7): The bud appears only in the corner of parent calice, on the inner surface of its wall. In transverse sections of corallites it has always been visible inside the wall of parent corallite. The connection between the chamber of bud and the visceral chamber of parent calice, persisting only to the moment at which the neotheca is formed, might occur only at the top.

The preblastic stage (Text-figs 6A, B; 7A). In the initial phase, a tiny spherical or ellipsoidal irregularity appears in the angle of the wall of parent calice. Its appearance is frequently preceded by the formation in this place of a connecting pore. In its further development, the irregularity mentioned above gradually extends and is replaced by an almost spherical bulb of which the bud develops. In the preblastic stage, the development takes place on the vertical section of corallite 0.15 to 0.20 mm long.

The hystero-nepionic stage (Text-figs 6C; 7B). A distinct thickening of the wall of parent corallite and bending of the epitheca towards an adjoining calice occurs in almost all cases just before the appearance of the bud or at the moment of its formation. In transverse section this phenomenon is marked in the form of an undulate line of median suture. As seen in transverse section the buds are round or oval, 0.1 to 0.15 mm, with dimensions 0.1 × 0.2 mm. The formation of neotheca and the separation of the descendant individual occur as follows: two walls of parent calice arranged at a certain angle to each other become walls of the descendant individual, while the third wall (neotheca), separating the young corallite from the parent individual, is formed gradually and mostly asymmetrically on two sides, from both adjoining walls of parent calice. In consecutive transverse sections through the corallite, this is marked in the form of two lines which approaching and join each other thus forming the median suture. At the moment of their conjunction, the young corallite completely separates from the parent individual. In this stage, the development takes place on distance about 0.15 to 0.20 mm long.

The hystero-neanic stage (Text-figs 6E, F; 7C, D). After their complete separation, the young corallites are mostly regularly triangular and measure 0.35 × 0.4 mm or, rarely, quadrangular (rectangular) and with dimensions 0.3 to 0.35 mm by 0.4 to 0.5 mm. Usually, they have relatively thin walls and round or oval lumen of their visceral chamber. The area of their trans-

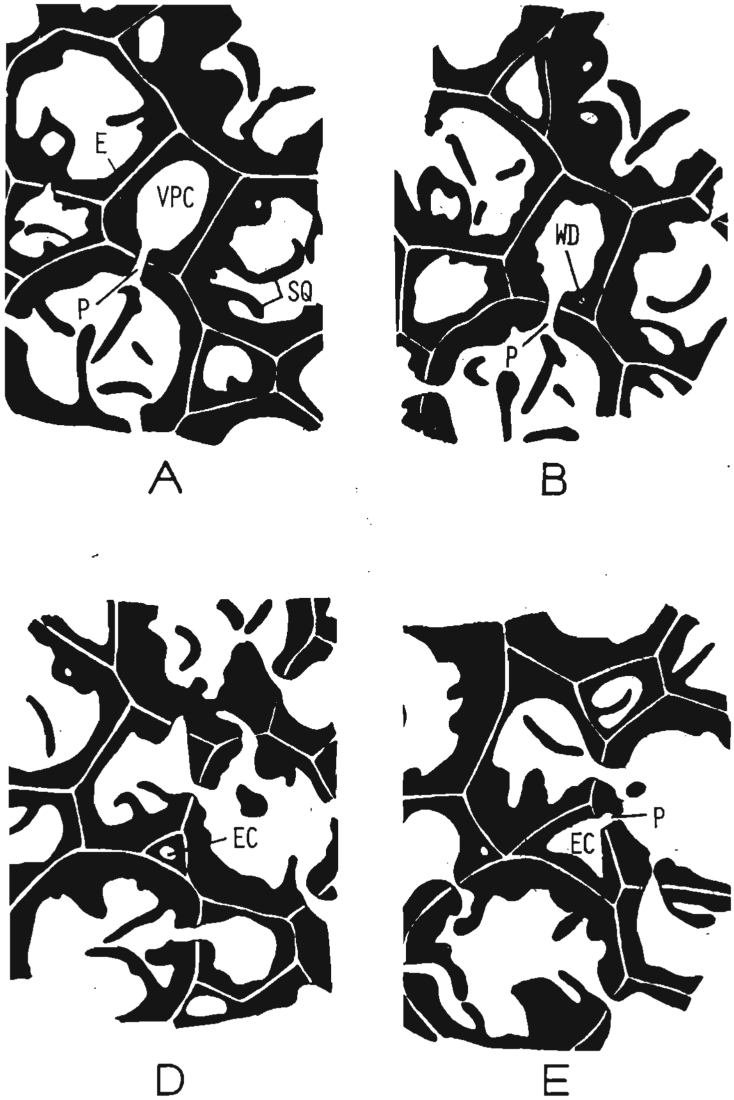

Fig. 6
Intracalicular-mural budding in *Squameofavosites megasquamatus* sp. n., holotype (ZPAL T IX/247); Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., Upper Visean, D_2 (transversal sections, × 10). *A-B*, preblastic stage, *C* — hystero-nepionic stage, *D-E* — hystero-neanic stage, *F* — ephebic stage (for description see pp. 31-32).

verse section constitutes about 10 per cent of that of parent calice. In their further developmental phases, the young corallites increase their diameters and thickness of their walls. The number of corners reaches five. At the end of this stage, there appear connecting pores, followed by tabulae and thin septal squamulae. Thus, the corallites have already all typical generic characters. In this stage, the development takes place on distance of 0.4 to 0.5 mm.

The ephebic stage (Text-fig. 6*F*). In this stage, the walls of corallites grow still thicker, the number of corners reaches eight and the septal squamulae strongly develop. At the end of this stage, the mean diameter of corallites reaches a value characteristic of the genus.

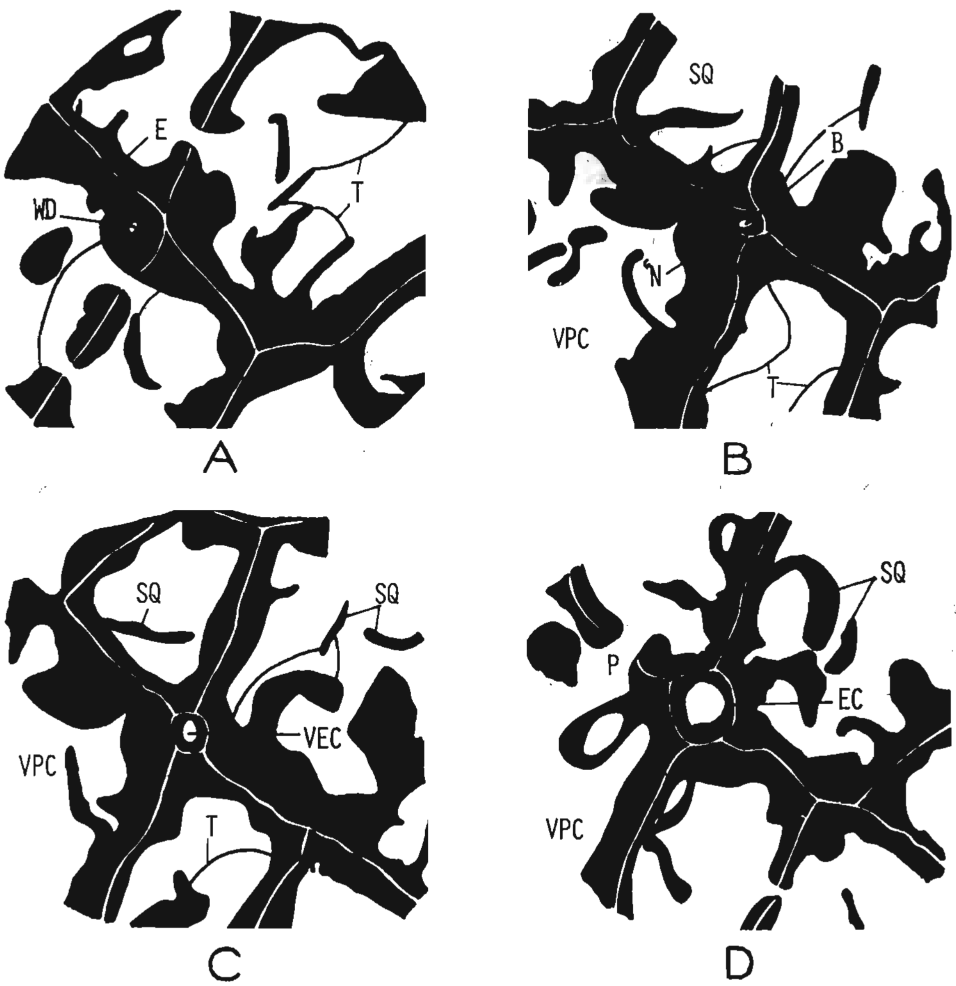

Fig. 7
Intracalicular-mural budding (a young individual is formed in the contact zone of four calices of adult individuals) in *Squameofavosites megasquamatus* sp. n., holotype (ZPAL T IX/247); Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., Upper Visean, D_2 (transversal sections, × 10). *A* — preblastic stage, *B* — hystero-nepionic stage, *C-D* — hystero-neanic stage (for description see pp. 31—32).

EMMONSIA

In the genus *Emmonsia*, there occurs the intracalicular mural budding. Its process has been observed in colonies of *Emmonsia czarnieckii* sp. n. In this genus, the vegetative reproduction of this type occurs in all stages similarly as in the representatives of the *Squameofavosites*.

The preblastic stage (Text-fig. 8*A*, *B*). In the initial phase, the wall thickens in the corner of parent calice and a spherical or ellipsoidal irregularity appears in it. Unlike in the representatives of the *Squameofavosites*, no bend is observed in the line of median suture at the moment of the bud formation.

The hystero-nepionic stage (Text-fig. 8 *C*, *D*). In transverse sections the bud is round in outline and 0.1 to 0.2 mm in diameter or oval and measures 0.1 to 0.2 by 0.2 to 0.3 mm. The formation of neotheca and separation of the descendant individual occur much the same as in

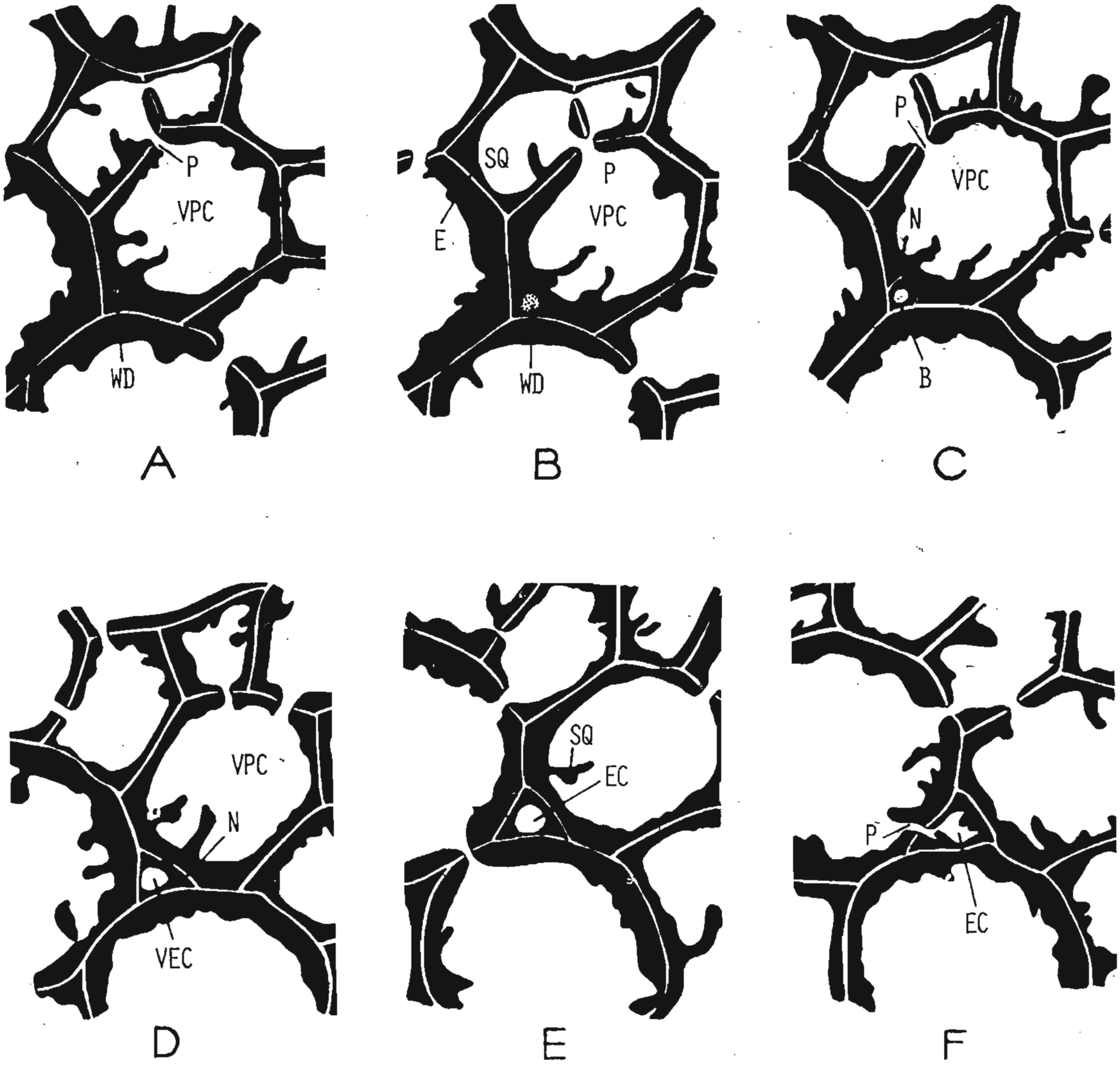

Fig. 8
Intracalicular-mural budding in *Emmonsia czarnieckii* sp. n. (ZPAL T IX/265); Gałęzice, (railroad cut on the Ostrówka Hill), Holy Cross Mts., Upper Visean, D_2, (transversal sections, × 10). *A-B* — preblastic stage, *C-D* — hystero-nepionic stage, *E* — hystero-neanic stage, *F* — ephebic stage (for description see pp. 33—34).

the representatives of the genus *Squameofavosites*. The development process of a young corallite takes place in this stage on a distance about 0.1 to 0.15 mm.

The hystero-neanic stage (Text-fig. 8*E*). Like in the case of *Squameofavosites*, after a complete separation from the parent corallite, the young corallites are triangular or quadrangular in transverse section, round and oval in the outline of their visceral chambers and have four and five corners. During development, as earliest elements apper connecting pores, followed successively by mural processes and swellings characteristic of this genus and, finally, by septal squamulae and tabulae.

The ephebic stage (Text-fig. 8*F*), is marked by a strong development of septal squamulae and reaching by a corallite a diameter characteristic of the genus.

MICHELINIA

This genus displays an intracalicular intravisceral budding effected by the formation of mural processes. This process has been observed in colonies of *Michelinia tenuisepta* de KONINCK, in which the buds appear in the corners of parent calice. They are developed as a result of the formation and subsequently conjunction of processes grown out of two adjoining walls of parent calice.

The preblastic stage (Text-fig. 9*A-C*). In the initial phase, two swellings appear on two adjoining walls in the corner of parent calice. They are then gradually transformed into two processes, which, with the growth of parent calice, approach each other and, at the same time, withdraw (in a horizontal plane) from the corner of calice and shift towards the middle of visceral chamber. Thus, in the corner of parent calice, there appears a round or oval depression connected, by a contraction, with the visceral chamber of this calice. The growth of processes is as a rule strongly asymmetric: mostly one process appears and, growing, approaches the opposite wall on which only a small convexity is formed. The club-shaped tip of this process displays a strong disturbance in the structure of stereoplasm. The occurrence of processes in frequently preceded by the formation of a connecting pore in the corner of parent calice. At the moment of the formation of processes and during their development, a short tabula is formed outside between the terminal end of process and the wall of calice. In the preblastic stage, the development occurs on an about 0.3 to 0.6 mm long vertical sector.

The hystero-nepionic stage (Text-fig. 9*D-F*). After the conjunction of both processes, the bud separates laterally from the visceral chamber of parent calice. In transverse sections, the chambers of buds are oval or irregular in outline and measure 0.2 to 0.3 mm by 0.35 mm or, less frequently, round and 0.3 to 0.4 mm in diameter. A complete separation of the descendant individual by its own wall takes place as soon as the neotheca, appearing in the middle of the wall formed by the conjunction of processes, fuses with that of parent corallite. The direction of the growth of neotheca is, therefore, opposite to that observed in the representatives of the genera *Squamofavosites* and *Emmonsia*. In this stage, the development takes in a 0.3 to 0.8 mm long sector.

The hystero-neanic stage (Text-fig. 9*G*, *H*). After a complete separation, the young corallites display a triangular outline in transverse sections, their dimensions being about 1.0 to 1.2 mm by 1.2 to 1.5 mm. They make up about two to five per cent of the area of transverse sections of parent calice. In the process of a further development, they increase their diameter, the number of corners (to 4-5) and the thickness of walls. The tabulae are the earliest to appear. The first of them has mostly round outline in transverse section and occupies the middle of the visceral chamber of a young corallite. Less frequently, it may be arcuate and attached to the newly formed wall of such a corallite. After the lids, there appear the connecting pores. In this stage, the development of corallites takes place in an about 2.0 to 3.0 mm long sector.

The ephebic stage (Text-fig. 9*I-M*) is marked by the development of all morphological characters of the genus, in particular by a characteristic diameter reached by the corallites.

THAMNOPORA

The intracalicular-intravisceral budding, occurring in this genus, takes place by the formation of a depression or a depression and small processes in the corner of the parent calice. The process of budding has been observed in colonies of *Thamnopora boloniensis* (GOSSELET) In order to describe it accurately it is necessary to distinguish two layers of stereoplasm of which the walls of corallites are formed in the genus *Thamnopora* and which behave differently in this process. Thus, an outer or periepithecal and an inner or pervisceral layer have been

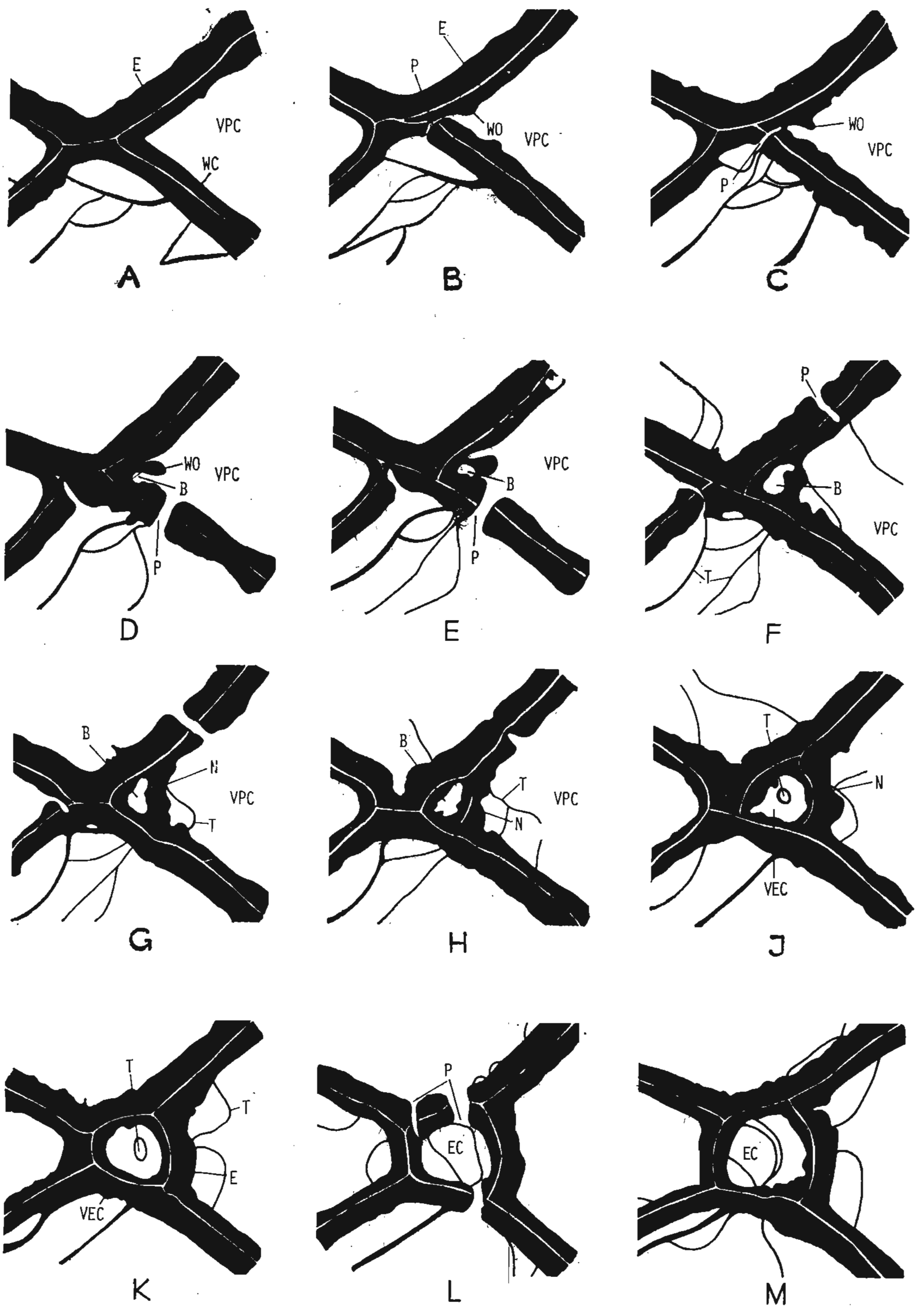

Fig. 9

Intracalicular-intravisceral budding occurring by the formation of mural processes in *Michelinia tenuiseptata* (PHILLIPS) (ZPAL T IX/280); Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., Upper Visean, D_2; (transversal sections, × 10). *A-D* — preblastic stage, *E-J* — hystero-nepionic stage, *K-L* — hystero-neanic stage, *M* — ephebic stage (for description see p. 35).

distinguished by the present writer. The periepithecal layer adheres directly to the epitheca and is composed of thin and short fibers, arranged radially. The perivisceral layer, known as a stereoplasmatic or secondarily stereoplasmatic thickening of the walls, directly borders the visceral chamber of corallite and, similarly as the periepithecal layer, is composed of radially arranged fibers, which, however, are thicker, very long and considerably more separated. The periepithecal layer of stereoplasm has always been thinner than the perivisceral one and, as shown by serial sections, more lightly coloured.

The preblastic stage (Text-fig. 10*A-C*). In the initial phase, the perivisceral layer slightly thickens in the corner of parent calice. At the same time, the outer part of the periepithecal layer detaches from the inner part, gradually shifts towards the visceral chamber of parent calice and, afterwards, growing thinner and thinner, becomes finally divided in the middle. A bulblike invagination, completely filled by the stereoplasm of the perivisceral layer, is formed as a result of this process in the periepithecal layer and increases its size with the progress of development. Then, in the perivisceral layer, filling the depression in the periepithecal layer, and outgrowth of the visceral chamber of parent calice is formed which gradually takes a corresponding shape. This is an incipient visceral cavity of a new individual. In this stage, the development takes place in an about 0.15 to 0.25 mm long sector.

The hystero-nepionic stage (Text-fig. 10*D, E*). With the growth of corallite, the connection between the chamber of the bud and the visceral chamber of the parent calice contracts as a result of the lateral growth of the wall outgrowths of the parent calice. These outgrowths, composed of two layers (periepithecal and perivisceral), subsequently fuse with each other forming a wall. The first fuse the perivisceral layers of both outgrowths, followed by the periepithecal layers. In transverse sections, the chamber of bud is round, about 0.15 mm in diameter, or oval and measures 0.12 to 0.15 by 0.18 to 0.22 mm. The neotheca gradually separates from the epitheca of parent calice, similarly as in the representatives of the genera *Squameofavosites* and *Emmonsia*. In *T. boloniensis*, the buds frequently appear in pairs, one in each of the adjacent corners of calice and not differing much in the time of their appearance. In the hystero-nepionic stage, the development takes place in an about 0.15 to 0.25 mm long sector.

The hystero-neanic stage (Text-fig. 10*F, G*). After their complete separation from the parent calice, the young corallites, viewed in transverse section, are quadrangular and about 0.3 to 0.4 by 0.5 to 0.55 mm in size, occupying about ten to twenty-five per cent of the area of parent calice. The young individuals increase their diameter, number of corners and thickness of walls (of both the periepithecal and perivisceral layer). In this stage, there already appear the first connecting pores. The development takes place in an about 0.33 to 0.40 mm long sector.

The ephebic stage (Text-fig. 10*H, I*) is marked by a further increase in the thickness of walls of corallites, in the number of corners (up to seven) and in the diameter of corallites which reaches a mean value characteristic of a given species.

SYRINGOPORA

This genus displays an intracalicular-extravisceral budding. The process has been observed on colonies of *Syringopora ramulosa* GOLDFUSS and *S. reticulata* GOLDFUSS. The vegetative reproduction takes place in this genus within limits of the visceral chamber of parent calice, that is, in its lateral appendix entering the outer lateral depression of the wall of parent calice.

The preblastic stage (Text-fig. 11*A, B*). In the initial phase, a local thickening, subsequently

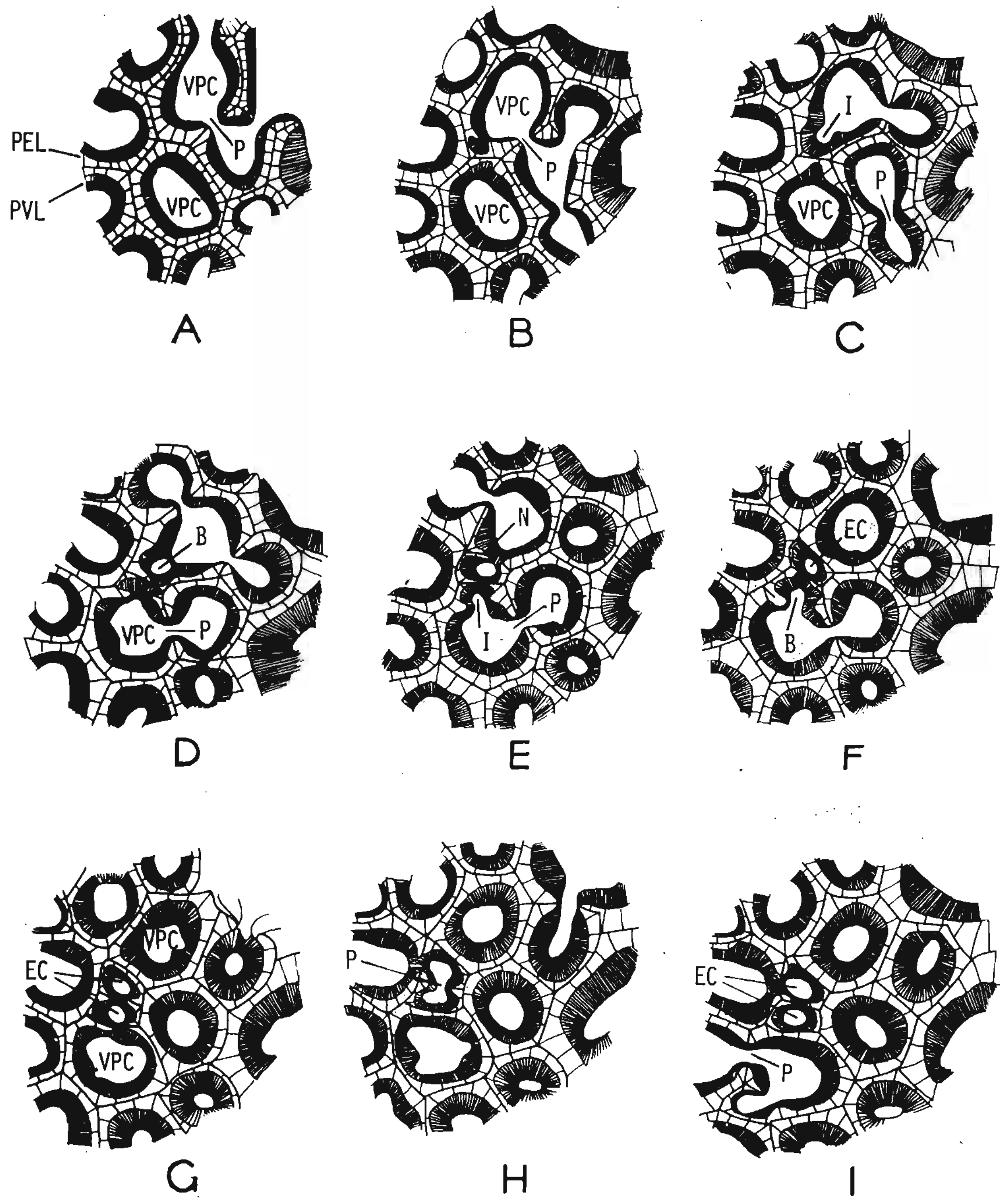

Fig. 10
Intracalicular-intravisceral budding occurring by the formation of a bud in a invagination on the wall of parent calice in *Thamnopora boloniensis* (GOSSELET); Kowala, Holy Cross Mts., Middle Frasnian (transversal sections, × 10). *A-C* — preblastic stage, *D-E* — hystero-nepionic stage, *F-G* — hystero-neanic stage, *H-J* — ephebic stage (for description see p. 37).

transformed into a hemispheric, lateral swelling, is formed at any point of the outer zone of the wall of the calice. A complete disappearance of all elements of septal apparatus and a lateral shift of tabulae, which laeve a completely smooth wall in the region of swelling, are charac-

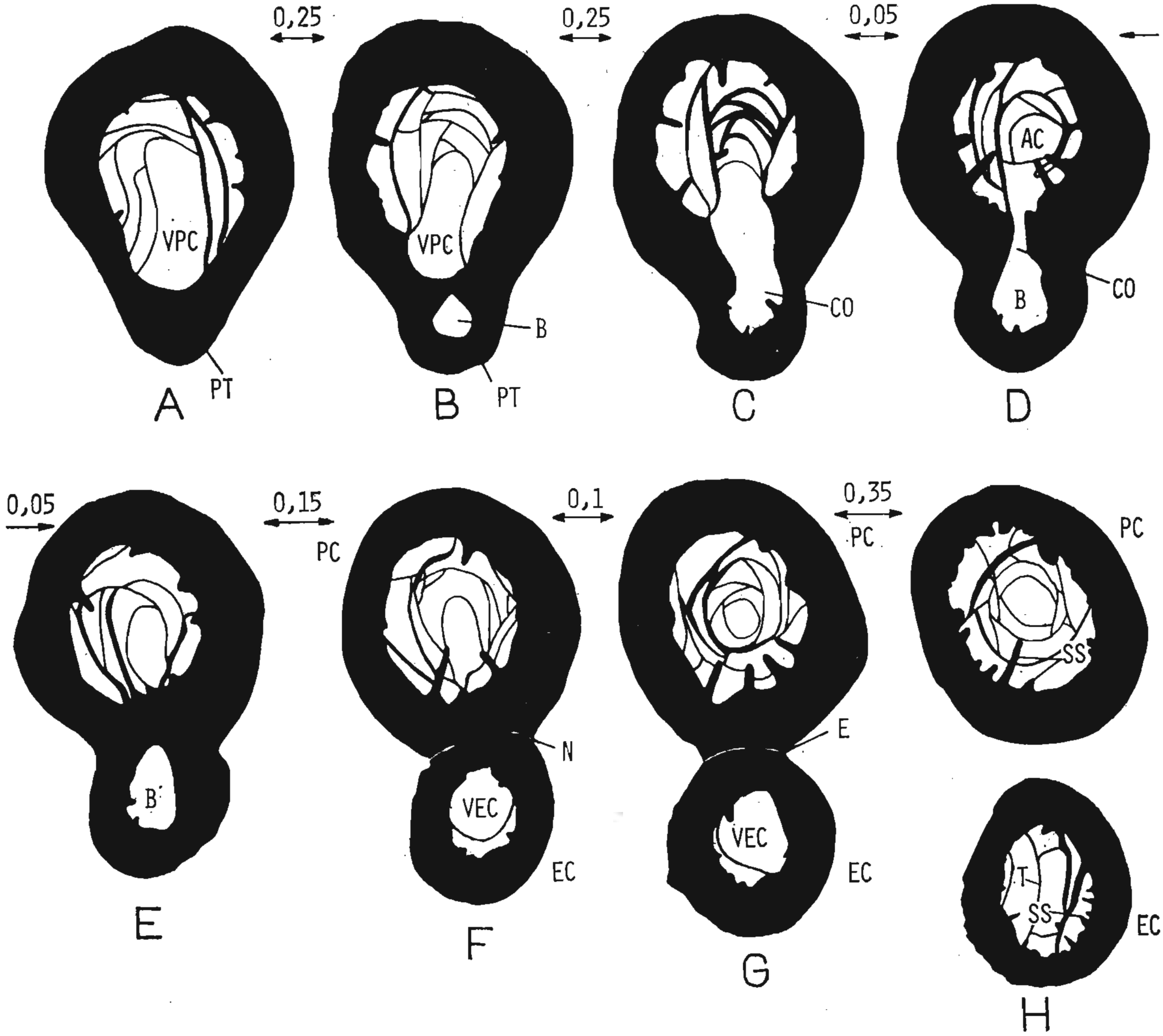

Fig. 11
Intracalicular-extravisceral budding in *Syringopora ramulosa* GOLDFUSS (ZPAL T IX/304); Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., Upper Visean, D_2 (transversal sections at intervals given in mm, × 20). *A-B* — preblastic stage, *C-F* — hystero-nepionic stage, *G* — hystero-neanic stage, *H* — ephebic stage (for description see pp. 37—40).

teristic phenomena observed on the inner surface of this part of wall of parent calice. In the next phase, a small microstructural irregularity appears inside the swollen wall of calice, followed by an irregularly spherical or ellipsoidal chamber in which the bud is formed. In transverse section, the chamber of bud is round, oval or triangular, 0.4 to 0.6 mm in diameter and separated laterally by a threshold from the visceral chamber of parent calice. The two chambers are connected with each other only at the top. In the preblastic stage, the development in the two species takes place in an about 0.4 to 0.6 mm long sector.

The hystero-nepionic stage (Text-fig. 11*C-F*). As seen in transverse section, the increasing lateral swelling of wall takes a circular shape. As a result of the lateral growth of wall, the connection between the chamber of bud and the visceral chamber of parent calice gradually contracts and subsequently closes, thus contributing to the separation of the bud from parent corallite. The wall separating the two chambers strongly thickens and the bud transforms into a young corallite which withdraws from parent calice. A distinct contraction is formed between the two corallites. At this moment the neotheca appears, gradually growing on both sides in the narrowest place from outside towards the middle. A complete separation of the young corallite from the parent individual takes place as soon as the neotheca is formed. The first, fine septal spines, followed by single, thin tabulae, appear in this stage. In the hystero-nepionic stage, the development in the two species takes place in a 0.3 to 0.5 mm long, vertical sector.

The hystero-neanic stage (Text-fig. 11*G*). After their complete separation, the young corallites are very similar morphologically to adult individuals and have walls of a normal thickness. The area of their transverse section makes up about 40 to 60 per cent of that of the parent calice. After forming the neotheca, the young corallite gradually withdraws from the parent individual and rapidly increases in diameter. In this stage, the corallite has already acquired all elements of its internal structure. The development takes place on an about 0.4 to 0.5 mm long sector.

The ephebic stage (Text-fig. 11*H*) is marked by a strong development of tabulae and septal spines and by an increase in the diameter of corallites up to a mean value characteristic of the species.

SYSTEMATIC PART

Class ANTHOZOA
Subclass TABULATA
Order FAVOSITIDA Sokolov, 1962
Suborder FAVOSITINA Sokolov, 1950
Family FAVOSITIDAE Dana, 1846
Subfamily EMMONSIINAE Lecompte, 1952
Genus **SQUAMEOFAVOSITES** Tchernychev, 1941

Type species: *Favosites hemisphaericus bohemicus* Počta (Počta, 1902; see also Kraicz, 1937).

Suplement to Dubatolov (1969) **diagnosis.** — The budding is of the intracalicular-mural (on the wall) type.

Remarks. — The genus *Squameofavosites* was separated by Tchernychev (1941) mostly on the basis of the structure of its septal apparatus which, in contrast to septal spines occurring in typical representatives of the Favositida (e. g., in the genera *Palaeofavosites*, *Multisolenia*, *Mesofavosites*, *Favosites*, *Pachyfavosites*), is developed in the form of squamulae. This genus was discussed by Tchernychev (1941), Sokolov(1955, 1962), Dubatolov (1959, 1962, 1963, 1969), Dubatolov & Lin -Bao Yui (1959) and Leleshus (1971). *Squameofavosites* differs from the related genus *Squamites* Leleshus from the Lower Devonian of Central Asia in considerably thinner walls of corallites, finer septal squamulae and a different arrangement of tabulae. In the genus *Squameofavosites*, the tabulae are mostly horizontal and in *Squamites* oblique, undulating and incomplete. Views are divergent concerning the numbers and place of the occurrence of connecting pores in the *Squameofavosites*. Dubatolov (1959) finds numerous pores on the walls of corallites where they are arranged in vertical rows (four or, sometimes, more of them). Barskaya & Scharkova (1963) mention pores occurring in the corners of corallites only. Dzjubo & Mironova (1960) and Dubatolov (1963) describe connecting pores both in the corners and on the walls of corallites. The septal apparatus of the *Squameofavosites* is not uniform (Dubatolov, 1969): in addition to squamae also septal spines may occur in some species, which relates them to the representatives of the genus *Squamites*. More than 70 species of the *Squameofavosites* have been described from deposits ranging between the Upper Silurian and the Middle Devonian. *Squameofavosites megasquamatus* sp. n. is the first Carboniferous species and the first representative of this genus ever found in Poland.

Distribution. — Upper Silurian: Western and Middle Europe, USSR. (Podolia, Kazakhstan, Tadjikistan, Kizil-Kum, Fergana, Altay, Vaygach Island, Novaya Zemlya); Upper Silurian through Lower Devonian: USSR (Ural, Central Asia, Tian-Shan, North-eastern Siberia); Upper Silurian through Middle Devonian: USSR (Kuznetsk Basin, Salair); Lower Devonian: Czechoslovakia, USSR (Taymyr, Kolyma Basin), Australia, North America, North Africa; Middle Devonian: China (Great Hingan), USSR (Upper Amur Basin); Lower Carboniferous: Poland (Holy Cross Mts.).

Squameofavosites megasquamatus sp. n.
(Pl. I, Figs 1*a*, *b*, 2, 3; Pl. II, Fig. 1)

Holotype: ZPAL T. IX/247; Pl.I, Fig. 1*a*, *b*.
Type horizon: Lower Carboniferous, Upper Visean, D_2 zone.
Type locality: Gałęzice village (the Ostrówka railway cutting), Holy Cross Mts.
Derivation of the name: *megasquamatus* — after its large septal squamulae.

Diagnosis. — Colonies spherical or hemispherical. Corallites polygonal, 2.0 to 2.5 mm in diameter. Walls 0.2 to 0.3 mm thick. Pores numerous, round, 0.15 to 0.2 mm in diameter, arranged in two vertical rows at 1.0 to 1.5 mm intervals. Septal squamae numerous, very strongly developed, frequently exceeding a half of the diameter of corallite. Tabulae numerous, horizontal, attached to septal squame.

Material. — Eleven complete, well-preserved colonies from Gałęzice (ZPAL T. IX/247-249, 252-257, A I-35/250, 251).

Dimension (in mm):

H×D	d	thw	dp	p-p	t-t
60-80×25-50	(1.8)2.0-2.5(3.0)	(0.1)0.2-0.3(0.35)	(0.1)0.15-0.2(0.25)	(0.8)1.0-1.5(2.0)	0. 2-2.0

Description. — Colonies small, spherical, hemispherical or slightly ovally elongate, composed of corallites, radially diverging from the middle of a colony and closely adhering to each other. Viewed in transverse sections, corallites are polygonal (mostly penta- to heptagonal) or polygonal with rounded corners. The visceral chambers in transverse sections are polygonal with rounded angles or, sometimes, very irregular. Walls of corallite straight, thick, without a secondary stereoplasmatic thickening and fibro-radial in microstructure. As revealed by transverse sections through corallite, the stereoplasmatic fibres are arranged perpendicularly and, by longitudinal sections, slightly obliquely to the walls of corallites. Epitheca poorly visible, forming a light-colored line. Pores numerous, round, arranged in two vertical rows, on the walls of corallites. Septal squamae numerous, very strongly developed, thick, long and as a rule exceeding a half of the inner diameter of corallite, sometimes even reaching the opposite wall. They are mostly strongly bent, less frequently straight and arranged somewhat obliquely to the walls of corallite. In transverse sections, they are semilunar in outline. Spaces between them amount to 0.5 to 1.0 mm. Septal squamae are situated most frequently above the connecting pores. Tabulae very thin, numerous, horizontal, oblique and bent, as a rule incomplete and attached to septal squamae. They do not penetrate the connecting pores up to the adjacent corallites.

Remarks. — *Squameofavosites megasquamatus* sp. n. differs from all the known species of this genus in a very strong development of septal structures and in a considerable thickness of the walls of corallites. This species displays a similarity to *S. hemisphaericus bohemica* (Poč-

TA) (= *S. bohemicus*) (KRAICZ, 1937; POČTA, 1902; TCHERNYCHEV, 1941; DUBATOLOV, 1959; DZJUBO & MIRONOVA, 1960) in a general appearance of its colony, diameter of corallites and connecting pores and intervals between squamae. On the other hand, it differs from this species in its smaller colonies, wider spacing of tabulae, which are as a rule incomplete, somewhat wider spacing of connecting pores and, primarily, in a stronger development of apparatus and a considerable thickness of the walls of corallites. In the form of its corallites, development of septal apparatus and diameters of connecting pores, arranged in two rows, *S. megasquamatus* resembles the Upper Silurian species, *S. incredibilis* CHEKHOVICH, 1964 from which it differs, however, in considerably larger diameters of corallites, more strongly developed septal apparatus, thicker walls of corallites and a wider spacing of connecting pores and tabulae. The colonies of *S. megasquamatus* encrusted colonies of *Michelinia tenuiseptata* (PHILIPPS) and stems of crinoids, which are frequently observed as foundations of a colony.

Subgenus **SQUAMEOFAVOSITES (DICTYOFAVOSITES)** TCHERNYCHEV, 1951

Type species: *Favosites (Dictyofavosites) salairicus* TCHERNYCHEV, 1951.

Diagnosis (according to DUBATOLOV, 1969, supplemented). — Colonies massive, spherical, hemispherical or discoidal. Corallites small, prismatic, straight, polygonal in transverse section, having relatively thick walls. Pores numerous, large, round or oval. Septal apparatus in the form of squamae and spines or reduced, sometimes lacking. Tabulae straight, horizontal, usually at the same level with those in adjacent corallites.

Remarks. — The distribution of tabulae at the same level in adjacent corallites was mentioned by TCHERNYCHEV (1951) and DUBATOLOV (1959) as an only character differing this subgenus from the *Favosites*. On the basis of such characters as the development of septal apparatus in the form of squamae and spines (or its partial or complete reduction), distribution of connecting pores on the walls and in the corners of corallites and situation of tabulae at the same level with those in adjacent corallites, MIRONOVA (1957, 1960), SOKOLOV (1962) and DUBATOLOV (1960, 1963) considered *Dictyofavosites* as a separate genus. In his later work DUBATOLOV (1969) recognized *Dictyofavosites* as a subgenus of the genus *Squameofavosites*. Difficulties of establishing the taxonomic position of this form result from an unsufficient degree of its knowledge and from the fact that its representatives display several characters transitional between the genera *Favosites*, *Hattonia*, *Pachyfavosites*, *Squameofavosites* and *Emmonsia*. To the genus *Favosites* they are similar in a general structure of colony and outline of corallites, to *Hattonia* — in the distribution of tabulae, to *Pachyfavosites* — in the thickness of the walls of corallites as well as in size and distribution of connecting pores, to *Emmonsia* — in the structure of septal apparatus and to *Squameofavosites* — in the type of the microstructure of walls, size and spacing of connecting pores and development of septal apparatus. As shown by TONG-DZUY THANH (1967), the arrangement of tabulae at an identical level with those on adjacent corallites is not a permanent character of *Dictyofavosites*. Frequently, its septal apparatus is also strongly reduced or completely atrophied. Taking into account a considerable similarity in morphological characters, treating *Dictyofavosites* as a subgenus within limits of the *Squameofavosites*, seems to be most strongly justified. Ten species of this subgenus have been described from the Lower Devonian deposits. No representatives of this subgenus have ever been described from Poland.

Distribution. — Lower Devonian: USSR (Kuznetsk Basin, Salair, Tas Chaiatach, Kolyma Basin); Upper Givetian: Poland (Cracow Region).

Squameofavosites (Dictyofavosites) pachyfavositoides sp. n.

(P. I, Fig. 4; Pl. II, Figs 2*a*, *b*, 3*a*, *b*, Text-fig. 12*A*, *B*)

Holotype: ZPAL T IX/1, Pl. II, Fig. 2*a*—*b*.
Type horizon: Upper Devonian, Middle to Upper Frasnian stage.
Type locality: Żbik and Dębnik (Żarnówczany Dół locality) in the Cracow Region.
Derivation of the name: similar to the genus *Pachyfavosites*.

Diagnosis. — Colonies spherical and hemispherical. Corallites small, very long, straight, radially arranged, polygonal in transverse sections and 0.5 to 0.7 mm in diameter. Walls 0.04 to 0.1 mm thick. Pores numerous, large round or slightly elliptical, in diameter 0.2 to 0.22 mm, spaced at 0.6 to 0.8 mm intervals. Septal elements strongly reduced. Tabulae thin, horizontal, straight or slightly bent at intervals of 0.2 to 1.1 mm, frequently arranged at the same level as those in adjacent corallites.

Material. — Two complete colonies from Żbik (ZPAL T IX/1, 2) and two large fragments of a colony from Dębnik — Żarnówczany Dół lccality, (ZPAL T IX/3, 4).

Dimensions (in mm):

H×D	d	thw	dp	p-p	t-t
90×80×100	(0.4)0.5-0.7(0.8)	0.05-0.1	0.2-0.22	0.6-0.8(0.9)	(0.2)0.4-0.8(1.1)

Description. — Colonies massive, irregularly spherical or hemispherical. Corallites small, very long, straight, regular, closely adhering to each other, radially diverging from the central part of the colony and emerging from it perpendicularly to its surface. Calices polygonal, with blunted edges and diameters approximating those of corallites. In transverse sec-

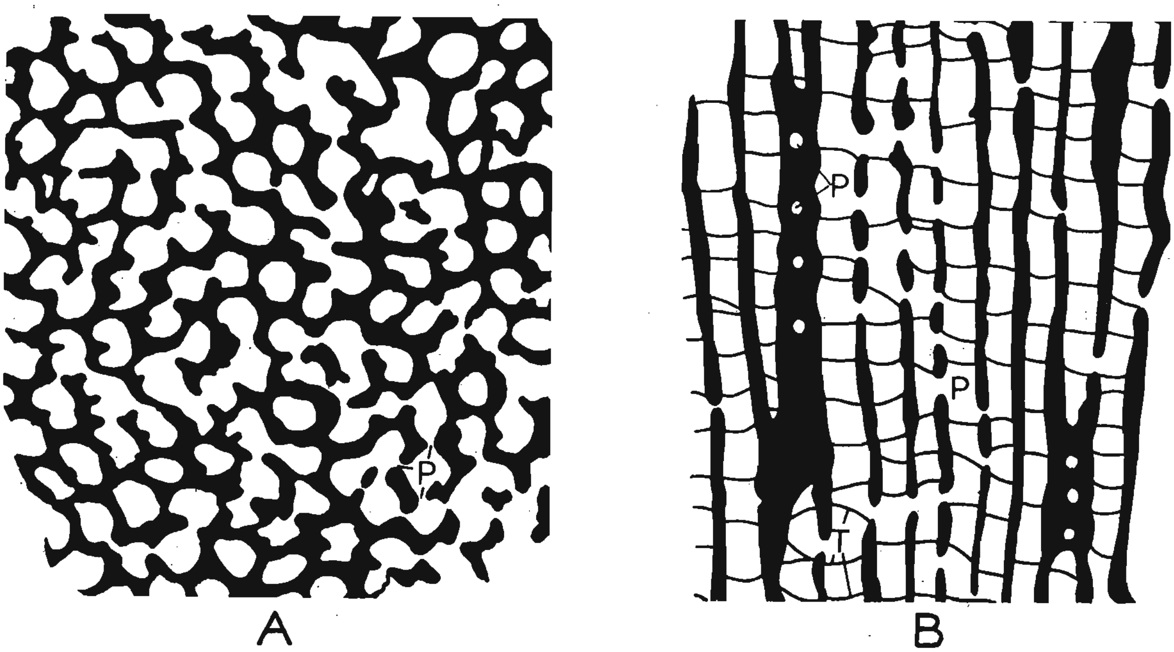

Fig. 12
Squameofavosites (Dictyofavosites) pachyfavositoides sp. n., Żbik (Cracow Region), Middle Frasnian, holotype (ZPAL T IX/1): *A* — transversal section, *B* — longitudinal section; × 6.5.

tions, corallites are more or less regularly polygonal (mostly penta- or heptagonal), less frequently polygonal and rounded, sometimes polygonal and elongate. Also in transverse sections, the lumina of corallites are rounded, oval, or, very rarely, irregularly rounded as a result of the thickening of the walls of corallites, which have fibro-radial miscrostructure. In longitudinal sections, stereoplasmatic fibers are situated strongly obliquely to the surface of the walls of corallites. Median suture distinct, thin, dark-colored. Connecting pores numerous, large, round or suboval, regularly arranged in one row on the walls of corallites, Septal structures absent or occurring very rare in the form of thick spines. Tabulae numerous, thin, sometimes secondarily thickened, continuous horizontal or somewhat oblique, straight or slightly bent, frequently arranged at the same level as those in adjacent corallites.

Remarks. — *Squameofavosites (Dictyofavosites) pachyfavositoides* sp. n. differs from all representatives of this subgenus known so far in the smallest diameters of corallites, in a thin wall and an almost complete lack of septal apparatus. With a small diameter of corallites, their walls are, however, relatively thick. The visceral chambers of corallites are rounded in transverse section and very similar to those of the representatives of the genus *Pachyfavosites*. *S. (D.) pachyfavositoides* displays a similarity to *S. (D.) tschernajaensis* DUBATOLOV, 1959 in the spacing of connecting pores and tabulae. On the other hand, it differs from this species in the shape of its colony, thinner walls of corallites, a somewhat smaller diameter of connecting pores and in an almost complete absence of septal apparatus. *S. (D.) pachyfavositoides* sp. n. is the first species ever described from the Middle Devonian (Upper Givetian).

Genus **EMMONSIA** MILNE-EDWARDS & HAIME, 1851

Type species: *Favosites emmonsi* ROMINGER, 1876.

Diagnosis (according to DUBATOLOV, 1963, supplemented). — Colonies spherical and hemispherical, composed of radially deverging, polygonal corallites, opening perpendicularly to the surface of a colony. Walls thick. Pores numerous, large, round, sometimes elliptical, distributed in one to three vertical rows situated at different levels in adjacent corallites. Tabulae few, poorly developed, incomplete. Septal apparatus in the form of strongly developed spoonlike squamae. Reproduced by an intracalicular-mural budding.

Remarks. — In his diagnosis, YANET (1959) erroneously maintains that the septal apparatus in the representatives of *Emmonsia* is developed in the form of squamous spines. This genus was discussed by SOKOLOV (1962), DUBATOLOV (1963) and TONG-DZUY THANH (1967), So far, about twenty of its species have been described from deposits ranging between the Upper Ludlovian and Lower Carboniferous. Only one species, *E. dalniae* STASIŃSKA from the Tournaisian of the Holy Cross Mts. (STASIŃSKA, 1973) has hitherto been known from Poland.

Distribution. — Upper Silurian through Middle Devonian: Ireland, England, Spain, Austria, Turkey, USSR (Kuznetsk Basin, Kazakhstan, Ural, Taymyr, Eastern Siberia), Central Asia, China, North America (USA); Devonian: Vietnam, Australia (New South Wales); Lower Carboniferous: Poland (Holy Cross Mts.), Belgium, USSR (Kazakhstan, Ural).

Emmonsia czarnieckii sp. n.
(Pl. III, Figs 1, 2)

Holotype: ZPAL T IX/264.
Type horizon: Lower Carboniferous, Upper Visean, D_2.
Type locality: Holy Cross Mts., Gałęzice (railroad cut on Ostrówka Hill).
Derivation of the name: In honour of Dr STANISŁAW CZARNIECKI.

Diagnosis. — Colonies small, spherical and hemispherical. Corallites regularly polygonal, rounded, 1.0 to 1.5 mm in diameter. Walls 0.1 to 0.2 mm thick. Connecting pores large, round, 0.15 to 0.20 mm in diameter, arranged in two vertical rows, spaced at 0.5 to 1.0 mm intervals. Septal squamae large, strongly developed. Tabulae very rare, thin incomplete, developed only in the central part of colony.

Material. — Ten colonies from Gałęzice, including eight complete and two fragmentary (ZPAL T IX/259-264, 266, 267 and AI-35/258, 265).

Dimensions (in mm):

H×D	d	thw	dp	p-p
15×10×25	(0.8)1.0-1.5(1.8) and 1.3-1.5×1.7-2.2	0.1-0.15(0.2)	0.15-0.2 and 0.2×0.3	0.5-0.8(1.0)

Description. — Colonies small, more or less regularly spherical, hemispherical or ellipsoidal. Corallites straight, closely adhering to each other, diverging radially from the central part of colony and opening perpendicularly to its surface. Their dimensions increase uniformly together with the growth of colony. In transverse sections, corallites are regularly polygonal (penta-hexa- or heptagonal), with rounded corners, less frequently elongate, oval in outline. Calices low, slightly separated, straight, with blunted edges. Walls irregular in thickness, with a fibro-radial microstructure, strongly swollen in the corners of corallites. In longitudinal sections, the fibers of stereoplasma are arranged slightly obliquely to the surface of corallite walls. Median suture (epitheca) well visible in some parts of colony in the form of a thin, dark, dotted line. Connecting pores large, numerous, well developed, round or, very rarely, elliptical, arranged in two vertical rows on the walls of corallites. Pores distributed on various levels in adjacent corallites and, in transverse sections of colonies, frequently visible in the angles of corallites. Septal apparatus in the form of many large, strongly developed, thick, obtuse or sharp squamae, arranged obliquely or, less frequently, perpendicularly to the walls of corallites at intervals of 0.4 to 1.0 mm, mostly 0.5 to 0.8 mm. Single squamae frequently reach the center of the visceral chamber of corallite. In transverse section they are semilunar. Tabulae very rare, thin, incomplete, irregularly twisted, occurring only in the initial development stages of colonies. Colonies of *E. czarnieckii* sp. n. frequently overgrow the stems of the Crinoidea.

Remarks. — *Emmonsia czarnieckii* sp. n. differs from other species of this genus in a very strongly reduced tabulae, occurring only in early developmental stages of a colony, in very thick septal squamae and in round and oval (and not angular) outlines of transverse sections of the visceral chamber which is of the *Pachyfavosites* type. In the size and shape of colony arrangement of corallites, thickness of walls as well as diameter and spacing of connecting pores this species resembles *E. dalniae* STASIŃSKA (1973), however, in smaller diameters of corallites, an occurrence of elliptical pores and a slightly different development of septal squamae. *E. czarnieckii* sp. n. also displays a certain similarity, in the shape of colony and shape and diameter of corallites, to the Middle Devonian species *E. globosa* DUBATOLOV, (DUBATOLOV, 1963), but differs from it in thinner walls of corallites, having round internal outlines, larger connecting pores, more strongly developed and thicker septal squamae and less strongly developed tabulae.

Family MICHELINIIDAE WAAGEN & WENTZEL, 1886
Subfamily MICHELINIINAE WAAGEN & WENTZEL, 1886
Genus MICHELINIA de KONINCK, 1841
(= **Eumichelinia** YABE & HAYASAKA, 1915; **Leptopora** RAFINESQUE, 1819)

Type species: *Calamopora tenuisepta* PHILLIPS, 1836 (= *Michelinia tenuisepta* de KONINCK, 1841).

Diagnosis (according to de KONINCK, 1841, extended). — Colonies massive, lumpy, hemispherical. Corallites polygonal, favositoid. Calices polygonal, sharp-edged. Walls thin, turbulently lamellar in microstructure. Connecting pores numerous, irregularly scattered over the walls of corallites. Septal apparatus in the form of serrate (granulate) vertical furrows with strongly developed septal spines. Tabulae numerous, thin, strongly twisted, frequently incomplete, turning in a vesicular tissue. Reproduction by intracalicular-intravisceral budding.

Remarks. — Discussed by F. A. ROMER (1851-1856), C. F. ROEMER (1863), FRAIPONT (1888), HILL (1942), JONES (1944), ROSS (1953), MINATO (1955), SOKOLOV (1955, 1962), DUBATOLOV (1959, 1962) and OMARA (1971), this genus displays a considerable morphological similarity to *Pleurodictyum*. For this reason, the two genera have very frequently been considered as one genus, *Michelinia* (FENTON & FENTON, 1936; LANG, SMITH & THOMAS, 1940; SMITH, 1941; STUMM, 1950 and others) or the *Michelinia* has been considered as a synonym of *Pleurodictyum* (FONTAINE, 1955). NICHOLSON (1879), MOORE & JEFFERDS (1945), SOKOLOV (1950, 1955, 1962), LECOMPTE (1952) and DUBATOLOV (1959 1962) and others consider *Michelinia* and *Pleurodictyum* as two separate genera. The irregular arrangement of the connecting pores in *Pleurodictyum* does not differ this genus from *Michelinia* as emphasized by SOKOLOV (1955, 1962) and DUBATOLOV (1959, 1962), since, as follows from the present writer's observations, the connecting pores are irregularly scattered over the walls of corallites in the representatives of both genera. A certain order in the arrangement of connecting pores, disposed in two or three chevron-like rows, was found by TCHUDINOVA (1965) in two Upper Permian species of *Michelinia* from the Transcaucasia. It seems that an essential difference between the two genera lies in the microstructure of corallite walls, but there are divergent opinions on this subject. A granular microstructure in *Pleurodictyum* and lamellar in *Michelinia* were found by STUMM (1950), LAFUSTE (1959) and OMARA (1971). According to SOKOLOV and DUBATALOV, *Michelinia* displays a lamellar microstructure, frequently turbulent in character and *Pleurodictyum* a fibro-radial one. *Michelinopora*, separated, along with *Eumichelinia* and *Protomichelinia*, by YABE & HAYASAKA (1915) as a subgenus of *Michelinia*, is considered at present as a separate genus, differing from *Michelinia* in long corallites, simple structure of tabulae (frequently complete and horizontal), and in the lack of septal structures. In *Michelinopora*, the connecting pores are also irregularly scattered and the microstructure is fibro-radial (TCHUDINOVA, 1965), which make it similar to *Pleurodictyum*.

The separate character of the three genera discussed above is also indicated by different time of their occurrence. The strongest development of *Pleurodictyum* falls in the Lower and Middle Devonian, of *Michelinia* — Lower Carboniferous through Permian and *Michelinopora* — Lower through Upper Permian. The genus *Michelinia* has not so far been described from Poland.

Distribution. — Lower to Middle Devonian: Turkey; Lower Devonian through Lower Carboniferous: Australia (Victoria, New South Wales, Queensland); Lower Devonian through Upper Carboniferous: USA; Middle Devonian: Canada, Bolivia; Middle Devonian through Upper Permian: USSR, China; Upper Devonian through Lower Carboniferous: Indochina; Lower Carboniferous: England, Ireland, France, Belgium, Germany, Poland, Hungary, Africa (Morocco, Egypt); Lower Carboniferous through Lower Permian: Austria; Lower Carboniferous through Upper Permian: Iran, Timor; Upper Carboniferous through Lower Permian: Spitsbergen; Lower Permian: Timan, Turkey; Upper Permian: Yugoslavia; Permian: Japan, India; Upper Permian through Lower Triassic: USSR (Transcaucasia).

Michelinia tenuisepta (PHILLIPS, 1836)
(Pl. III, Figs 3-5; Pl. IV, Figs 1-4)

1836. *Calamopra tenuisepta* PHILLIPS; J. PHILLIPS, p. 201, Fig. 50.
1852. *Michelinia tenuisepta* (PHILLIPS); H. MILNE-EDWARD & J. HAIME, p. 144, Pl. 49, Figs 1, 1*a*, 1*b* (here synonymy).
1872. *Michelinia tenuisepta* (PHILLIPS); L. G. de KONINCK, p. 133, Pl. 13, Fig. 2.
1880-1897. *Michelinia tenuisepta* (PHILLIPS); C. F. ROEMER, I (2), p. 430.
1919. *Michelinia tenuisepta* (PHILLIPS); K. E. GABUNIA, p. 8 (here synonymy).
1924. *Michelinia tenuisepta* (PHILLIPS); J. J. TOLMACHOFF, p. 300.
1931. *Michelinia tenuisepta* (PHILLIPS); J. J. TOLMACHOFF, Pl. 22, Fig. 1-3.
1931. *Michelinia tenuisepta* (PHILLIPS); V. D. FOMITCHEV, p. 5, Pl. 1, Figs. 1*a*, *b*; Fig. 1.
1962. *Michelinia tenuisepta* (PHILLIPS); T. A. DOBROLJUBOVA & N. W. KABAKOVITSH, p. 116, Pl. C-3, Figs 7, 8.
1966. *Michelinia tenuisepta* (PHILLIPS); T. A. SAJUTINA, p. 205, Pl. 37, Figs 2, 3.

Diagnosis. — (according to DOBROLJUBOVA & KABAKOVITSH, 1962 — supplemented). — Colonies large, bulbous or spindle-shaped. Corallites long, polygonal in transverse section, 6.0 to 10.0 mm in diameter. Calices situated at an angle of 65° to 70° to the surface of colony. Walls 0.2 to 0.8 mm thick. Connecting pores rare and irregularly spaced, round, 0.2 to 0.3 mm in diameter. Septal spines rare, strongly developed, also occurring on tabulae. Tabulae numerous, thin, incomplete, twisted, near the wall of corallite forming a vesicular tissue.

Material. — Seventeen well-preserved, almost complete colonies from Gałęzice. (ZPAL T. IX/268-273, 275, 276, 278-281, 284; AI-35/274, 277, 282, 283).

Dimensions (in mm.):

H×D	d	thw	dp	p-p
100-150×70-120×70-90	(6.0)7.0-8.0(10.0)	(0.2)0.4-0.6(0.8)	0.2-0.3	2.0-6.5

Description. — Colonies bulbous, irregularly spindle-shaped, or spherical, varying in size. In the axial zone of a colony corallites are arranged parallel to the growth axis of colony. In the peripheral zone, they gently deflect arcuately from the central zone and open on the surface at an angle of 65° to 70°. Calices polygonal, regular, 5.0 to 10.0 mm in depth, with diameters approximating those of corallites, and with sharp edges. Corallites long, prismatic, more or less regularly polygonal (mostly hexa- to heptagonal) in transverse section. Corallite walls varying in thickness in particular zones of a colony. Microstructure turbulently lamellar.

Median suture distinct, dark, sometimes strongly folded. A secondary stereoplasmatic swelling of the wall of corallites and tabulae is observed locally in some parts of a colony. Connecting pores round, widely and irregularly spaced on the walls of corallites. Septal apparatus in the form of uneven, granular septal crests, with irregularly spaced short spines. Separate, short and pointed spines frequently occur on tabulae. Tabulae numerous, thin, incomplete; strongly and irregularly twisted, sometimes forming a vesicular tissue near the walls of corallites.

Remarks. — Colonies of *Squameofavosites megasquamatus* sp. n. frequently develop on those of *M. tenuisepta*.

Distribution. — Belgium: Tournaisian to Visean; France, Australia: Visean; Great Britain, Ireland, USSR (Central Russia, Kazakhstan, Siberia): Lover Carboniferous; USSR (Moscov and Kuznetsk basins, Western Siberia, Nova Zemla): Tournaisan; Timan: Upper Carboniferous.

Michelinia aseptata sp. n.

(Pl. IV, Figs 5-7; Text-fig. 13*A*, *B*)

Holotype: ZPAL T IX/285; Pl. IV, Fig. 5.
Type horizon: Lower Carboniferous, Upper Visean, D_2.
Type locality: Gałęzice, Holy Cross Mts. (railorad cut on Ostrówka Hill).
Derivation of the name: Lat. *aseptata* — devoid of septal spines.

Diagnosis. — Colonies small, irregular, up to 20×30×40 mm in size. Corallites short, polygonal in transverse section. 2.0 to 3.5 mm in diameter. Corallite walls 0.2 to 0.3 mm thick,

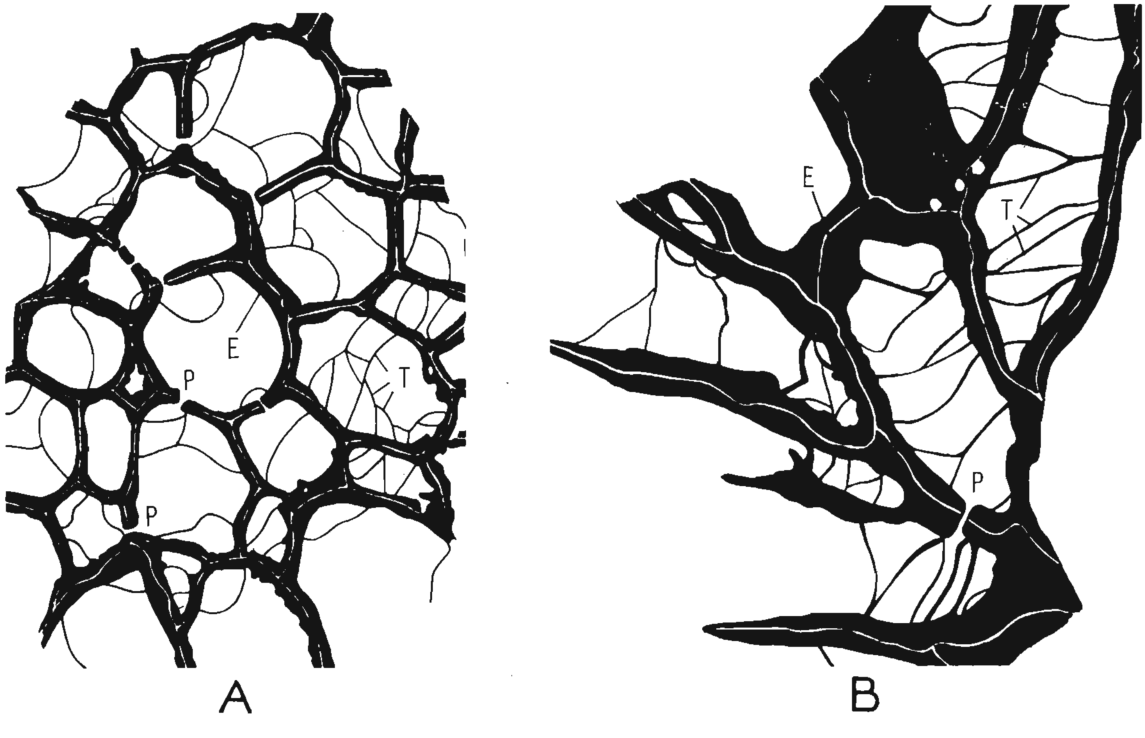

Fig. 13
Michelinia aseptata sp. n., Gałęzice (railway cut on the Ostrówka Hill), Holy Cross Mts., Upper Visean, D_2, holotype (ZPAL T IX/285): *A* — transversal section, *B* — longitudinal section; × 6.5.

Connecting pores round, irregular and widely scattered on corallite walls, frequently ocurring in corallite corners. Tabulae numerous, thin, twisted or straight, locally oblique. No vesicular tissue and septal spines observed.

Material. — Four well-preserved, nearly complete colonies from Gałęzice (ZPAL T. IX/285-288).

Dimensions (in mm):

H×D	d	thw	dp	t-t
30-40×15-20	(1.5)2.0-3.0(4.0)	(0.1)0.2-0.3(0.35)	0.1-0.15(0.2)	0.2-1.5

Description. — Colonies irregular or irregularly spindle-shaped, composed of radially diverging corallites. Calices funnel-like or conical, relatively deep (2.0 to 4.0 mm, mostly 2.5 mm), regularly polygonal in transverse section, terminating in sharp edges. Corallites short, straight, more or less polygonal (tetra- to hepta-, mostly penta- to hexagonal) in transverse section. Corallite lumina have the shape of rounded polygons. Median suture distinct, dark, frequently folded. Connecting pores round, widely and irregularly scattered on corallite walls, frequently in corallite corners. Tabulae numerous, thin, incomplete, irregularly twisted or obliquely disposed to corallite walls, irregularly spaced, not forming a vesicular tissue. Septal spine lacking.

Remarks. — *M. aseptata* sp. n. is similar to the Lower Carboniferous species *M. parasitica* (PHILLIPS, 1836; MILNE-EDWARDS & HAIME, 1850, 1852, 1854; MC COY, 1844; de KONINCK, 1872; STUCKENBERG, 1895) in the size and shape of colony, shape and length of corallites, distribution of connecting pores and shape and arrangement of tabulae, but differs from it in somewhat larger diameters of corallites, deeper calices and pores smaller in diameter. The new species is also similar to the Lower Carboniferous *M. concinna* (LONSDALE, 1845; MURCHINSON, 1845; MILNE-EDWARDS & HAIME, 1853; EICHWALD, 1860; STUCKENBERG, 1895) in general structure and length of corallites and the presence of many incomplete tabulae. On the other hand, it differs from it in larger diameters of corallites, smaller colonies, deeper calices and more irregularly arranged and more strongly twisted tabulae.

Family PALAEACIDAE POČTA, 1902
Genus **PALAEACIS** HAIME *in* MILNE-EDWARDS, 1857

Type species: *Palaeacis cuneiformis* HAIME *in* MILNE-EDWARDS, 1857. Lower Carboniferous (Mississippian), Indiana, USA.

Diagnosis (after SANDO, 1969, supplemented). — Colonies small, flat, composed of few, very short corallites. Calices shallow, round or oval in transverse section. Walls very thick, spongy in microstructure, pierced by many anastomosing, tortuous canals having their outlets both on the surface of colony (between calices) and — in the form of many pores — inside calices. Septal structures in the form of irregular costae or vertical rows of tubercles, sometimes absent at all. No tabulae.

Remarks. — The genus *Palaeacis* was originally assigned to the Eupsammidae (Hexacoralla) or to the Spongiae (VERRILL, 1864). Its characteristics and comparisons with related genera were given by HINDE (1896), GERTH (1921), SMYTH (1929), MOORE & JEFFORDS (1945), HILL & STUMM (1956) and SOKOLOV (1955, 1962). About twenty species of this genus have been described from Lower Carboniferous through Upper Permian. The following two species are known from the territory of Poland: *P. laxa* LUDWIG from the Carboniferous of Silesia (KUNTH, 1869) and *P. antiqua* (MC COY, 1844, 1847), described by WEIGNER (1938) from what is known as the Gołonóg sandstones as *Microcyathus antiquus* MC COY, 1844.

Distribution. — Lower Carboniferous: Poland (Silesia, Silesia-Cracow Upland), Ireland, Great Britain (Scotland, Isle of Man), Belgium, Australia (Queensland), USA (Arkansas, Illinois, Indiana, Iova, Kentucky, Missouri, Oklahoma); Upper Carboniferous: Yugoslavia (Dalmatia), USA (Texas); Permian: Timor.

Palaeacis orlei sp. n.
(Pl. V, Figs 1*a*, *b*, 2*a*, *b*)

Holotype: Specimen AI-35/290; Pl. V, Fig. 1*a*, *b*.
Type horizon: Lower Carboniferous, Upper Vissean, D_2.
Type locality: Zalas (Orlej gorge), Cracow Region.
Derivation of the name: *Lat. orlei* — after the Orlej gorge in Zalas.

Diagnosis. — Colonies flat, triangular, 11×14 mm and 5.0 to 7.0 mm high, composed of three corallites forming an isosceles triangle. Calices round, 4.5 to 5.5 mm in diameter and to 2 mm deep, flat and bowl-like in longitudinal section, slightly projecting from the coenenhyma of colony. Anastomosing canals most frequently perpendicular to corallite walls, opening with pores between tubercles. Septal structures in the from of low knobs, arranged in vertical rows.

Material. — Six incomplete but rather well-preserved colonies from Orlej. (AI-35/289-294). Dimensions (in mm):

H×D	C-C	d
5-7×11-12×12	1.8-2.2	4.5-5.5

Description. — Colonies small, flat, shaped like a triangular shield, slightly convex upwards composed of three corallites forming an isosceles triangle. Calices round or suboval in transverse section. In longitudinal section, they display the shape of shallow (to 2 mm deep), asymmetric flat-bottomed bowls, slightly projecting with their rounded edges from the coenenhyma. Particular calices are separated from each other by shallow furrows more distinct on the periphery of colony. Narrow spaces between calices and the entire upper surface of colony are covered with closely but irregularly spaced round, oval or triangular, strongly elongate and horseshoe-like tubercles, forming a characteristic, rough ornamentation. These tubercles also pass to calice edges and, partly, onto the basal side of colony. Corallite walls very thick, not separated, fusing with the coenenhyma. Median suture lacking. The microstructure of walls and coenenhyma spongy. Both corallite walls and coenenhyma are pierced by many tortuous, branching and connecting canals which are oval, round or irregular in transverse section, 0.1 to 0.2 mm in diameter, frequently running perpendicularly to the inner surface of calices and opening between tubercles. Septal tubercles well-developed, sometimes spiny, arranged in 35 to 40 vertical rows resembling costae. They frequently branch dichotomously towards the aperture of calice. Calice bottom covered with similar, irregularly scattered tubercles. Basal surface of colony slightly convex or flat, covered with fine tubercles arranged in more or less distinct rows running radially towards its central part. Basal part of colony consists of two layers: outer, that is, epitheca which is 0.8 to 1.2 mm thick and radial in microstructure and inner, 0.1 to 0.22 mm thick, spongy in microstructure, similar to that of coenenhyma but not pierced by anastomosing canals. Several thick growth increments are clearly visible on basal surface. The characteristic, three- or six-radial symmetry of the colony was probably developed so that at first a triangular plate was formed consisting of three calices situated in the angles of the triangle. A further growth of calices took place by the budding of a new individual in succession or simultaneously at the bases of this triangle (outwardly, between two adult individuals). Thus, a six-calice colony was formed.

Remarks. — *Palaeacis orlei* sp. n. differs from so far known species in the arrangement of calices and order of their budding (cf. Text-fig 14*a-d*). A similar, triangular arrangement of calices is visible in a fragmentary colony of *Microcyathus cyclostoma* (PHILLIPS, 1836; GERTH, 1921; HILL & STUMM, 1956). The differences between *P. orlei* sp. n. and other species of this genus, expressed in the arrangement of calices in the colony and in the order of their budding, are shown in Text-fig. 14*a-d*. *P. orlei* sp. n. is most similar to *P. antiqua* MC COY (MC COY,

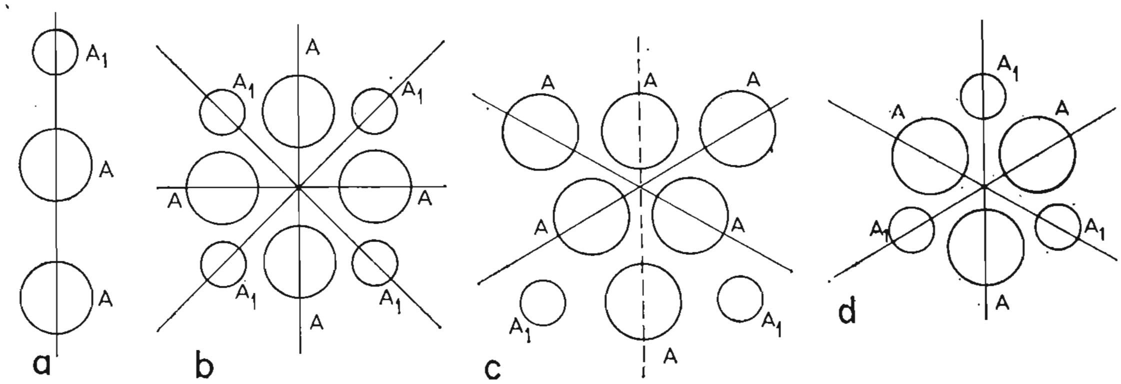

Fig. 14
Diagram of adult corallites distribution and the place in which young corallites are formed in various species of *Palaeacis* MILNE-EDWARDS & HAIME. *a* — linear arrangement of corallites in the Lower Carboniferous *P. cuneiformis* MILNE-EDWARDS & HAIME (a bilaterally symmetric colony); *b* — tetramerous arrangement of corallites in the Permian *P. regularis* GERTH and *P. tubifer* GERTH (at first tetramerous symmetry, later passing into bilateral), *c* — at first triangular, later bilateral arrangement of corallites in the Lower Carboniferous *P. antiqua* (MC COY); *d* — triangular arrangement of corallites in the Lower Carboniferous *P. orlei* sp. n., *A* — calices of adult individuals, A_1 — calices of young individuals (see pp. 51—52).

1844; CRAMER, 1910), described by WEIGNER (1938) as *Microcyathus antiquus* (MC COY), in the shape and diameter of the flat-bottomed calices and in the structure of septal apparatus. The new species differs, however, from *P. antiqua* in considerably smaller colonies composed of a smaller number of individuals, a different arrangement of calices which to not project above the surface of colony and somewhat larger spaces between calices. It also differs from the holotype in a different arrangement of corallites in the colony, considerably larger diameters of calices and an irregular scattering of tubercles over the upper surface of colony.

Suborder THAMNOPORINA SOKOLOV, 1962
Family PACHYPORIDAE GERTH, 1921
Subfamily THAMNOPORINAE SOKOLOV, 1950
Genus **THAMNOPORA** STEININGER, 1831

Type species: *Thamnopora madreporacea* STEININGER, 1831 and 1849 (= *Calamopora polymorpha* var. *ramoso-divaricata* GOLDFUSS, 1829; *Thamnopora cervicornis* SMITH, 1945). Found by SMITH and LANG, described in HILL'S (1937) work. Middle Devonian of Bensberg, Germany.

Diagnosis. — See TCHUDINOVA, 1959.

Remarks. — A genus which was extensively discussed by LECOMPTE, (1936, 1939), SOKOLOV (1952, 1955, 1962), TCHUDINOVA (1959) and DUBATOLOV (1959). A considerable similarity to the fine-branched *Thamnopora* is displayed by the representatives of the genus *Gracilopora* TCHUDINOVA. According to TCHUDINOVA (1964) and DUBATOLOV (1969), the genus *Gracipora* differs from *Thamnopora* in an indistinct, obscure, fibro-radial misroctructure of walls, a less strongly developed median suture, septal spines and tabulae and smaller diameters of corallites. The poor development of septal spines in *Gracilipora,* emphasized by DUBATOLOV (1969), is not, in the present writer's opinion, an essential character in which it differs from *Thamnopora*, since, as is well-known, many species of *Thamnopora* also display a very poor development or even a complete lack of these elements. Also insufficiently explained is the problem of the arrangement of calices in the genera *Thamnopora, Parastriatopora* and *Gracilipora.* TCHUDINOVA'S (1959) and many other author's general statement that calices in the representatives of *Thamnopora* are perpendicular to the surface of branches (which, according to TCHUDINOVA, is a character relating this genus to *Parastriatopora*) is not in all cases correct. As follows from the present writer's analysis, for *Thamnopora* characteristic is a more or less oblique arrangement of calices, while in *Parastiatopora* calices are as a rule perpendicular to the surface of branches. More than 150 species of *Thamnopora* have so far been described, including about twenty subspecies, from deposits ranging between the Silurian through the Permian. The following eight species are known from Poland: *T. micropora* LECOMPTE from the Cuvinian of Grzegorzowice, *T. reticulata* (BLAINVILLE) from the Givetian of Skały, *T. cervicornis* (BLAINVILLE) from the Givetian of Sitkówka and *T. boloniensis* (GOSSELET) from the Frasnian of Kowala — all the four from the Holy Cross Mts. (STASIŃSKA, 1958), as well as *T. densa* TCHUDINOVA, *T. irregularis* LECOMPTE and *T. tumefacta* LECOMPTE from the Givetian of the borehole Miastko I (STASIŃSKA, 1969), and, finally, *T. undvaensis* KLAAMANN from the Wenlockian of erratic boulders of Northern Poland (STASIŃSKA, 1967).

Distribution. — Silurian through Permian: Baltic coasts, USSR (Podolia, Siberia, Timan); Silurian through Upper Devonian: USSR (Ural, Arctic, Kazakhstan, Kolyma and Amur basins, Chukotka), Central Asia; Silurian through Devonian: Western Europe, South-western Asia, China, North America, Australia; Permian: Timor Island, Japan, Australia.

Thamnopora boloniensis (GOSSELET, 1877)
(Pl. VI, Figs. 3-8)

1939. *Thamnopora boloniensis* (GOSSELET); M. LECOMPTE, p. 122, Pl. 17, fig. 1 (here an earlier synonymy).
1944. *Pachypora cristata* MILNE-EDWARDS & HAIME; MEGGENDORFER, p. 28.
1953. *Thamnopora boloniensis* (GOSSELET); M. KROPFITSCH & A. SCHOUPPÉ, p. 91, Fig. 1.

1954. *Thamnopora boloniensis* (GOSSELET); D. HILL, p. 30, Pl. 2, Figs 16, 17.
1958. *Thamnopora boloniensis* (GOSSELET); A. STASIŃSKA, p. 198, Pl. 9, Figs 1-4; Pl. 10, Figs 1-4; Pl. 11, Figs. 1-2.
1959. *Thamnopora boloniensis* (GOSSELET); DUBATOLOV, p. 111, Pl. 39, Figs 2*a-d*.
1969. *Thamnopora boloniensis* (GOSSELET); A. STASIŃSKA, p. 769.

Diagnosis. — See DUBATOLOV, 1959.

Material. — Thirty-six large, fragmentary colonies from Dubie (ZPAL T. IX/5-40) and eight large fragmentary colonies from Siedlec (ZPAL T. IX/41-48).

Dimensions (in mm):

D	d	thw	dp	p-p	t-t
(7)10-12(13)	(0.3)0.4-1.0(1.1) and (0.8)1.0-1.5(2.0)	(0.1)0.2-0.3(0.4) and 0.3-0.5(0.7)	0.2-0.25(0.3)	(0.9)1.0-1.2(1.4)	0.4-1.3

Description. — Colonies fascicular, with a widely-spaced, obliquely distributed branches. Branches cylindrical, round or, less frequently, suboval in transverse section. Calices slightly funnel- or cuplike, polygonal in transverse section, 1.2 to 2.0 mm in diameter. Visceral chambers round or suboval in transverse section. In the axial zone of branch, corallite are arranged vertically, in the peripheral zone gently arcuate and opening obliquely at an angle of 50° to 70°, mostly 60° to 65°, to the growth axis of the branch. In transverse sections, corallites are irregularly polygonal, very rarely with rounded corners, their lumen being frequently contracted as a result of a stereoplasmatic thickening of the walls. Corallite diameter increasing from the axial to peripheral zone. Corallite walls varying in thickness, flat or somewhat undulate. The stereoplasmatic thickening of walls strong and variable in different zones of the branch, gradually increasing towards peripheries. Microstructure of walls fibro-radial, exceptionaly well-developed and strongly empasized by the concentration of a dark pigment. Median suture very distinct, in the form of a dark line, displaying, when strongly magnified, a structure consisting of two very thin, dark lines, separated by a light-colored space. Connecting pores round, less frequently elliptical, arranged in a single row on corallite walls. Septal spines lacking. Tabulae rare, thin, continuous, horizontal and oblique, bent or, less frequently, straight.

Remarks. — *T. boloniensis* from the U. Givetian of Dębnik differs from all so far described representatives of this species only in somewhat larger diameters of their connecting pores, which also may be sometimes elliptical. A similar diameter of these pores is recorded only in specimens described from the Frasnian of Kowala (STASIŃSKA, 1958). In typical representatives of this species, the diameters of connecting pores do not exceed 0.2 mm. The presence of septal spines is, in the representatives of this species, a variable character. Most specimens of *T. boloniensis* from the Ardennes, Belgium (LECOMPTE, 1939) are devoid of septal spines or they very few in them and occur in the peripheral zone of their branches. A complete lack of these septal elements was found by KROPFITSCH & SCHOUPPÉ (1953). Septal spines are also very rate in specimens from the Frasnian of Kowala and Miastko 1 borehole (STASIŃSKA, 1958, 1969), as well as from the Givetian of Eastern Australia (Hill, 1954). The best-developed septal apparatus that has ever been described is that in *T. boloniensis* from the L. Frasnian of the Kuznetsk Basin (DUBATOLOV, 1959), in which septal spines occur mostly in the peripheral zone of branches.

Distribution. — Poland (Holy Cross Mts. — Kowala, Miasto 1 borehole): Frasnian; Australia: Givetian; Belgium; France, USSR (Kuznetsk Basin): Frasnian; Germany: Upper Devonian.

Thamnopora striatoporoides sp. n.
(Pl. VI, Figs. 1*a-c*; 2; 3*a-c*)

Holotype: ZPAL T. IX/236; Pl. VI, Fig. 1*a-c*.
Type horizon: Middle Devonian, Upper Givetian.
Type locality: Dębnik near Krzeszowice (Czarna Górna outcrop), Cracow Region.
Derivation of the name: *Lat. striatoporoides* — a species having certain characters of the genus *Striatopora*.

Diagnosis. — Colonies fascicular. Branches cylindrical, 3.0 to 4.5 mm in diameter. Calices slightly funnel-like with blunted edges, 0.6 to 0.9 mm in diameter, with a short, thick septal projection. Corallites polygonal, 0.4 to 0.6 mm in diameter, arranged at an angle of 60° to 80° to the surface of branch. Wall thickness 0.04 to 0.12 mm in the axial and 0.2 to 0.3 mm in peripheral zone. Pores round, 0.12 to 0.2 mm in diameter, spaced at 1.0 to 1.2 mm intervals. Septal spines rare, thin, oblique and bent, arranged at 0.3 to 0.6 mm intervals.

Material. — Twenty well-preserved fragmentary colonies (ZPAL T. IX/235-246).

Dimensions (in mm):

D	d	thw	dp	p-p	t-t
(2.0)3.0-4.5(6.0) and 3.0-3.5×3.5-4.2	(0.2)0.4-0.6(0.7) and 0.35-0.4×0.5-0.7	(0.04)0.12-0.2(0.3)	0.12-0.2	(0.8)1.0-1.2(1.4)	0.3-0.6

Description. — Colonies small, fascicular, with widely-spaced, obliquely situated branches, which are cylindrical, round or suboval in transverse section. Calices slightly funnel-like, relatively deep, with blunt, rounded edges, in transverse section mostly irregularly polygonal or irregularly polygonal-elongate, with a single, short and thick septal spine. In the axial zone of colony, corallites are arranged parallel to the axis of the growth of corallite and in the peripheral zone they are bent in the form of a wide, gentle arch and open on the surface of colony at an angle of 60° to 80°. In transverse section, corallites are more or less regularly polygonal or, less frequently, polygonal-elongate. Corallite diameters slightly increase from the middle towards the periphery of the branch. Visceral chamber frequently very strongly contracted as a result of a secondary, stereoplasmatic thickenning of the walls, in transverse section displaying oval, rounded and, less frequently, round outlines. Corallite walls straight, relatively thick, sometimes undulate. Microstructure of wall fibro-radial, distinctly visible only in the peripheral zone of colony, where the fibres of stereoplasma, the same as in the calices, have a pinnate arrangement (obliquely to the wall of corallite). Median suture distinctly visible, only in the axial part of branch occurring in the form of a thin, dark line. Connecting pores rare, round, sometimes subelliptical. Septal spines fairly numerous, well-developed, short and thick, with a wide base, conical or hummocky, with blunted edges, occurring in single rows situated mostly in the peripheral zone of colony and in calices. In the axial zone, they are very rare and considerably smaller. Tabulae rare, thin, straight or slightly bent, horizontal or oblique, poorly preserved and occurring mostly in the axial zone of branches.

Remarks. — *T. striatoporoides* sp. n. differs from other species of this genus in small diameters of branches and in the presence of well-developed, thick septal spines, arranged in single rows occurring in calices and in the peripheral zones of branches. The presence of these projections gives a picture of the transverse sections of corallites characteristic of this species but resembling some species of the genus *Scoliopora*. In addition, the species described is marked by some characters occurring in the representatives of both the *Thamnopora* and

Striatopora genera. Besides small diameters of branches, the characters of the genus *Striatopora* include the concentrical-fibrous type of the microstructure of corallite walls in the axial zone of the colony and the general form of corallites. Blunt, rounded edges of calices, an irregular arrangement of calices on the surface of branch and a locally strong stereoplasmatic thickening of corallite walls are among the characters of the genus *Thamnopora*.

Subfamily **PACHYPORINAE** Gerth, 1921
Genus **CLADOPORA** Hall, 1851

Type species: *Cladopora seriata* Hall, 1851.

Diagnosis — See Dubatolov, 1972.

Remarks. — Despite its common occurrence in the Silurian and Devonian, the genus *Cladopora* has not so far been sufficiently studied. This results from, among other things, inaccurate descriptions of originals which are supposed to serve as a basis for separating this genus and from the fact that many representatives of *Cladopora* display several characters in common with genera of the subfamilies Thamnoporinae and Pachyporinae. This caused an erroneous assignment of many species of the genus *Cladopora* to other genera, to *Striatopora, Thamnopora, Gracilopora, Zeapora* (Hall, 1852; Penecke, 1894; Sokolov, 1955; Tchudinova, 1959), *Alveolitella* (and *Alveolites*), *Coenites* and Bryozoa. Some typical *Cladopora* were described by Mironova (1969) under the name *Taxopora*. Oliver's (1963) studies resulted in a more precise presentation of only some of the characters of *Cladopora* (corallites opening obliquely to the surface of branch, calices sloping and with a slightly bent lower lip, connecting pores arranged irregularly), but did not emphasize the fundamentally different nature of the genus, the more so as the type of the microstructure of wall was not presented by Oliver. As follows from the present writer's studies conducted thus far and from his analysis of the species known thus far, the following features are characteristic of the genus *Cladopora*: (1) Small, fascicular colonies round in transverse section; (2) Small corallites opening most frequently very obliquely to the surface of branch, round or polygonal-oval in transverse section and relatively thin-walled in the axial zone despite the occurrence of the stereoplasmatic thickening; sometimes, corallites display a stellar arrangement in transverse section; (3) Calices are small, conical, slightly asymmetric, sloping, with a more or less distinct lower lip, with oval or sometimes semilunar (Oliver, 1963; Dubatolov, 1972) apertures having blunted or rounded edges and arranged in more or less regular vertical rows; (4) A gradual (and not violent) thickening of the walls of corallites towards the periphery of branch; (5) The microstructure of walls is fibro-cryptoradial, in the form of concentric layers of stereoplasma visible only in well-preserved specimens; (6) Median suture is on the whole poorly visible; (7) Connecting pores are small, rare and irregularly distributed; (8) Tabulae are rare; (9) Septal apparatus is poorly developed or lacking at all.

The representatives of *Cladopora* display the greatest similarity to the genus *Striatopora* in an oblique arrangement of corallites to the surface of branches, in the size and general form of calices, in the type of the microstructure of sclerenchyma and in the diameter of branches. They differ, however, from this genus in the lack of a well-developed lower lip of calice, stellar arrangement of corallites in transverse sections of branches, gradual thickening of walls in the peripheral zone, fibro-lamellar microstructure of stereoplasma, rare tabulae and a very poor development or complete lack of septal apparatus. More than 50 species of this genus have so far been known from the Upper Silurian through the Upper Devonian deposits. The presence of this genus in the Permian is uncertain. Only one species, *C. gracilis* LECOMPTE from the Cuvinian of Grzegorzowice, Holy Cross Mts. (STASIŃSKA, 1958) is known from Poland.

Distribution. — M. Silurian through U. Devonian: USA; U. Silurian: USSR (Salair); U. Silurian through U. Devonian: USSR (Kuznetsk Basin, Ural); L. Devonian: North-eastern USSR; M. Devonian: Italy, USSR (Siberia), China, Vietnam, Australia; Middle to U. Devonian: Poland, Germany, England, USSR (Altay); U. Devonian: Belgium, USSR (East-European Platform), Central Asia; Permian: USA.

Cladopora gracilis (SALÉE, 1915)

(Pl. VI, Figs 4*a-c*, 5, 6)

1915. *Striatopora gracilis* SALÉE, n. ms. in col.
1939. *Cladopora gracilis* LECOMPTE; M. LECOMPTE, p. 78, Pl. 12, Figs 6-10,
1952. *Cladopora gracilis* LECOMPTE; B. S. SOKOLOV, p. 69, Pl. 14. Figs 2-5.
1954. *Cladopora gracilis* LECOMPTE; A. STASIŃSKA, p. 286.
1958. *Cladopora gracilis* LECOMPTE; A. STASIŃSKA, p. 195, Pl. 7, Figs 1-3.
1960. *Cladopora gracilis* LECOMPTE; K. H. ERMAKOVA, p. 80, Pl. 4, Fig. 1.
1967. *Cladopora gracilis* LECOMPTE; TONG-DZUY THANH, p. 89, Pl. 16, Fig. 1*a-b*.

Diagnosis. — (After LECOMPTE, 1939, revised). Colonies, small, fascicular. Branches cylindrical, 1.5 to 3.5 mm in diameter. Corallites polygonal in transverse section with rounded angles and 0.2 to 0.35 mm in diameter. Walls 0.04 to 0.08 mm thick in the axial and 0.1 to 0.25 mm in the peripheral part. Connecting pores very rare, round, 0.08 to 0.12 mm in diameter, distributed at 0.5 to 0.8 mm intervals. Tabulae rare, at 0.3 to 1.0 mm intervals. Septal spines lacking.

Material. — Eighteen large fragments of colonies from the M. Frasnian of Żbik (ZPAL T IX/49-66), one colony from the L. Frasnian of Dębnik — Rokiczany Dół, gorge (ZPAL T IX/68) and one from the U. Frasnian of Dębnik — Żarnówczany Dół, gorge (ZPAL T IX/67).

Dimensions (in mm):

D	d	thw	dp	p-p	t-t
2.0-3.5(4.0)	(0.2)0.25-0.35(0.4)	(0.04)0.06-0.1(0.25)	0.1-0.12	0.5-0.6	0.3-0.9

Description. — Colonies small, fascicular. Branches cylindrical, rarely dichotomously branching, round or slightly oval in transverse section. Calices conical, narrow, relatively deep, with thick, rounded edges, sloping and situated obliquely to the surface of branch, arranged in vertical rows. In the axial zone of branch, corallite long, straight or slightly bent and in the peripheral zone deflected from the axis and oblique to the surface of branch. In transverse sections they are polygonal, with rounded angles, or irregularly polygonal and oval in outline. The lumen of corallites round or oval, frequently strongly contracted as a result of the stereoplasmatic thickening of the walls. Corallite walls, relatively thin in the axial zone, become gradually thicker and thicker towards the periphery of the branch. Median suture indistinct. Microstructure of walls fibro-radial, well visible only in the peripheral zone where it occurs in the form of thin, concentric lamellae parallel to the surface of corallite walls. Within limits of these lamellae, the fibers of stereoplasma are arranged perpendicularly to the surface of walls. Connecting pores rare, round, irregularly distributed on the walls of corallites. Tabulae rare, thin, complete, straight or slightly bent, horizontal and oblique, distributed irregularly. Septal spines absent.

Remarks. — The species *Cladopora gracilis* described above differs from the specimens from the Frasnian of Ural (SOKOLOV, 1952) only in somewhat thinner walls of corallites in the axial zone of branches. From the lectotype, coming from the Frasnian of Belgium (LECOMPTE, 1939; SOKOLOV, 1952) it differs in larger diameters of branches, and connecting pores, as well as in strongly blunted edges of calices. From the specimens from the Cuvinian of Grzegorzowice (STASIŃSKA, 1958), it differs in slightly larger diameters of branches and somewhat larger connecting pores. Finally, from the specimens described from the Frasnian of the Voronezh District (ERMAKOVA, 1960) and Eifelian of Vietnam (TONG-DZUY THANH, 1967), it differs only in slightly thinner walls of corallites in the axial zone.

Distribution. — Poland (Holy Cross Mts. — Grzegorzowice): Eifelian; Vietnam Givetian; Belgium, USSR (Western Ural, Voronezh Region): Frasnian.

Suborder ALVEOLITINA SOKOLOV, 1950
Family ALVEOLITIDAE DUNCAN, 1872
Genus **ALVEOLITES** LAMARCK, 1801

Type species: *Alveolites suborbicularis* LAMARCK, 1801.

Diagnosis. — See DUBATOLOV, 1962.

Remarks. — This genus was discussed in detail by NICHOLSON & ETHERIDGE (1877), LECOMPTE (1933, 1936, 1939), SMITH (1933), JONES (1942), SOKOLOV (1952, 1955, 1962), DUBATOLOV (1959) and MIRONOVA (1960). Many species, formerly assigned to the genus *Alveolites*, have recently been included in newly erected genera. SOKOLOV (1952) erected the genus *Alveolitella* in which he included the species *Alveolites polenovi* PEETZ, 1901; *A. orbuscula* RADUGUIN, 1938 and *A. fecundus* LECOMPTE, 1939. In 1955, the genus *Crassialveolites* was erected by this same author who assigned to it the species: *A. cavernosus* LECOMPTE, 1933, *A. crassus* LECOMPTE, 1939, *A. multiperforatus* LECOMPTE, 1939, *A. crassiformis* SOKOLOV, 1952 and *A. domrachevi* SOKOLOV, 1952. MIRONOVA (1969) erected a new genus, called *Squameoalveolites*, in which she included, among other species, those which, in her opinion, displayed a structure transitional between *Alveolites* and *Caliapora*, that is, *A. fornicatus* SCHLÜTER, 1889, *A. megastomus* STEININGER, 1849, *A. parvus* LECOMPTE, 1939, as well as *Caliapora pileatus* KOKHSCHARSKA, 1968 and *C. incrustans* KOKSHCHARSKA, 1967, 1968. According to MIRONOVA, the representatives of the genus *Squameoalveolites* differ from *Alveolites* only in the presence of a row of squamae occurring in the same places in which a row hypertrophic spines occurs in *Alveolites*. They differ from *Caliapora* only in the alveolitic (semilunar) form of corallites. On the whole, more than 70 species of this genus have been described, including ten subspecies, from the deposits ranging from the U. Ordovician through U. Devonian. Nineteen species of the genus *Alveolites* were described from Poland (ZEUSCHNER, 1866; C. F. ROEMER, 1870; GÜRICH, 1896, 1903; SOBOLEV, 1904, 1909, 1911; STASIŃSKA, 1953, 1954, 1958, 1969; GUNIA, 1962, 1966, 1968; KAŹMIERCZAK, 1971; TOMCZYKOWA, 1972; PAJCHLOWA, 1972).

Distribution. — Ludlovian: USSR (Novaya Zemlya, Tuva); U. Silurian: Western Europe, North America; Ludlovian through Frasnian: USSR (Kazakhstan, Ural, Altay); Lower

Devonian: USSR (Taymyr); L. Devonian through Frasnian: USSR (Russian Platform, Timan, Siberia, Kolyma Basin, Arctica), Central Asia; M. devonian through Frasnian: Poland, Belgium, USSR (Kuznetsk Basin), China, Indochina, Eastern Australia; Eifelian: Spain, Morocco, USSR (Salair); Frasnian: Germany, Carnian Alps, USSR (the Main and Central Devonian Field, Caucasia), China (Great Hingan), North Africa, North America.

Alveolites suborbicularis LAMARCK, 1801

(Pl. IX, Figs 1*a-c*, 2)

1952. *Alveolites suborbicularis* LAMARCK; B. S. SOKOLOV, p. 78, Pl. 17, Figs 1-4 (here earlier synonymy).
1953. *Alveolites suborbicularis* LAMARCK; A. STASIŃSKA, p. 232, Pl. 4, Fig. 1.
1954. *Alveolites suborbicularis* LAMARCK; H. FONTAINE, p. 26, Pl. 1, Fig. 1.
1959. *Alveolites suborbicularis* LAMARCK; W. N. DUBATOLOV, p. 142, Pl. 47, Fig. 4*a-g* (here earlier synonymy up to 1953)

Diagnosis. — See DUBATOLOV, 1959.

Material. — Eighteen nearly complete colonies from the U. Givetian of Dubie (ZPAL T IX/69-86), and two colonies from the U. Givetian of Siedlec (ZPAL T IX/87, 88).

Dimensions (in mm):

d	thw	dp	p-p	t-t
0.5-0.7×0.7-1.0	(0.07)0.1-0.15(0.2)	(0.12)0.15-0.18(0.2)	(0.6)0.8-0.9(1.0)	(0.2)0.3-0.6(0.9)

Description. — Colonies small, bulbous, irregular, sometimes flattened and growing in layers, composed of twisted corallites opening obliquely to the surface of colony. In transverse section, corallites are semilunar in outline or, less frequently, triangular or oval. Corallite walls varying in thickness depending on the zone of colony. Median suture distinct, emphasized by falciform concentrations of a dark pigment. Microstructure of walls fibroradial. In longitudinal sections, the fibers of stereoplasma are arranged obliquely to the surface of corallite walls. Locally, the fibers are arranged in a pinnate form. Connecting pores rare, round, arranged in a single row. Septal spines rarely occurring, poorly preserved, fine, distributed in a few vertical rows. Tabulae numerous, complete, horizontal, straight or, less frequently, oblique and bent.

Distribution. — Poland, Holy Cross Mts.: Eifelian to Frasnian, Sudeten: Upper Devonian; Australia: Lower to Middle Devonian; France: Eifelian to Frasnian; Germany, Czechoslovakia: Eifelian to Givetian; Spain: Middle Devonian to Frasnian; Alps, Austria, USSR (Volhynia, Armenia, Ural, Siberia), China, Africa, USA: Middle Devonian; England, Belgium: Frasnian; India: Upper Devonian; USSR (Kuznetsk Basin, Timan): Devonian.

Alveolites taenioformis SCHLÜTER, 1889

(Pl. VIII, Fig. 6; Pl. IX, Fig. 3)

1889. *Alveolites taenioformis* SCHLÜTER; C. SCHLÜTER, p. 121.
1904. *Alveolites angusticellata* SOBOLEV; D. SOBOLEV, p. 28, Pl. 3, Fig. 1-3.
1909. *Alveolites angusticellata* SOBOLEV; D. SOBOLEV, p. 520.
1939. *Alveolites taenioformis* SCHLÜTER; M. LECOMPTE, p. 55, Pl. 8, Fig. 3, 4.
1952. *Alveolites taenioformis* SCHLÜTER; B. S. SOKOLOV, p. 91, Pl. 23, Fig. 6.
1958. *Alveolites taenioformis* SCHLÜTER; A. STASIŃSKA, p. 214, Pl. 25, Fig. 1, 2; Pl. 26, Fig. 1-3.

Diagnosis. — See LECOMPTE, 1933.

Material. — Two almost complete colonies from the M. Frasnian of Żbik (ZPAL T IX/89, 90) and one colony from Dębnik's Żarnówczany Dół, (ZPAL T IX/91).

Dimensions (in mm):

H×D	d	thw	dp	p-p	t-t
30×20×15	0.2-0.3×0.4-0.7	0.04-0.05(0.07)	0.1-0.12(0.15)	0.5	0.2-0.5(0.6)

Description. — Colonies small, bulbous or flattened, composed of long, thin, sometimes strongly twisted corallites, frequently arranged in layers whose convexity is turned towards the top of a colony and opening obliquely to its surface. In transverse sections, corallites are elliptical, flattened, or fusiform in outline, mostly strongly elongate. Corallite walls constant in thickness. Median suture very indistinct or absent at all. Walls radial-fibrous in microstructure. In both transverse and longitudinal sections, the fibers of stereoplasma are arranged perpendicularly to the surface of corallite walls. Connecting pores occurring rarely, round and arranged in a vertical row. Septal spines very fine, rarely occurring, arranged in a vertical row. Tabulae rarely occurring, relatively thin, sometimes thickened, horizontal or oblique, straight or slightly bent.

Remarks. — As compared with *A. taenioformis* from the Givetian of the Holy Cross Mts. (Skały, Pokrzywianka, Miłoszów — STASIŃSKA, 1958) the specimens described above have somewhat larger diameters of connecting pores.

Distribution. — Poland (Holy Cross Mts. — Pokrzywianka, Skały, Miłoszów): Givetian; USSR (Western Ural): Lower Givetian; Belgium, Germany: Givetian.

Genus **ALVEOLITELLA** SOKOLOV, 1952

Type species: *Alveolites fecundus* (SALÉE) *in* LECOMPTE, 1939.

Diagnosis. — See SOKOLOV, 1952.

Remarks. — The genus *Alveolitella* was separated by SOKOLOV (1952) mostly on the basis of the morphology of colonies. He assigned to this genus all representatives of the genus *Alveolites* which have fascicular and polygonal colonies and whose thin-walled corallites occur in the axial zone of a colony. Now, the following, formerly described species are assigned to the genus *Alveolitella*: *Alveolites polenovi* PEETZ, 1901; *A. orbuscula* RADUGUIN, 1938; *A. fecundus* (SALÉE) *sensu* LECOMPTE, 1939; *A. subaequalis* LECOMPTE, 1939; *A. densatus* LECOMPTE, 1939; *Pachypora karmakensis* TCHERNYCHEV, 1951. Detailed characteristics and a comparison with related genera are given in DUBATOLOV'S (1959, 1969), DUBATOLOV, LIN-BAO YUI'S (1959), MIRONOVA'S (1969), SOKOLOV'S (1952, 1955, 1962) and YANET'S (1959) works. About eighteen species of this genus have so far been described from the deposits ranging from the L. Devonian through Frasnian. In Poland, only one species, *Alveolitella fecunda*, is known from the M. Frasnian of the Holy Cross Mts. (Wietrznia), from the Givetian of the Miastko 1 borehole and from the U. Devonian of the Sudetes (STASIŃSKA, 1953, 1969; GUNIA, 1968; PAJCHLOWA, 1972).

Distribution. — L. Devonian: The North-eastern USSR (Tas Hajachtach); L. Devonian through Eifelian: USSR (Western Siberia), China (Great Hingan); Eifelian: USSR (Northern Ural); Eifelian through Givetian: USSR (Kuznetsk Basin); Givetian through Frasnian: Belgium (the Ardennes), Poland (the Holy Cross and the Sudetes Mts., Cracow Region); Frasnian: USSR (East-European Platform).

Alveolitella fecunda (SALEÉ, 1915)

(Pl. VII, Fig. 1*a-b*)

1939. *Alveolites fecundus* (SALÉE) *in* LECOMPTE; M. LECOMPTE, p. 57, Pl. 9, Figs 2, 3.
1953. *Alveolites fecundus* (SALÉE) *in* LECOMPTE; A. STASIŃSKA, p. 225, Pl. 1, Fig. 4; Pl. 2, Fig. 1.
1959. *Alveolitella fecunda* (SALÉE *in* LECOMPTE); W. N. DUBATOLOV, p. 160, Pl. 52. Fig. 4a, b.
1969. *Alveolitella fecunda* (SALÉE *in* LECOMPTE); A. STASIŃSKA, p. 772.

Diagnosis. — See DUBATOLOV, 1959.

Material. — Two almost complete colonies from the U. Frasnian of Dębnik (Żarnówczany Dół, — gorge); (ZPAL T IX/92, 93).

Dimensions (in mm):

D	d	thw	dp	p-p	t-t
9-15	(0.4)0.5-0.7(0.8)	0.07-0.1 and 0.2-0.35	0.15-0.18	0.9-1.2	(0.4)0.5-0.8(1.2)

Description. — Colonies small, fascicular. Branches short, cylindrical or slightly flattened, sometimes laterally fused with each other, composed of parallel corallites, very slightly bent and opening strongly obliquely at an angle of about 30° to the surface. Calices polygonal, flattened, fissured or semilunar, 0.5×0.9 - 1.3 mm in dimensions. In the axial zone of branch, corallites are in transverse section polygonal and have rounded angles, towards peripheries they gradually become round-triangular or semilunar. Relatively thin in the axial zone, corallite walls uniformly thicken towards peripheries. Microstructure of walls radial-fibrous. In both transverse and longitudinal sections fibers of stereoplasma are arranged perpendicularly to the surface of corallite walls. Median suture sometimes very distinct, is emphasized by an irregular concentration of pigment. Connecting pores round, distributed in single vertical rows on corallite walls. Septal spines fairly numerous, fine, distributed irregularly in three to five vertical rows spaced at 0.15 to 0.5 mm, mostly 0.2 to 0.3 mm intervals. Tabulae horizontal or oblique, straight or slightly bent, in the axial zone thin and towards peripheries thickening and becoming more frequent.

Remarks. — As compared with the specimens from the Givetian and Frasnian of Belgium, those described from Poland have somewhat smaller diameters of branches and their connecting pores are more widely spaced. Compared with *A. fecunda* from the Frasnian of the Holy Cross Mts. (Wietrznia) and from the Miasto 1 borehole (STASIŃSKA, 1953, 1969), the colonies from the Frasnian of Dębnik have slightly larger diameters of corallites in the axial zone of branches. The form described above differs from the representatives of the same species from the Givetian of the Kuznetsk Basin (DUBATOLOV, 1959) in slightly smaller diameters of branches and thinner corallite walls in the axial zone.

Distribution. — Poland Holy Cross Mts. — Wietrznia: Frasnian, Miastko 1 borehole: Givetian to Frasnian, Sudeten: Upper Devonian; USSR (Kuznetsk Basin, Kazakhstan): Givetia; Belgium: Givetian to Frasnian.

Alveolitella ramosa (F. A. ROEMER, 1855)

(Pl. VII, Fig. 2*a-c*; Pl. VIII, Fig. 1; Text-fig. 15*A*, *B*)

1855. *Alveolites ramosus* A. ROEMER; A. ROEMER, p. 27, Pl. 6, Fig. 4.
1885. *Alveolites ramosus* A. ROEMER; F. FRECH, p. 110, Pl. 11, Fig. 8.
1903. *Alveolites ramosa* A. ROEMER; G. GÜRICH, p. 132.
1939. *Alveolites ramosus* A. ROEMER; M. LECOMPTE, p. 58 — *non* M. LECOMPTE, 1933; p. 46, Pl. 2, Fig. 3; *non* J. STEININGER, 1831, Pl. 6, Fig. 2, 3.

Diagnosis (After FRECH, 1885, supplemented). — Colonies small, fascicular. Branches short, cylindrical or oval, 3.0 to 10.0 mm in diameter. Corallites long, opening at an angle of 30 to 45° to the surface of a colony. In the axial zone of a colony, corallites are irregularly polygonal in transverse section and 0.3 to 0.5 mm in diameter. In this zone, walls are 0.05 to 0.1 mm thick. Connecting pores fine, very widely spaced. Septal spines lacking. Tabulae horizontal or oblique, straight or slightly bent, spaced at 0.8—1.5 mm intervals.

Material. — Two large, fragmentary colonies from the M. Frasnian of Dębnik (Żbik) (ZPAL T IX/94, 95).

Dimensions (in mm):

D	d	thw	t-t
(3)6-9(10)	(0.25)0.3-0.5(0.7) and 0.3-0.45×0.6-0.9	0.02-0.05 and 0.05-0.07(0.1)	0.8-1.5

Description. — Colonies small, irregular and fascicular. Branches short, cylindrical or irregularly cylindrical, round or irregularly round in transverse section. Calices shallow, irregularly polygonal, polygonal rounded and elongate, sometimes fissured in transverse section. Corallites relatively long, slightly wavy and twisted, arranged parallel to the axis of branch, towards the periphery of colony slightly bent and opening obliquely at an angle of 30 to 45°. In the axial zone of branch, corallites are thin-walled, irregularly polygonal (penta- and hexagonal) in transverse section, less frequently regularly polygonal with a polygonal, rounded lumen. Towards periphery of branch, corallites become polygonal, rounded and oval, triangular or reniform in outline. Microstructure of walls fibro-radial. In transverse and longi-

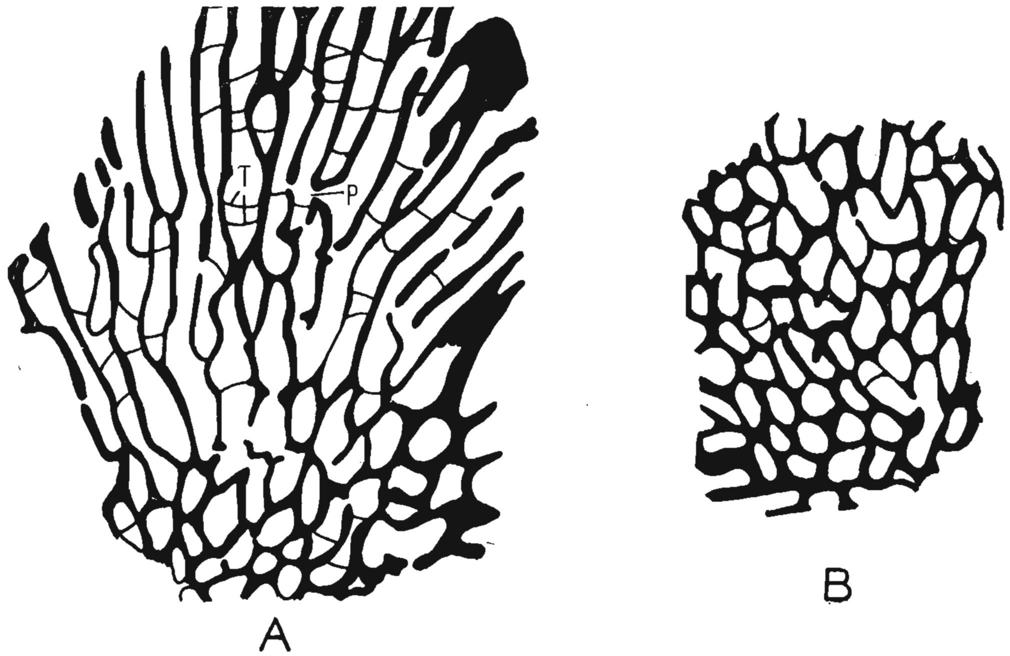

Fig. 15
Alveolitella ramosa (F. A. ROEMER), Żbik (Cracow Region), Middle Frasnian, (ZPAL T IX/94): *A* — longitudinal section, *B* — transversal section; × 10.

tudinal sections, the fibres of stereoplasma are perpendicular to the surface of corallite walls. A pinnate arrangement of fibers is frequently observed in the peripheral zone and in calices. Median suture fairly distinct. Connecting pores fine, round, very rarely occurring. Septal spines invisible. Tabulae horizontal and slightly oblique, straight or slightly bent, rare.

Remarks. — *Alveolitella ramosa* from the M. Frasnian of the environs of Żbik is most similar to the specimens of the same species, described by FRECH (1885). Due to the lack of an accurate description of this species it is impossible to compare it with forms presented by ROEMER (1855). As compared with a specimen described by LECOMPTE (1939) from the Frasnian of Belgium (beds with *Hypothyridina cuboides*, zone F_2i), *Alveolitella ramosa* from Żbik display a considerable similarity in the diameter and shape of corallite viewed in transverse section. It differs, however, from it in larger dimensions and fascicular form of colony, thin corallite walls, strong reduction in the size of septal spines (which might be destroyed) and larger diameters of connecting pores. Considerable morphological differences between these forms result from a tentative assignment of the specimen, described by LECOMPTE, to *Alveolites ramosus*, as even this author himself emphasizes that the specimen he describes is dissimilar to *A. ramosus* of FRECH. A comparison with *Alveolitella ramosa* described by GÜRICH (1903) from the Frasnian outcrops of the environs of Żbik is difficult, since GÜRICH gives a very incomplete description of the species without illustrating it in the text. On the basis of the similarity in the diameter of corallites, it can be presumed that the specimens described by GÜRICH and the colonies described by the present writer are conspecific.

Distribution. — Belgium: Frasnian.

Alveolitella rarispinosa sp. n.
(Pl. VIII, Figs. 2-5)

Holotype: ZPAL T IX/97; Pl. VIII, Fig. 4.
Type horizon: Upper Devonian, Lower-Middle Frasnian.
Type locality: Żbik in Cracow Region.
Derivation of the name: *Lat. rarispinosa* — with rarely occurring septal spines.

Diagnosis. — Colonies ramose or elongate. Branches cylindrical, 4.5 to 14.0 mm in diameter. In the axial zone of branch corallites are thick-walled, irregularly polygonal and 0.4 to 0.5 mm in diameter, as well as elongate and 0.4-0.5×0.6-0.8 mm in size. They open at an angle of 30 to 50° to the surface of colony. Walls are 0.06 to 0.12 mm thick in the axial and 0.12 to 0.2 mm in the peripheral zone. Connecting pores round, 0.12 to 0.15 mm in diameter, spaced at about 1.0 mm intervals. Septal spines thick, conical, rare. Tabulae thin, horizontal, straight or slightly bent, spaced at 0.5 to 0.9 mm intervals.

Material. — Seven colonies from the M. Frasnian of Żbik (ZPAL T IX/96-102) and two from the L. Frasnian of Dębnik (Rokiczany Quarry) (ZPAL T IX/103, 104).

Dimensions (in mm):

D	d	thw	dp	p-p	t-t
4.5-10.0 and 7×12-14	(0.35)0.4-0.5(0.7) and 0.4-0.5×0.6-0.8	(0.05)0.06-0.12(0.18)	0.12-0.15	1.0	(0.4)0.5-0.9(1.0)

Description. — Colonies small, ramose or irregularly elongate. Branches very short, straight, cylindrical or bent, round or slightly oval in transverse section. Calices shallow, with blunted, rounded edges, irregularly polygonal, elongate or sometimes slightly fissured in transverse section. Corallites relatively long, undulating, closely adhering to each other, in the axial zone of colony parallel to the axis of the growth of branch, towards periphery slightly deflecting and opening on the surface of colony at an acute angle of about 30 to 50°. In the axial zone, corallites are thick-walled, irregularly polygonal (penta-, hexa- and heptagonal) or elongate-polygonal in transverse section. In transverse section, visceral chamber is oval, oval- elongate or, rarely, round. In the peripheral zone, corallites are irregularly polygonal and rounded, elongate, typically alveolitic in shape and slightly larger than in the axial zone. Visceral chamber of this zone is strongly contracted and frequently fissured. In the axial zone, corallite walls are relatively thick. Towards periphery, they become yet thicker. Microstructure of walls radial-fibrous. In the axial zone of colony, the fibers of stereoplasma are arranged perpendicularly to the surface of corallite walls, while in the peripheral zone their arrangement is oblique and primate. Median suture dark, poorly visible. Connecting pores round or suboval. Septal spines thick, conical, with a wide base, sometimes slightly bent, occurring rarely in corallites of both the axial and peripheral zone. Tabulae rare, thin, horizontal, sometimes oblique, straight or slightly bent.

Remarks. — In the general shape of its branches, dimensions and shape of calices, diameters of corallites, thickness of walls in both the axial and peripheral zone of colony and diameters of connecting pores *Alveolitella rarispinosa* sp. n. resembles *A. subaequalis* (M.-EDWARDS & HAIME) from the U. Frasnian of Belgium (LECOMPTE, 1939). On the other hand, it differs from this species in smaller and very rarely branched colonies, different general shape of corallites, septal apparatus consisting of single, thick spines and larger spaces between connecting pores. As compared with *A. cella* from the U. Givetian of the Kuznetsk Basin (TCHUDINOVA, 1964), the new species displays a similarity to it in the diameters of branches, shape of corallites, thickness of corallite walls in the peripheral zone of colony and in the morphology of and spaces between tabulae. It differs, however, from *A. cella* in larger diameters of corallites, somewhat thinner walls in the axial zone of branches, smaller diameter of connecting pores and their wider spacing and better developed septal spines. The similarity of the new species to *A. insueta* from the Frasnian of the Russian Platform (ERMAKOVA, 1960) is expressed in the diameters of branches, shape and diameter of corallite of both the axial and peripheral zone of colony, thickness of corallite walls in the axial zone and morphology of tabulae. *A. rarispinosa* differs, however, from *A. insueta* in thinner corallite walls in the peripheral zone of branches, smaller diameters of connecting pores, better developed septal apparatus and wider spacing of tabulae.

Genus **CRASSIALVEOLITES** SOKOLOV, 1955

Type species: *Alveolites crassiformis* SOKOLOV (SOKOLOV, 1952).

Diagnosis. — See SOKOLOV, 1955.

Remarks. — The genus *Crassialveolites* was erected by SOKOLOV (1955), who included in it the representatives of the genus *Alveolites* marked by a polygonal outline of corallites, very thick walls, a poor development of and the lack of differentiation in septal apparatus, relatively large connecting pores, which frequently turn into connecting canals, as well as in corallites opening perpendicularly to the surface of colony.

In the development of the *Crassialveolites* lineage, whole ancestors were representatives of the genus *Alveolites* (DUBATOLOV, 1969) certain changes may be observed in the morphology of colony and in the internal structure of corallites. In the oldest representatives of this genus such as *C. tomskoensis* from the uppermost Silurian or lowermost Devonian of the Kuznetsk Basin (DUBATOLOV, 1963) or *C. abramovi* from the L. Devonian of the north-eastern part of the USSR (DUBATOLOV, 1969), colonies are cristate, thin-layered or flat. In the Eifelian forms, colonies are mostly flattened and tuberculate, while massive, irregular, spherical and bulbous forms predominate in the Givetian ones. On the other hand, in the Frasnian representatives of this genus, macelike and massive colonies are accompanied by flat or flattened forms. At the same time, in the development of this group we may observe a certain tendency to increase the diameter of corallites from 0.4 to 0.6 mm in the oldest forms, e. g., *C. tomskoensis* to a maximum of 1.3 mm in the Givetian and Frasnian forms such as, for example, *C. domrachevi* and *C. crassiformis* from the Givetian of the Central Devonian Field (SOKOLOV, 1952). The septal apparatus is relatively best developed in the Eifelian forms.

About twenty species of the genus *Crassialveolites* have so far been described from the deposits ranging from the Uppermost Silurian through the U. Devonian. Two species of this genus were described from the territory of Poland: *C. crassus* (LECOMPTE) from the Frasnian of the Holy Cross Mts. and the Givetian of Miastko 1 borehole, as well as *C. multiperforatus* (SALÉE *sensu* LECOMPTE) from the Frasnian of the Holy Cross Mts. (STASIŃSKA, 1953, 1969).

Distribution. — L. Devonian: USSR (Salair); L.-M. Devonian: USSR (north-eastern Siberia), Central Asia; L. Devonian through Frasnian: USSR (Kuznetsk Basin); M. Devonian: Belgium, USSR (Ural, Kazakhstan, Transcaucasia, East-European Platform), China; M.-U. Devonian: Poland (Holy Cross Mts.), USSR (Altay).

Crassialveolites polonicus sp. n.

(Pl. IX, Figs 4, 5; Pl. X, Figs 1, 2; Text-fig. 16*A, B*)

Holotype: ZPAL T IX/121; Pl. IX, Fig. 5 and Pl. X, Fig. 1.
Type horizon: Middle Devonian, Upper Givetian.
Type locality: Dubie, Cracow Region.
Derivation of the name: *Lat. polonicus* — occurring in Poland.

Diagnosis. — Colonies bulbous, oval or cylindrical, 20 to 50 mm in diameter, composed of thick-walled, radially diverging corallites, which open perpendicularly to the surface of colony. Corallites irregularly polygonal or oval in transverse section, 0.8 to 1.0 mm in diameter. Walls varying in thickness between 0.08 and 0.25 mm. Pores large, round, less frequently elliptical, 0.25 to 0.3 mm in diameter, arranged in a row and spaced at 0.8 to 0.9 mm intervals. Septal spines very rare, fine arranged in a few rows. Tabulae numerous, complete, horizontal, less frequently oblique, bent and spaced at 0.25 to 0.4 mm intervals.

Material. — Nineteen colonies from Dubie (ZPAL T IX/105-123) and nine from Siedlec (ZPAL T IX/124-132).

Dimensions (in mm):

D	d	thw	dp	p-p	t-t
20-50	(0.5)0.8-1.0(1.2)	(0.08)0.1-0.2(0.25)	0.2-0.3	0.8-0.9	(0.1)0.25-0.4(0.6)

Description. — Colonies small, bulbous, oval or cylindrical, mostly round in transverse section, composed of thick-walled corallites, diverging radially from the axis, straight, sometimes slightly twisted, closely adhering to each other and opening perpendicularly to the surface. In transverse sections, corallites are more or less irregularly polygonal, polygonal-rounded or oval and, less frequently, oval-triangular in outline. Due to large pores, corallites in such sections are frequently meandering. Diameters of corallites are somewhat larger in the peripheral than axial zone of colony. The lumen of corallite tubes is round, oval or oval-triangular in outline which is caused by a strong and irregular thickening of their walls. Walls varying in thickness, in longitudinal sections sometimes displaying regular geniculate swellings. Median suture very poorly visible. Microstructure of walls fibro-radial with a frequently visible primate arrangement of fibers. In transverse sections, the fibers of stereoplasma are arranged perpendicularly to the surface of walls and in longitudinal sections slightly obliquely, sometimes also perpendicularly. Local concentrations of a dark pigment are rather rarely visible in corallite walls. Septal spines very rare, fine but relatively thick, frequently tuberculate, better developed in the peripheral zone of colony, arranged in two to three vertical rows. Connecting pores numerous, very large, round, rarely oval, distributed in a single vertical row, frequently turning into straight connecting canals. Tabulae numerous, complete, horizontal, rarely oblique, bent, less frequently straight. Incomplete tabulae, attached by their free end to adjacent ones or penetrating through connecting pores and reaching adjacent corallites, occur very rarely.

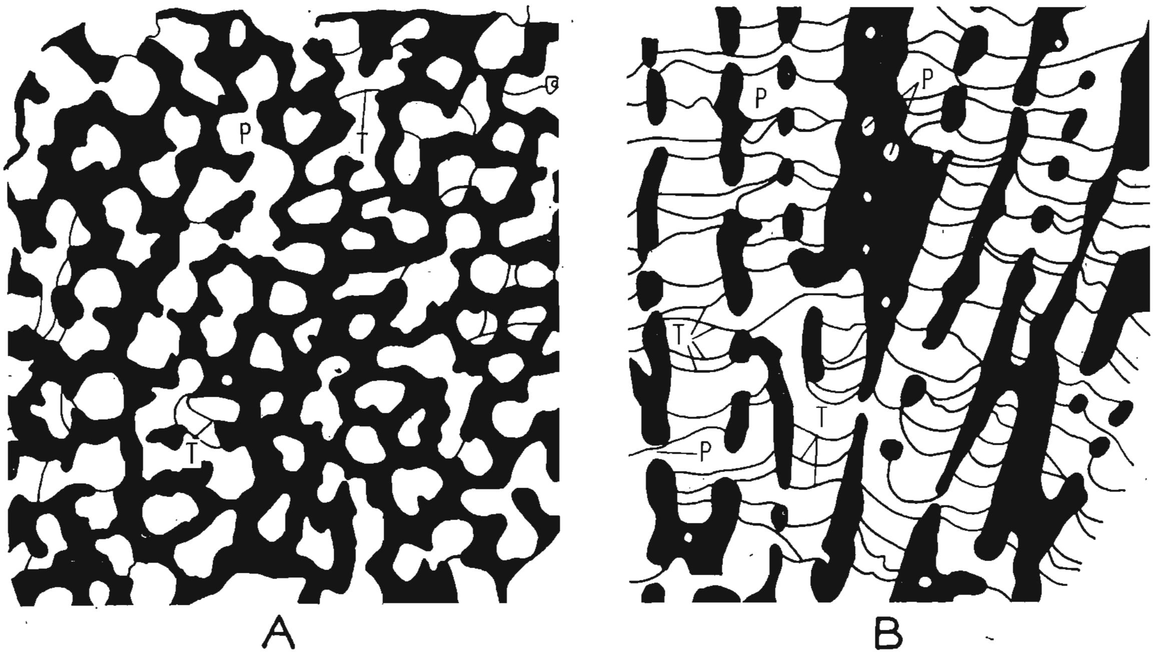

Fig. 10

Crassialveolites polonicus sp. n., Dubie (Cracow Region), Upper Givetian, holotype (ZPAL T IX/121): *A* — transversal section, *B* — longitudinal section; × 10.

Remarks. — *Crassialveolites polonicus* sp. n. is related to *C. macrotrematus* from the M. Eifelian of the Kuznetsk Basin (Dubatolov, 1963) in the thickness of walls of its corallites and outline of their transverse sections, diameters of connecting pores and spaces between them, shape and arrangement of tabulae and, finally, size and shape of septal spines. It differs from this species in a digital shape of colony, larger diameters of corallites, strong reduction in the size of and scarce occurrence of septal spines and wider spaces between tabulae. The new species displays a similarity to the type species in the diameter of its corallites, pinnate microstructure of walls, spaces between tabulae and a poor development and rare occurrence of septal spines. *C. polonicus* sp. n. differs, however, from it in considerably tinner walls, outline of corallites in transverse section (in *C. crassiformis* semilunar outlines are abundant), larger pores and more strongly bent tabulae. The new species also displays some similarities to *C. domrachevi* SOKOLOV from the Frasnian of Western Ural (SOKOLOV, 1952), East-European Platform, Kuznetsk Basin and Altay (DUBATOLOV, 1959). The two species are marked by a similar outline of transverse sections of corallites, pinnate microstructure of walls, poor development of septal spines and spaces between tabulae. *C. polonicus* sp. n. differs, however, pronouncedly from *C. domrachevi* in smaller diameters of corallites (in *C. polonicus* they reach the largest average diameters of all known representatives of this genus), thinner walls, more closely spaced and larger pores arranged in a single row (in *C. domrachevi* they form a zig-zag line) and more strongly bent tabulae.

Genus **CALIAPORA** SCHLÜTER, 1889

Type species: *Alveolites battersbyi* MILNE-EDWARDS & HAIME (MILNE-EDWARDS & HAIME, 1851).

Diagnosis. — See DUBATOLOV, 1969.

Remarks. — The genus *Caliapora* was erected by SCHLÜTER (1889), who emphasized its most characteristic feature, that is, the development of its septal apparatus in the form of squamae arranged in a few rows on the walls of corallites. Its characteristics and comparisons with related genera were given by: CHARLESWORTH (1914), OZAKI (1934), TCHERNYCHEV (1941), LECOMPTE (1939, 1952), SOKOLOV (1950, 1952, 1955, 1962), SCHOUPPÉ (1951), DUBATOLOV & LIN-BAO YUI (1959), DUBATOLOV (1959, 1969), KOKSCHARSKA (1967), CHEKHOVICH (1971). The genus *Subcaliapora*, described from the Silurian of Tuva (CHEKHOVICH, 1971) is related to *Caliapora*, as it displays several morphological characters transitional from *Subalveolites* and *Caliapora*. A species, described by RUKHIN (1938) as *Caliapora kerneri*, is assigned by CHEKHOVICH (1971) to the genus *Subcaliapora*. A variable thickness of corallite walls, both along a single corallite and in various zones of colony, is among characteristic features of *Caliapora*. The thickness of corallite walls conspicuously increases in the peripheral zone of colony and, consequently, the polygonal outline of corallites becomes irregularly circular (YANET, 1959; DUBATOLOV, 1959, 1963; DUBATOLOV & TONG-DZUY THANH 1965; STASIŃSKA, 1969). However, a constant thickness of walls over the whole length of corallite is found by some authors, including SOKOLOV (1952). About twenty species of this genus have so far been described from the deposits ranging from the U. Silurian to the M. Devonian. On the territory of Poland only *Caliapora battersbyi* is known from the Givetian of Miastko 1 borehole (STASIŃSKA, 1969).

Distribution. — Silurian: USSR (Karaganda); L. Devonian: USSR (Taymyr, Kolyma Region); L.-M. Devonian: USSR (Ural, Kuznetsk Basin), Central Asia; M. Devonian: China (Great Hingan, south-eastern China), North Vietnam, Belgium (The Ardennes), Poland (Cracow Region, Holy Cross Mts.).

Caliapora battersbyi (MILNE-EDWARDS & HAIME), 1851
(Pl. XI, Figs 1*a-c*, 2)

1851. *Alveolites battersbyi* MILNE-EDWARDS & HAIME; H. MILNE-EDWARDS & J. HAIME, p. 257.
1853. *Alveolites battersbyi* MILNE-EDWARDS & HAIME; H. MILNE-EDWARDS & J. HAIME, p. 220, Pl. 49, Fig. 2, 2*a*.
1860. *Alveolites battersbyi* MILNE-EDWARDS & HAIME; H. MILNE-EDWARDS, p. 267.
1880—1897. *Alveolites battersbyi* MILNE-EDWARDS & HAIME; C. F. ROEMER, p. 443.
1889. *Alveolites battersbyi* MILNE-EDWARDS & HAIME; F. MAURER, p. 130, Pl. 4, Fig. 14, 15b.
1889. *Caliapora battersbyi* (MILNE-EDWARDS & HAIME); C. SCHLÜTER, p. 95, Pl. 14, Fig. 8-9.
1908. *Caliapora battersbyi* (MILNE-EDWARDS & HAIME); K. TORLEY, p. 4.
1922. *Caliapora battersbyi* (MILNE-EDWARDS & HAIME); W. PAECKELMANN, p. 82.
1939. *Caliapora battersbyi* (MILNE-EDWARDS & HAIME); M. LECOMPTE, p. 136, Pl. 19, Fig. 1-7.
1969. *Caliapora battersbyi* (MILNE-EDWARDS & HAIME); A. STASIŃSKA, p. 773, Pl. 1, Figs 1, 2, 4.

Diagnosis. — See LECOMPTE, 1939.

Material. — Twenty-one colonies from the U. Givetian of Dubie (ZPAL T IX/133-154) and eight from Siedlec (ZPAL T IX/155-162).

Dimensions (in mm):

H×D	d	thw	dp	p-p	t-t
35-110×15-40×25-55	(0.4)0.7-0.9(1.1)	(0.08)0.1-0.15(0.25)	0.2-0.25 and 0.15-0.25×0.3	(0.5)0.7-0.9(1.0)	(0.3)0.4-0.8(0.9)

Description. — Colonies small, bulbous, oval, pear-shaped, cylindrical or irregular, composed of radially diverging corallites opening, in the form of shallow calices, perpendicularly to the surface of colony. In transverse sections, corallites are irregularly polygonal, their lumen being round or oval which results from a secondary thickening of the walls. Walls varying in thickness. Their microstructure radial. In longitudinal sections, fibers are arranged slightly obliquely and, in transverse sections, perpendicularly to the surface of corallite walls. Median suture distinct. Septal apparatus in the form of numerous, large squamae having strong, wide bases and distal ends pointed and deflected towards the aperture of corallite. Squamae are arranged somewhat obliquely or, less frequently, perpendicularly to the wall of corallite and form three to four regular rows spaced at 0.5 to 1.0 mm, mostly 0.7 to 0.9 mm, intervals, An alternate arrangement of squamae, characteristic of this species, is visible in longitudinal sections. The length of squamae, including the thickness of wall, amounts to 0.3 to 0.6 mm and as a rule exceeds the middle of a tube of corallite. In transverse section, squamae display a characteristic semilunar or crescentiform outline. Connecting pores numerous, round or less frequently, oval, arranged at some intervals in a single row. Tabulae horizontal, rarely oblique, straight or bent, sometimes incomplete, attached by one end to septal squamae.

Remarks. — The specimens described above differ from the representatives of the same species described from the Givetian of Miastko 1 borehole, north-western Poland (STASIŃSKA, 1969) in larger spaces between septal squamae, larger diameter of and smaller spaces between pores and between tabulae. As compared with the species described above, *Caliapora battersbyi* from the Givetian of England (LECOMPTE, 1939) is marked by slightly larger diameters of corallites, thicker walls, particularly in the peripheral zone of colony, smaller spaces between squamae, smaller and more closely spaced connecting pores and much more closely spaced tabulae.

Distribution. — Poland (Holy Cross Mts. — Jurkowice, Miastko 1 borehole): Givetian; Great Britain, Belgium: Givetian.

Family COENITIDAE SARDESON, 1896
Subfamily COENITINAE SARDESON, 1896
Genus **PLACOCOENITES** SOKOLOV, 1955

Type species: *Coenites orientalis* EICHWALD, 1861.

Diagnosis. — See SOKOLOV, 1955.

Remarks. — The genus *Placocoenites* is marked by a flat, laminar form of colony, in which it fundamentally differs from the most closely related genus, *Coenites* (having a ramose colony), with which it has previously been connected. The representatives of the genus *Placocoenites* display a considerable similarity to those of the genus *Tyrganolites* in a flat shape of colony and nearly identical structure of calices. However, *Placocoenites* differs from *Tyrganolites* in the lack of zonal thickenings and thinnings, of a zonal pigmentation of colony and in an irregular and wider spacing of connecting pores and tabulae.

Due to the flat form of their colonies, the following species of the genus *Coenites* have now been assigned to *Placocoenites*: *C. escharoides* (STEININGER, 1833); *C. gradatus* LECOMPTE, 1939; *C. medius* LECOMPTE, 1939; *C. monostichus* FRECH, 1886; *C. orientalis* EICHWALDI, 1861; *C. selwinii* NICHOLSON; *C. labrosus* HINDE.

Eighteen species of his genus have hitherto been described from deposits ranging from the U. Llandoverian through the M. Devonian, including two from Poland; *P. medius* (LECOMPTE) from the Givetian of Miastko 1 borehole (STASIŃSKA, 1969) and *P. escharoides* (STEININGER, 1849) from the Givetian of the same locality and from the Eifelian and Givetian of the Holy Cross Mts. (GÜRICH, 1896; STASIŃSKA, 1958, 1969). The last-named species was also described by GÜRICH (o. c.) as *Coenites expansus* FRECH var. *polonica*.

Distribution. — Silurian: Baltic countries; U. Silurian: USSR (Siberian Platform); L.-M. Devonian: USSR (Kazakhstan, Ural, Kuznetsk Basin, Altay, Sayan, North-eastern Siberia), Central Asia; M. Devonian: Poland, Germany, Belgium (the Ardennes), China, North America; Devonian: Indochina, Australia.

Placocoenites medius (LECOMPTE, 1939)
(Pl. X, Fig. 3*a*-*c*)

1939. *Coenites medius* LECOMPTE; M. LECOMPTE, p. 73-74, Pl. 12, Fig. 3-4.
1959. *Placocoenites medius* (LECOMPTE); W. N. DUBATOLOV, p. 171, Pl. 55, Fig. 1*a*-*b*.
1960. *Placocoenites medius* (LECOMPTE); W. N. DUBATOLOV & N. V. MIRONOVA, p. 362, Pl. D-22, Fig. 7*a*-*b*.
1962. *Placocoenites medius* (LECOMPTE); W. N. DUBATOLOV, p. 61, Pl. 22, Fig. 1.
1963. *Placocoenites medius* (LECOMPTE); T. T. SCHARKOVA, p. 169, Pl. 35, Figs 6, 7.
1964. *Placocoenites medius* (LECOMPTE); I. I. TCHUDINOVA, p. 54, Pl. 25, Figs 3, 4.
1969. *Placocoenites medius* (LECOMPTE); A. STASIŃSKA, p. 773.

Diagnosis (after LECOMPTE, 1939, revised). — Colonies flat, 3.0 to 10.0 mm thick, with bulbois swellings. Corallite oblique to the surface of colony. Calices fissured and semilunar. In transverse section, corallites semilunar, oval, less frequently triangular, 0.4 to 0.45 by 0.7 to 0.9 mm in dimensions. Walls 0.2 to 0.4 mm thick. Connecting pores round, 0.15 to 0.2 mm in diameter, occuring only in the initial stages of the growth of colony. Septae rare, in the form of low cysts. Tabulae thin, horizontal and oblique, straight or bent, spaced at 0.2 to 0.6 mm intervals.

Material. — Three almost complete colonies from the U. Givetian of Dubie (ZPAL T IX/163-165).

Dimensions (in mm):

H×D	d	thw	dp	p-p	t-t
3-10×50×60-80	0.35-0.5×0.6-1.1	(0.05)0.2-0.4(0.6)	0.15-0.20	0.6-1.2	(0.2)0.4-0.6(1.0)

Description. — Colonies relatively small, flat, laminar, testaceous, slightly twisted, with an uneven upper surface, with bulbous processes and swellings, overgrowing the surfaces of the cenoseta of the Stromatoporoidea and other organisms. Basal epitheca thin.

Corallites short, slightly twisted, more or less parallel and closely spaced, in the initial stages of growth creeping over the substrate and in further stages deflecting upwards and opening obliquely to the surface of colony. Calices shallow, fissured, semilunar, horseshoe-shaped or oval, distributed irregularly over the surface of colony or disposed in processes around their centers. In the initial growth stages, corallites are thin-walled, in transverse sections oval, of the alveolitic type and with a wide visceral chamber. In later stages corallites are, in transverse sections, elongate and oval, semilunar, less frequently triangular and round, with rounded angles and strongly contracted lumen of visceral chamber.

Walls, thin only in the initial stages of the growth of colony, in later stages rapidly thicken. Median suture poorly visible, thick and obliterated, emphasized by accumulations of a brown pigment. Microstructure of walls fibro-radial. In longitudinal sections of corallites, the fibers of stereoplasma are disposed obliquely to walls and display a pinnate arrangement, emphasized by zonal concentrations of brown pigment, the same as in the genus *Tyrganolites.*

Connecting pores fine, round, rarely oval and infrequently occurring, are arranged irregularly on the walls of corallites. They occur only on the corallites of the initial stage.

Septal elements very rarely occurring in the form of fine, short, obtuse hills.

Tabulae complete, thin, straight and bent, horizontal or oblique, sometimes penetrating through the connecting pores and reaching adjacent corallites.

Remarks. — *Placocoenites medius* from the U. Givetian of the Cracow Region differs from the forms described by LECOMPTE (1939) from the Givetian of Belgium in its lower colony, presence of the median suture and somewhat thicker walls.

The species described differs from *P. monostichius* (Frech, 1885) in a smaller thickness of colony, wider calices, larger diameter of corallites and thinner walls.

Distribution. — Poland (Miastko 1 borehole): Givetian; USSR (Kuznetsk Basin, Tarbagatai): Eifelian to Givetian; USSR (Altai): Eifelian; Belgium, USSR (Salair): Givetian.

Subfamily NATALOPHYLLINAE SOKOLOV, 1950
(= SCOLIOPORINAE LECOMPTE, 1952)
Genus **NATALOPHYLLUM** RADUGUIN, 1938

Type species: Natalophyllum giveticum RADUGUIN, 1938.

Diagnosis. — See DUBATOLOV, 1959.

Remarks. — Erecting the genus *Natalophyllum*, RADUGUIN (1938) gave, however, a very vague diagnosis and description of species. SOKOLOV (1952) united representatives of the genera *Natalophyllum* and *Scoliopora* to form a single genus *Natalophyllum*, but later, following his studies in Devonian materials from China (SOKOLOV, 1955), he once again separated *Natalophyllum* from *Scoliopora* as two independent genera. According to SOKOLOV (1955, 1962) and DUBATOLOV (1955), the representatives of *Natalophyllum* differ from the genus *Scoliopora* in a larger thickness of corallite walls in the axial zone of colony, somewhat smaller diameters of connecting pores distributed on the same level, poor development of septal spines and a laminar distribution of stereoplasma.

However, as follows from a comparison of the two genera, conducted by the present writer, some of the diagnostic characters of the genus *Natalophyllum* described above also occur in certain species of *Scoliopora* and vice versa. In the Givetian species *N. giveticum* and Eifelian *N. pussilum* from Miastko 1 borehole (STASIŃSKA, 1969) the walls in the axial zone of branches are relatively thin, while in *Scoliopora dubrovensis* from the Givetian of the Kuznetsk Basin (DUBATOLOV, 1959) and, in particular, in *S. muricata* from the same stage and locality (TCHUDINOVA, 1964) they are very thick in this zone. In addition, as shown by an analysis, the diameters of connecting pores in *Natalophyllum* are, in contrast to the views of SOKOLOV, 1955, 1962 and DUBATOLOV, 1959, larger than those in *Scoliopora*. In the representatives of *Natalophyllum*, they amount to 0.12 to 0.2 mm and reach at most 0.3 mm in *N. rarus* from the M. Givetian of the Kuznetsk Basin (TCHUDINOVA, 1964), while in those of *Scoliopora* they amount a bare 0.1 to 0.15 mm, reaching a maximum of 0.2 mm in *S. muricata* from the Givetian of the Kuznetsk Basin (TCHUDINOVA, 1964).

The ratio of the diameter of branch to that of axial zone seems to be a character differing from each other the adult forms of the genera *Natalophyllum* and *Scoliopora*. In all the known species of *Natalophyllum* the axial zone is very narrow (which has been emphasized by many authors) and strongly separated by a violent deflection of the corallites of peripheral zone. In the representatives of *Scoliopora*, this zone is wide and the corallites mostly deflect in the peripheral zone by wide, gentle arcs. The ratio of the diameter of branch to that of axial zone fluctuates in the representatives of the genus *Natalophyllum* between 2.5 and 5, while in *Scoliopora* it amounts as a rule to 2 or less. The laminar distribution of stereoplasma in the peripheral zone of branches in *Natalophyllum*, considered by DUBATOLOV (1959) as the most important diagnostic character of this genus differing it from *Scoliopora*, is not general in all species of *Natalophyllum* (described only in *N. giveticum* and *N. pussilum*) and, moreover, it is also displayed by some species of *Scoliopora*.

Thus, an accurate documentation of fundamental diagnostic differences between the two genera or uniting them into one genus require additional studies.

Six species of the genus *Natalophyllum* have been described so far. *N. simplex* from the Givetian of Central Ural (SOKOLOV, 1952) should probably be assigned to *Scoliopora*, as indicated by its not very large branches having a wide axial zone, by very thin corallite walls in this zone and by a poorly developed septal apparatus occurring in the form of fine denticles.

Two species, *N. giveticum* and *N. pussilum* from the Givetian of Miastko 1 borehole (STASIŃSKA, 1969) are known from the territory of Poland.

Distribution. — Eifelian: China (Siczuan); Eifelian through Givetian: Poland (Miastko 1 borehole); M. Eifelian through U. Givetian: USSR (Kuznetsk Basin); Givetian: USSR (Ural), U. Givetian: Poland (Cracow Region).

Natalophyllum giveticum RADUGUIN, 1938

(Pl. XIII, Fig. 3; Pl. XIV, Fig. 1*a*, *b*; Pl. XV, Fig. 3)

1938. *Natalophyllum giveticum* RADUGUIN; K. W. RADUGUIN, p. 79, Pl. 2, Figs 9-10; Pl. 5, Figs 5-6.
1959. *Natalophyllum giveticum* RADUGUIN; W. N. DUBATOLOV, p. 184, Pl. 58, Fig. 3-4, 5*a-g*; Pl. 59, Fig. 1*a-b*.
1960. *Natalophyllum giveticum* RADUGUIN; W. N. DUBATOLOV & N. V. MIRONOVA, p. 365, Pl. D-24, Fig. 2*a-g*.
1964. *Natalophyllum giveticum* RADUGUIN; J. I. TCHUDINOVA, p. 58, Pl. 28, Figs 1-3.
1969. *Natalophyllum giveticum* RADUGUIN; A. STASIŃSKA, p. 775, Pl. 2, Figs 1, 2.

Diagnosis. — See DUBATOLOV, 1959.
Material. — Seven U. givetian colonies from Dubie (ZPAL T IX/206-212).
Dimensions (in mm):

D	d	thw	dp	p-p	t-t
18-25 and 18×25	(0.3)0.4-0.6(0.7) and 0.5-0.6×0.7-0.9	0.06-0.12 and 0.25-0.4	(0.12)0.15-0.18(0.2)	(0.5)0.6-0.8(0.9)	(0.1)0.3-0.5

Description. — Colonies fascicular. Branches cylindrical or slightly flattened. Calices flattened, extended, oval, horseshoe-shaped, bean-shaped or meandering and fissured with a short, thick, single septal spine. Their dimensions: 0.2×0.4 mm to 0.4×0.6 mm and 0.2× 0.8 mm. The inside of branch distinctly divided into two zones: a narrow axial zone, 3.5 to 5.0 mm in diameter in which corallites are parallel to the axis of the growth of branch and a wide peripheral zone whose corallites violently deflect from the central zone at an angle of about 90° and open perpendicularly to its surface. The ratio of the diameter of branch to that of the axial zone in various colonies and various transverse sections fluctuates between 4.0 and 4.5 its value increasing proportionally to an increase in the diameter of branch.

Axial zone. Its corallites are more or less regularly polygonal, less frequently flattened, with inner outlines rounded or elongate. Corallite walls relatively thin. Median suture fairly distinct. Microstructure of walls radial, fibers of stereoplasma arranged perpendicularly to corallite walls.

Peripheral zone. Its corallites are polygonal, flattened and elongate in transverse sections. Median suture very poorly visible or absent at all. A characteristic microstructure of walls in the form of folded concentric rings parallel to the surface of branch is observed in this zone. These structures are emphasized by laminar accumulations of a dark pigment. In longitudinal sections the fibers of stereoplasma are strongly oblique to the surface of corallite walls.

Connecting pores numerous, round, concentrically distributed on the same level as in adjacent corallites, arranged in single corallites in one vertical row. Septal spines rare, short and thick, with a wide base, arranged in a single row and occurring only in the peripheral zone and calices. Tabulae numerous, horizontal and oblique, slightly bent or straight. Spirally twisted tubes of foreign organisms, 0,15 to 0,20 mm in diameter, are frequently observed in the peripheral zone of branches.

Remarks. — In the U. Givetian colonies of *N. giveticum* from Dubie, the largest variability is observed in the thickness of corallites walls in the axial zone of branches, which fluctuates from 0.1 to 0.15 to 0.20 mm and from 0.18 to 0.30 mm. This variability occurs simultaneously in the same colony and even in the same branch, but on its various levels. Diameters of connecting pores also display certain small fluctuations. As compared with *N. giveticum* from the Givetian of Miastko 1 borehole (STASIŃSKA, 1969), the form described above differs in a relatively larger axial zone of branch, somewhat smaller diameters of corallites in this zone, in a larger thickness of corallite walls in this zone and smaller in the peripheral zone.

N. giveticum from Dubie differs from forms from the Givetian of the Kuznetsk Basin (DUBATOLOV, 1959; DUBATOLOV & MIRONOVA, 1960; TCHUDINOVA, 1964) in slightly smaller diameters of corallites, thicker walls in the axial zone and a somewhat smaller diameter of this zone.

Distribution. — Poland (Miastko 1 borehole): Givetian; USSR (Kuznetsk Basin): Upper Givetian.

Natalophyllum dubiensis sp. n.

(Pl. XIII, Figs. 1, 2*a*-c)

Holotype: ZPAL T IX/213; Pl. XIII, Fig. 2*a-c*.
Type horizon: Middle Devonian, Upper Givetian.
Type locality: Dubie, Cracow Region.
Derivation of the name: *dubiensis* — after the name of the village Dubie.

Diagnosis. — Colonies fascicular. Branches cylindrical to 25 mm in diameter. Calices oval, bean-shaped, 0.3 by 0.6 mm, with a single, short septal spine. Axial zone 4-6 mm in diameter. The ratio of the diameter of branch to that of axial zone amounts to 6. In the axial zone, corallites are irregularly polygonal, 0.4 to 0.5 mm thick. In the peripheral zone, corallites are oval and elongate, 0.6 by 1.0 to 0.8 by 1.1 mm, their walls being 0.15 to 0.20 mm thick. Pores round, 0.15 to 0.18 mm in diameter, spaced at 0.8 to 1.0 mm intervals. Septal spines short, thick, arranged in one row, occurring only in the peripheral zone and calices. Tabulae horizontal, oblique and slightly bent, spaced, at 0.4 to 0.8 mm intervals.

Material. — Five well-preserved colonies from Dubie (ZPAL T IX/213-217).

Dimensions (in mm):

D	d	thw	dp	p-p	t-t
(24)25 × 32	(0.3)0.4-0.5 and 0.55-0.8× 0.6-1.2	(0.05)0.07-0.12(0.15) and (0.1)0.15-0.2(0.25)	(0.12)0.15-0.18(0.2) and 0.12×0.2	(0.7)0.8-1.0(1.2)	0.4-0.8

Description. — Colonies fascicular. Branches short, thick, cylindrical or flattened, frequently fused with each other by lateral walls. A branch consists of a very narrow axial zone, 4.0 to 5.0 to 6.0 mm in transverse section, in which corallites are parallel to the axis of the growth of colony and a wide peripheral zone whose corallites violently deflect from the axis of branch, opening perpendicularly to the surface of colony. The ratio of the diameter of branch to that of axial zone amounts to 6. Calices elongate, oval, mostly bean-shaped, frequently meandering, 0.25 by 0.5 to 0.3 by 0.7 mm, with a short septal spine. On the whole, they resemble the calices of the genus *Scoliopora*, for example, *S. denticulata* or *S. muricata*.

In the axial zone, corallites are more or less regularly polygonal, less frequently polygonal and flattened. Due to a considerable thickening of walls in this zone, the lumen of corallites is strongly contracted, displaying oval outlines in transverse sections. Corallites walls fairly variable in thickness. Median suture very poorly visible in the form of a thin, dark line. Microstructure of walls radial, in the form of fine fibers, in transverse sections arranged perpendicularly to the surface of corallites. A distinctly wavy-fibrous microstructure of walls in the form of slightly folded, concentric rings parallel to the surface of branches, is exceptionally observed in the peripheral zone. These zones are emphasized by the occurrence of laminar accumulations of a dark pigment. The fibers of stereoplasma are arranged strongly obliquely to the surface of corallite walls, which may be observed in longitudinal sections.

Connecting pores not very numerous, round, sometimes elliptical, arranged concentrically and on the same level as in adjacent corallites. Single, vertical rows are arranged in separate corallites. Septal spines fairly numerous, short, thick, with a wide base, arranged in single rows and occurring only in the peripheral zone and calices. Tabulae rare, horizontal and oblique, slightly bent or straight.

Remarks. — *N. dubiensis* sp. n. differs from the remaining species of this genus in very thick walls of corallites in the axial zone of colony and in a very narrow axial zone. The new species is most similar to *N. huangi* SOKOLOV from the Eifelian of Southern China (SOKOLOV, 1955) in regard to the dimensions of calices, diameters of corallites in the axial zone and those, of connecting pores. *N. dubiensis* differs from *N. huangi* in somewhat larger diameters of branches, presence of septal spines (absent in *N. huangi*), thinner walls in the peripheral zone of colony, presence of elliptical pores and wider spacing of tabulae. As compared with the type species, *N. giveticum*, the new species has more elongate calices, smaller diameters of corallites in the axial zone, somewhat smaller diameters and wider spacing of connecting pores.

Genus **SCOLIOPORA** LANG, SMITH & THOMAS, 1940

Type species: *Alveolites denticulatus* MILNE-EDWARDS & HAIME, 1851.

Diagnosis. — See DUBATOLOV, 1959.

Remarks. — Detailed characteristics and comparisons with related genera are presented by LECOMPTE (1939), SOKOLOV (1952, 1955, 1962), FONTAINE (1954), DUBATOLOV (1959), SCHARKOVA (1963) and TCHUDINOVA (1964). See also pp. 70-71.

In *Scoliopora* the median suture is as a rule invisible and septal spines frequently occur also in the corallites of the axial zone. Most representatives of the genus *Scoliopora* have fascicular colonies. However, flattened colonies are also met with, e. g., in *S. maillieuxi* from the Frasnian of the Ardennes (LECOMPTE, 1936, 1939), *S. ronensis* from the Emsian of Indochina (FONTAINE, 1954) and *S. septosa* from the Ludlovian of the Tarbagatai Ridge (SCHARKOVA, 1963).

As follows from studies, the septal apparatus is variously developed in different species of *Scoliopora*. Species with flat colonies resemble in internal structure the representatives of the genera *Alveolites* and *Placocoenites*, from which they differ, however, in the presence of a platelike septum (SOKOLOV, 1955). Such a septum was described in forms having both flat and fascicular colonies, including *S. firmita* and *S. formosa* from the Givetian of the Kuznetsk Basin (TCHUDINOVA, 1964) and *S. septosa*. Their presence was also found by SCHARKOVA (1963) in *S. denticulata*.

According to other authors, the septal apparatus may be developed, at least in some number of the representatives of *Scoliopora*, in the form similar to that of pseudoseptal projections observed in *Chaetetes* (DUBATOLOV, 1959) as a few (one to three) rows of septal spines occurring in calices (SOKOLOV, 1952; FONTAINE, 1954) or as a single, strongly developed spine, sometimes accompanied by several fine spines (SCHARKOVA, 1963) as is the case of the representatives of the genus *Alveolites*. Frequently described are also spine less forms or those having a poorly developed spine. This is the reason why the species *Alveolites intermixtus* LECOMPTE, 1939 from the Eifelian of Belgium and Givetian of Poland (LECOMPTE, 1939; STASIŃSKA, 1958) was assigned by TCHUDINOVA (1964, p. 60) to the genus *Scoliopora*.

So far, twenty species of this genus have been described from deposits ranging from the Ludlovian through the U. Devonian. From the territory of Poland only three species of this genus have been known. They are: *S. denticulata* (MILNE-EDWARDS & HAIME, 1851) from the Eifelian of the Holy Cross Mts., Miastko 1 borehole and the Sudeten Mts. (GÜRICH, 1896; SOBOLEV, 1909; GUNIA, 1966; STASIŃSKA, 1969), *Sc.* cf. *denticulata* from the M. Devonian of the Holy Cross Mts. (STASIŃSKA, 1954), *S. dziewkiensis* from this same locality (GÜRICH, 1896, 1909) and *S. intermixta* from the Givetian of these mountains (STASIŃSKA, 1958).

Distribution. — Ludlovian: USSR (Kazakhstan, Tarbagatai Range); U. Silurian: USSR (Balkhash); Emsian through Givetian: Indochina; Eifelian (Cuvinian): Australia (Queensland); Eifelian through Givetian: Poland (Holy Cross Mts., Miasto 1 borehole, Sudeten Mts.), Germany; Givetian: USSR (Bashkir SSR, Salair); M. Devonian: USSR (Armenia, Transcaucasia); Eifelian through Frasnian; Belgium (The Ardennes); Givetian through Frasnian: USSR (Kuznetsk Basin); M. Devonian through Frasnian: Spain (Asturias); Frasnian: USSR (Byelorussia); Famennian: China (Yuman); U. Devonian: North-western India (Chitral); Devonian: USSR (Timan).

Scoliopora denticulata (MILNE-EDWARDS & HAIME, 1851)

(Pl. XI, Fig. 3; Pl. XII, Figs 1-5)

1959. *Scoliopora denticulata* (MILNE-EDWARDS & HAIME); W. N. DUBATOLOV, p. 178, Pl. 56, Figs 6*a-w*, 7*a-b* (here, earlier synonymy).
1960. *Scoliopora denticulata* (MILNE-EDWARDS & HAIME); W. N. DUBATOLOV & N. V. MIRONOVA, p. 363, Pl. D-23, Fig. 3.
1960. *Scoliopora denticulata* (MILNE-EDWARDS & HAIME); K. A. ERMAKOVA, p. 80, Pl. 5, Figs 1-5.
1966. *Scoliopora denticulata* (MILNE-EDWARDS & HAIME); T. GUNIA
1969. *Scoliopora denticulata* (MILNE-EDWARDS & HAIME); A. STASIŃSKA, p. 774.

Diagnosis. — See DUBATOLOV, 1959.

Material. — Twenty-eight colonies from the U. Givetian of Dubie (ZPAL T IX/166-193) and nine from the U. Givetian of Siedlec (ZPAL T IX/194-203).

Dimensions (in mm):

D	d	thw	dp	p-p	t-t
5-18 and 6.5-11×8-13	0.25-0.7 and 0.4-0.5×0.6-0.7	(0.05)0.07-0.15(0.2) and 0.15-0.25	0.12-0.15(0.18) and 0.15×0.2	0.4-0.6	(0.15)0.2-0.4(0.6)

Description. — Colonies fascicular. Branches cylindrical or somewhat flattened, sometimes laterally fused with each other. Calices oval, flattened, horseshoe-shaped, or beanlike, less frequently extended and fissured, sometimes meandering, with a single, strong septal spine, mostly 0.5 by 1.8 mm. Axial zone 3.5 to 7.0 mm in diameter. In the peripheral zone, corallites deflect in an arcuate manner from the branch and open perpendicularly to its surface. The ratio of the diameter of branch to that of axial zone fluctuate between 1.6 and 2.6.

In the axial zone, corallites irregularly polygonal, elongate, less frequently regularly polygonal. As a result of a considerable thickening of walls in this zone the lumen of corallite tubes is strongly contracted and displays in transverse section an oval, fissured, or less frequently, round outline. Corallite walls as a rule thick, as a result of a deposition of stereoplasma. Microstructure of walls fibro-radial. In transverse sections, the fibers of corallites are arranged perpendicularly and in longitudinal sections strongly obliquely to corallite walls. A pinnate arrangement of fibers, sometimes emphasized by a laminar concentration of dark pigment, is observed on the peripheries of branches. Median suture very poorly visible and in the axial zone only.

In the peripheral zone corallites are similar in size to calices. Connecting pores not very numerous, round or, less frequently, elliptical.

Septal spines well-developed, short, thick, with a broad base, arranged in single, vertical rows on corallite walls of the axial and peripheral zone in calices. Tabulae numerous, horizontal or oblique, bent or, less frequently, straight. The colonies of *S. denticulata* are mostly poorly preserved, with a partly destroyed internal structure and mostly overgrown by the stromatoporoids.

Remarks. — The species *S. denticulata* includes two subspecies: *S. denticulata longispina* LECOMPTE from the Givetian of Belgium (LECOMPTE, 1939) and *S. denticulata vassinoensis* DUBATOLOV from the U. Frasnian of the Kuznetsk Basin (DUBATOLOV, 1959). *S. denticulata* from the village Dubie differs from the colonies, described from the Givetian and Frasnian of Western Europe (LECOMPTE, 1939), in only slightly thicker corallite walls in the axial zone.

As compared with *S. denticulata* from the Frasnian of Kuznetsk Basin (DUBATOLOV, 1959), the form discussed above has less regularly polygonal corallites with walls thicker in the axial zone of branch and more closely spaced tabulae. In comparison with *S. denticulata* from the Givetian of Miastko 1 borehole (STASIŃSKA, 1969), the form described has somewhat thicker corallite walls in the axial zone of branches.

Distribution. — Poland, Holy Cross Mts.: Eifelian, Miastko 1 borehole: Givetian, Sudeten: Middle Devonian; Germany: Givetian; Belgium: Givetian to Frasnian; Spain, USSR (Russian Platform, Kuznetsk Basin, Armenia): Frasnian; China: Famennian.

Scoliopora cf. **muricata** TCHUDINOVA, 1964
(Pl. XII, Fig. 6*a*, *b*)

Material. — Three fragmentary colonies from the U. Givetian of Dubie (ZPAL T. IX/204, 205).

Dimensions (in mm):

D	d	thw	dp	p-p	t-t
5-15	0.4-0.5×0.6-0.7	(0.1)0.15-0.25	0.12-0.2	0.5	0.3-0.5

Description. — Colonies fascicular or bulbous, small, with large digitate processes. Branches cylindrical or flattened, as a rule fused together laterally. Calices oval, flattened, horseshoe-shaped or beanlike, slightly differentiated into a very wide axial and narrow peripheral zone. Corallite perpendicular to the surface of colony. In the axial zone, corallites are more or less regularly polygonal (mostly penta- and hexagonal) or, less frequently, polygonal-elongate in transverse section. As a result of a considerable thickening of walls, the lumen of visceral chamber of corallites is on the whole strongly contracted and displays an ovally elongate or, less frequently, round outline in transverse section. Corallite walls relatively thick, with a fibroradial microstructure. Both in transverse and longitudinal sections, the fibers of stereoplasma are arranged perpendicularly to corallite walls. Median suture locally distinct, thin, dark, sometimes strongly emphasized by a dark pigmentation. In the peripheral zone, corallites, seen in transverse section, are similar in size and shape to calices. Connecting pores not very numerous, round or suboval, arranged in single vertical rows. Septal spines well-developed, short, thick, obtuse, with a broad base, occurring mostly in the peripheral zone. In the axial zone they are smaller and widely spaced. Tabulae frequently, horizontal or oblique, straight or slightly bent.

Remarks. — The described form from the Givetian of Dubie displays a similarity to *S. muricata* TCHUDINOVA from the Givetian of Kuznetsk Basin (TCHUDINOVA, 1964) in a slight differentiation of its axial and peripheral zones of branches, in the shape of transverse sections, dimensions of corallites, thickness of wall, diameter of connecting pores and development of septal apparatus. It differs, however, in smaller diameters of laterally fusing branches of colony, semicircular and less elongate transverse sections of calices and, finally, wider spacing of connecting pores. From *S. denticulata* it differs in larger diameters of corallites, thicker walls in both the axial and peripheral zone and larger diameters of and smaller spaces between connecting pores.

Distribution. — USSR (Kuznetsk Basin): Givetian.

Genus **TYRGANOLITES** TCHERNYCHEV, 1951

Type species: *Tyrganolites eugeni* TCHERNYCHEV, 1951.

Diagnosis. — See SCHARKOVA, 1963.

Remarks. — The genus *Tyrganolites*, erected by TCHERNYCHEV (1951), displays a considerable similarity to *Placocoenites* and *Natalophyllum*. The similarity between *Tyrganolites* and *Placocoenites* is expressed in the shape of flat, crustose colonies and transverse sections of the visceral chambers of corallites. *Tyrganolites* differs from *Placocoenites* in zonal thickening and thinning of corallite walls and in the distribution of connecting pores on the same level with those in adjacent corallites. The similarity between *Tyrganolites* and *Natalophyllum* is expressed partly in the shape of transverse sections of corallites, distribution of connecting pores, which in both genera occur on the same level in adjacent corallites, zonal thickening and thinning of corallite walls and zonal pigmentation of colony. *Tyrganolites* differs from *Natalophyllum* in a flat shape of colony and polygonal, elongate sections of corallites.

About ten species of this genus, known from the M. Devonian only, have so far been described. No representatives of this genus have hitherto been recorded on the territory of Poland.

Distribution. — Eifelian: USSR (Rudnyi Altay); Givetian: USSR (Eastern Ural, Balkhash, Salair, Tarbagatai Ridge); Poland (Cracow Region); Eifelian and Givetian: USSR (Kuznetsk Basin); M. Devonian: South-western China; Frasnian: Poland (Cracow Region).

Tyrganolites eugeni TCHERNYCHEV, 1951

(Pl. XIV, Fig. 2*a-c*)

1951. *Tyrganolites eugeni* TCHERNYCHEV; B. B. TCHERNYCHEV, p. 65, Pl. 17, Figs 5-7.
1955. *Tyrganolites eugeni* TCHERNYCHEV; B. S. SOKOLOV, Pl. 33, Figs 3-4.
1959. *Tyrganolites eugeni* TCHERNYCHEV; W. N. DUBATOLOV, p. 181, Pl. 57, Figs 2*a-b*, 3*a-w*; Pl. 70, Figs 5-7.
1960. *Tyrganolites eugeni* TCHERNYCHEV; W. N. DUBATOLOV & N. V. MIRONOVA, p. 364, Pl. D-23, Fig. 5.
1962. *Tyrganolites eugeni* TCHERNYCHEV; B. S. SOKOLOV, Pl. 10, Fig. 5*a-b*.
1972. *Tyrganolites eugeni* TCHERNYCHEV; F. E. YANET, p. 97, Pl. 34, Fig. 2*a-b*.

Diagnosis. — See DUBATOLOV, 1959.

Material. — Five colonies from the U. Givetian of Dubie (ZPAL T IX/218-222).

Dimensions (in mm):

H×D	d	thw	dp	p-p	t-t
20×30-40×40	0.3-0.6 and 0.35-0.4×0.5-0.7	(0.08)0.1-0.2(0.25)	0.12-0.2	0.4-0.6	0.2-0.4(0.5)

Description. — Colonies small, crustose, flat or bulbous-flat, with irregular processes, overgrowing other organisms, mostly the cenostea of the Stromatoporoidea. Colony composed of short, thick-walled, locally twisted corallites, opening perpendicularly to its surface.

In the initial stages of the growth of colony, corallites are arranged horizontally. In transverse sections, calices are fissured, semilunar, bent and oval, with rounded, blunt edges. In transverse sections, corallites are irregularly polygonal or polygonal-rounded and elongate, rarely regularly polygonal. The lumen of corallites locally strongly contracted, fissured, semilunar, bent, oval or, very rarely, round. Corallite walls varying in thickness within a considerable range. The walls are very thin in the initial growth stages and in irregular processes. In these places, corallites are distinctly polygonal. Median suture locally distinct. The zonal thickening or thinning of walls not very distinct, but somewhat emphasized by a laminar distribution of pigment. Microstructure of walls fibro-radial, with corallites displaying, in longitudinal sections, an oblique arrangement of stereoplasma, locally pinnate in character. Connecting pores numerous, round, distributed on the same level as those in adjacent corallites. Septal spines rare, short, thick, bluntly terminating, arranged in single rows. Tabulae numerous, thin, complete or, less frequently, incomplete, horizontal or oblique, straight or bent, locally passing through connecting pores and reaching adjacent corallites.

Spirally twisted tubes of foreign organisms, to 0.4 mm in diameter, are visible in corallite walls.

Remarks. — *Tyrganolites eugeni* from the U. Givetian of the Cracow Region has thicker colonies and somewhat larger diameters of corallites than those observed in specimens described from the Givetian of the Kuznetsk Basin (TCHERNYCHEV, 1951; DUBATOLOV, 1959) and Salair (DUBATOLOV & MIRONOVA, 1960). As compared with specimens from the Givetian of the eastern slopes of the Ural, the colonies from Poland have more closely spaced connecting pores, which are marked by smaller diameters, and more closely spaced tabulae and septal spines. A species most closely related to *T. eugeni* is *T. altaicus* TCHEREPINA, 1960 from the Givetian of the Rudnyi Altay (DUBATOLOV & MIRONOVA, 1960; DUBATOLOV, 1962).

Distribution. — USSR (Kuznetsk Basin, Salair, Ural): Givetian; USSR (Altai), South-Western China: Middle Devonian.

Tyrganolites frasnianus sp. n.

(Pl. XIV, Fig. 3*a, b*)

Holotype: ZPAL T IX/223; Pl. XIV, Fig. 3*a, b*.
Type horizon: Devonian, Middle Frasnian.
Type locality: Żbik, Cracow Region.
Derivation of the name: *Lat. frasnianus* — after the name of the Frasnian stage.

Diagnosis. — Colonies plano-convex, to 25 mm in diameter and to 10 mm high. Corallites irregularly polygonal and elongate in transverse sections, 0.4 to 0.5 by 0.6 to 1.0 mm. Lumen of corallites somewhat contracted, oval, semicircular or triangular. Walls 0.08 to 0.15 mm thick. Pores widely spaced, round, 0.15 mm in diameter, distributed on the same level in adjacent corallites and spaced at 0.5 to 0.8 mm intervals. Septal spines widely scattered, short, thick. Tabulae numerous, thin, horizontal and oblique, spaced at 0.2 to 1.2 mm intervals.

Material. — Three well-preserved colonies from Żbik (ZPAL T IX/223-225).

Dimensions (in mm):

H×D	d	thw	dp	p-p	t-t
10×25	0.4-0.5×0.6-1.0 and 0.4-0.6	(0.05)0.08-0.15(0.2)	0.15	0.5-0.8	(0.2)0.4-0.7(1.2)

Description. — Colonies small, oval, flattened or plano-convex, composed of relatively short, thick-walled corallites, locally slightly twisted and opening perpendicularly to the surface of colony. In the initial growth stages, corallites are arranged horizontally, in later — they rise. In transverse sections, calices are fissured, oval, locally semicircular, with blunt edges. Corallites are irregularly polygonal (penta- to heptagonal), mostly strongly elongate, with rounded corners or, less frequently, polygonal and suboval. Lumen of corallites slightly contracted, fissured-oval, bent, bean-shaped, rarely semicircular, triangular or round. Walls varying in thickness both all along the corallite and in various zones of colony. In the initial growth stages, walls are very thin and corallites display an alveolitic shape. Median suture indistinct. A fibro-radial microstructure of walls is locally emphasized by zones of laminar, dark pigmentation. In longitudinal sections, the fibers of stereoplasma are arranged obliquely and in transverse sections perpendicularly to corallite walls. Connecting pores widely spaced, round, distributed on the same level in adjacent corallites. Septal spines rare, well-developed, short, thick, with wide bases, bluntly terminating, arranged in single rows. Tabulae numerous, complete, thin, horizontal and oblique, straight or slightly twisted.

Remarks. — *Tyrganolites frasnianus* sp. n. differs from all other known species in a general internal structure of its colony and a crypto-fibrous microstructure of walls. Most representatives of the genus *Tyrganolites*, (e. g. *T. tchernychevi* DUBATOLOV, 1959; *T. trigonalis* SCHARKOVA, 1963; *T. obrutschevi* SOKOLOV, 1955) display a laminar-concentric microstructure. In the shape of transverse sections and diameters of corallites, diameters and spacing of connecting pores and spacing of tabulae the new species is related to *T. altaicus* TCHEREPINA (1960) from the Eifelian of Rudnyi Altay (DUBATOLOV & MIRONOVA, 1960; DUBATOLOV, 1962) from which it differs, however, in smaller colonies, thinner corallite walls and better developed septal apparatus.

T. frasnianus sp. n. displays a similarity in the shape and size of colony, thickness of corallite walls and diameter and spacing of connecting pores, to *T. beresovkaensis* DUBATOLOV from the Eifelian of the Rudnyi Altay and Givetian of Tarbagatai Ridge (DUBATOLOV, 1960, 1962; SCHARKOVA, 1963), from which it differs, however, in a less extensive range of variability in size, different outlines of transverse sections of corallites, better developed septal apparatus and larger variability in the spacing of tabulae. The new species differs from *T. eugeni* TCHERNYCHEV, 1951 in smaller colonies, larger diameters of corallites and somewhat different outline of their transverse sections, as well as in a wider spacing of tabulae.

Order SYRINGOPORIDA SOKOLOV, 1962
Family SYRINGOPORIDAE NICHOLSON, 1879
Genus **SYRINGOPORA** GOLDFUSS, 1826

Type species: *Syringopora ramulosa* GOLDFUSS, 1826.

Diagnosis. — See TCHUDINOVA, 1971.

Remarks. — Supplementing the diagnosis, it should be mentioned that the funnel-like or strongly twisted tabulae of the genus *Syringopora* frequently fuse together in the axial zone of corallite to form a more or less distinct centrally or eccentrically situated axial canal communicating, through connecting tubes, with such a canal of an adjacent corallite. Septal elements in *Syringopora* frequently occur on tabulae and in the wall of axial canal. In addition, such well-developed elements as septal spines do not occur at all in many species. The reproduction is effected by intracalicular-extravisceral budding.

Characteristics of the genus *Syringopora* and its comparison with related genera are given in the works of SOKOLOV (1947, 1952, 1955, 1962), DUBATOLOV (1959, 1962), DUBATOLOV & (LIN-BAO YUI, (1959) and TCHUDINOVA (1971). The related genus *Syringella* NOWIŃSKI, 1970 differs from *Syringopora* in characteristic oval vesicles (vacuoles), occurring in corallite walls and in the presence of a thickwalled axial canal with spines and funnel-like tabulae.

The following eighteen species of the genus *Syringopora* have so far been known from Polish territories: *S. bifurcata*, *S. blanda*, *S. blandiformis*, *S. crassa*, *S. fascicularis*, *S. lindstraemiformis*, *S. maxima*, *S. multifaria*, *S. novella*, *S. parva*, *S. parviformis*, *S. polonica*, *S. schmidti* and *S. schmidtiformis* from the Ordovician and Silurian erratic boulders of the Baltic coast (STASIŃSKA, 1967); *S. crispa* and *S. sokolovi* from the Givetian of the Holy Cross Mts. (STASIŃSKA, 1954, 1958); *S. reticulata* and *S. ramulosa* from the L. Carboniferous of Silesia and the Sudetes (KNUTH, 1869; RÖMER, 1870; TIETZE, 1871; ŻAKOWA, GŁOWACKI & JURKIEWICZ, 1963; ŻAKOWA, 1966; KICUŁA & ŻAKOWA, 1972).

Distribution. — U. Ordovician: USSR (Ural); Silurian: Poland (Baltic region), USSR (Podolia, Siberia); Wenlockian: Sweden (Gotland); Wenlockian through Ludlovian: Norway; Silurian through Carboniferous: USSR (Ural, Kuznetsk, Basin, Kazakhstan, Kolyma Basin), Central Asia; Devonian: USSR (East-European Platform, Transcaucasia); Carboniferous: USSR (Moscow and Donetsk basins, Novaya Zemlya), China, Vietnam; L. Permian: USSR (Ural, Timan); Silurian through Carboniferous: Western and Eastern Europe, South America, China, South-eastern Asia, Australia.

Syringopora ramulosa GOLDFUSS, 1826
(Pl. XVI, Figs 1, 2, 3; Pl. XVII, Fig. 1)

1826. *Syringopora ramulosa* GOLDFUSS; G. A. GOLDFUSS, p. 76, Pl. 25, Fig. 7.
1895. *Syringopora ramulosa* GOLDFUSS; A. A. STUCKENBERG, p. 14, Pl. 1, Figs. 12, 13 (here earlier synonymy up to 1872).
1910. *Syringopora ramulosa* GOLDFUSS; A. WILMORE, p. 576.
1911. *Syringopora ramulosa* GOLDFUSS; F. FRECH, p. 79.
1915. *Syringopora ramulosa* GOLDFUSS; H. YABE & J. HAYASAKA, p. 83 (21).
1919. *Syringopora ramulosa* GOLDFUSS; K. E. GABUNIA, p. 5.
1920. *Syringopora ramulosa* GOLDFUSS; H. YABE & J. HAYASAKA, p. 10, Pl. 10, Fig. 3.
1931. *Syringopora ramulosa* GOLDFUSS; V. D. FOMITCHEV, p. 15 (here, earlier synonymy up to 1931).
1933. *Syringopora ramulosa* GOLDFUSS; Y. S. CHI, p. 10, Pl. 1, Fig. 3*a-c*.
1935. *Syringopora ramulosa* GOLDFUSS; J. J. GORSKY, p. 26, Pl. 5, Fig. 6.
1938. *Syringopora ramulosa* GOLDFUSS; A. N. IVANOV, p. 51, Pl. 2, Fig. 3.
1938. *Syringopora ramulosa* GOLDFUSS; J. J. GORSKY, p. 13.
1939. *Syringopora ramulosa* GOLDFUSS; N. S. ILINA, p. 68, Pl. 1*a*, Fig. 4.
1950. *Syringopora ramulosa* GOLDFUSS; B. S. SOKOLOV, p. 22, Pl. 1, Figs 1, 2.
1950. *Syringopora ramulosa* GOLDFUSS; N. P. VASSILJUK, p. 142, Pl. 1, Figs 1, 2.
1962. *Syringopora ramulosa* GOLDFUSS; N. P. VASSILJUK, p. 28, Pl. 4, Fig. 1*a*, *b*.
1962. *Syringopora ramulosa* GOLDFUSS; T. A. DOBROLUBOVA & V. V. KABAKOVICH, p. 117, Pl. C-4, Fig. 4.
1966. *Syringopora ramulosa* GOLDFUSS; N. P. VASSILJUK, p. 53.
1966. *Syringopora ramulosa* GOLDFUSS; T. A. SAYUTINA, p. 217, Pl. 42, Fig. 2.

Diagnosis. — See SOKOLOV, 1950.

Material. — Four colonies from the U. Visean of Gałęzice's railway cut on Ostrówka Hill (ZPAL T IX/304-306 and AI-35/303), two from Gałęzice, Todowa Grząba Hill (ZPAL T IX/307, 308) and two from the M.-U. Visean of the region of Dębnik (ZPAL T IX/309, 310).

Dimensions (in mm):

H×D	C-C	d	thw	dax	ds	s-s
450×200×270	(0.5)1.5-2.5(3.2)	(2.0)2.5-2.8(3.2)	(0.3)0.4-0.5(0.6)	(0.25)0.4-0.6(0.8)	(0.8)1.0-1.5(1.7)	6.0-9.0

Description. — Colonies dendroid, large, irregularly elongate or slightly fusiform, composed of very large, cylindical, straight or slightly twisted corallites, arranged parallel to each other. In transverse sections, corallites are round in outline or, very rarely, slightly elliptical or triangular. Corallite walls with a typical concentric-lamellar microstructure. Epitheca very thin, 0.02 to 0.03 mm.

Connecting tubes relatively short, very widely and irregularly spaced. Tabulae funnel-like, arcuate, long, as a rule strongly oblique to corallite walls and arranged in two distinct zones. Thin tabulae occur mostly near the inner surface of corallite wall, forming local bunches of vesicles, and axially, forming a thin-walled axial canal. These tabulae occur in a space between the inner wall of corallite and the wall of axial canal. Tabulae frequently pass, through the connecting tubes, to adjacent corallites. Axial canal thin-walled, round or rounded, less frequently oval in transverse section occurring not over the entire length of corallite tube and situated centrally, less frequently eccentrically. Septal spines numerous, long, reaching one-third the inner diameter of corallite or, sometimes, even the middle of tube, arranged in 24 to 30 vertical rows spaced at 0.25 to 0.5 mm intervals. They are mostly somewhat oblique to corallite wall and very frequently penetrate tabulae or, even sometimes, the wall of axial canal. Single smaller spines occur on tabulae and walls of axial canal.

Remarks. — As compared with specimens from Gałęzice, *S. ramulosa* from Czerna is marked by a wider spacing of corallites, somewhat larger diameters and considerably thinner walls of corallites, larger dimensions of connecting tubes, and longer septal spines which are arranged in more rows.

Distribution. — Poland, Sudeten: Lower Carboniferous, Silesia: Lower to Upper Carboniferous; Belgium, USSR (Kuznetsk Basin, Eastern Siberia), Egypt, Syria: Tournaisian; China: Tournaisian to Visean; France, Germany, Austria, Australia: Visean; England, Spain, Hungary, USSR (Moscov Basin, Ural, Kazakhstan, Nova Zemla), North America: Lower Carboniferous; USSR (Timan): Upper Carboniferous; Spitsbergen: Upper Carboniferous to Lower Permian.

Syringopora reticulata GOLDFUSS, 1826

(Pl. XV, Figs 1*a*, b, 2)

1826. *Syringopora reticulata* GOLDFUSS; G. A. GOLDFUSS, p. 76, Pl. 25, Fig. 6.
1895. *Syringopora reticulata* GOLDFUSS; A. A. STUCKENBERG, p. 17, Pl. 1, Figs 24, 25 (here, earlier synonymy up to 1886).
1919. *Syringopora reticulata* GOLDFUSS; K. E. GABUNIA, p. 4.
1931. *Syringopora reticulata* GOLDFUSS; V. D. FOMITCHEV, p. 25 (here, earlier synonymy up to 1924).
1935. *Syringopora reticulata* GOLDFUSS; J. J. GORSKY, p. 27, Pl. 5, Figs 4, 5.
1938. *Syringopora reticulata* GOLDFUSS; A. N. IVANOV, p. 50, Pl. 2, Fig. 2.
1938. *Syringopora reticulata* GOLDFUSS; J. J. GORSKY, p. 14.
1939. *Syringopora reticulata* GOLDFUSS; N. S. ILINA, p. 85, Pl. 2*a*, Fig. 3.
1947. *Syringopora reticulata* GOLDFUSS; B. S. SOKOLOV, p. 22, Figs 1, 2.
1950. *Syringopora reticulata* GOLDFUSS; B. S. SOKOLOV, p. 23, Pl. 1, Figs 3, 4.
1950. *Syringopora reticulata* GOLDFUSS; N. P. VASSILJUK, p. 143, Pl. 2, Figs 1, 2.
1955. *Syringopora reticulata* GOLDFUSS; H. FONTAINE, p. 69, Pl. 1, Fig. 8; Pl. 2, Figs 1, 2.

1960. *Syringopora reticulata* GOLDFUSS; N. P. VASSILJUK, p. 29, Pl. 6, Fig. 1*a-c*.
1966. *Syringopora reticulata* GOLDFUSS; N. P. VASSILJUK, p. 53.
1966. *Syringopora reticulata* GOLDFUSS; T. A. SAYUTINA, p. 209, Pl. 41, Fig. 1.

Diagnosis. — See SOKOLOV, 1950.

Material. — Two U. Visean colonies from Gałęzice (ZPAL T IX/295, 296), three M. Visean colonies from Eliaszówka (ZPAL T IX/297-299), and three U. Visean colonies from Czatkowice (ZPAL T IX/300-302).

Dimensions (in mm).

C-C	d	thw	dax	ds	s-s
0.1-0.5(1.0)	(1.5)1.8-2.1(2.4)	0.2-0.3(0.4)	(0.4)0.6-0.9(1.0)	(0.6)0.7-0.8(1.0)	(1.5)2.0-3.0(3.5) and (3.5)4.0-4.5 (6.5)

Description. — Large dendroid colonies, composed of subparallel, slightly arcuate, cylindrical corallites which diverge in a pinnate manner. In transverse section, corallites round. less frequently oval or rounded. Microstructure of corallite walls typically concentric-lamellar, Epitheca to 0.05 mm thick. Connecting tubes very short, thick.

Tabulae funnel-like, well-developed, arcuate, long, as a rule strongly oblique to corallite walls, in the center of tube forming a relatively wide axial canal. Near the inner surface of corallite walls, they form a vesicular zone. Sometimes, tabulae reach adjacent corallites through the connecting tubes.

In transverse section, axial canal oval, less frequently round, variable in diameter all along the corallite tube. Connecting canals occurring not over the entire length and communicating with each other in adjacent corallites through the connecting tubes. Axial canal running also in the budding individual.

Septal spines numerous, pointed, similar to thorns, reaching one-fifth the inner diameter of corallite, situated perpendicularly or obliquely to walls and arranged in 20 to 27 vertical rows spaced at 0.2 to 0.25 mm intervals. Spines frequently penetrate tabulae and the wall of axial canal and project in its lumen. Single, somewhat smaller spines occur on tabulae and inner surfaces of the walls of axial canal. In some colonies, septal spines are very poorly preserved.

Remarks. — The specimens from Gałęzice, Czatkowice and Eliaszówka, described above, display a certain variability in some morphological characters which, however, remains within limits of the intraspecific variability. As compared with the colonies from Gałęzice, *Syringopora reticulata* from Czerna has corallites somewhat smaller in diameter, with thinner walls and displays a closer spacing of connecting tubes. In addition, the specimens from Czerna are poorly preserved and have a strongly damaged septal apparatus.

Distribution. — Poland (Sudeten): Lower Carboniferous; Belgium, USSR (Kuznetsk Basin, Kazakhstan, Taymyr, Siberia): Tournaisian; France, China, Japan, Australia: Visean; USSR (Moscov Region, Podolia, Tuva, Ural, Nova Zemla), North America (Canada, USA): Lower Carboniferous; USSR (Ural, Timan): Upper Carboniferous; Spitsbergen: Upper Carboniferous to Lower Permian; Korea, Manchuria: Permian.

Syringopora geniculata PHILLIPS, 1836

(Pl. XVII, Figs 3*a*, *b*; Text-fig. 17*A*, *B*)

1836. *Syringopora geniculata* PHILLIPS; J. PHILLIPS, p. 201, Pl. 2, Fig. 1.
1872. *Syringopora geniculata* PHILLIPS; L. G. de KONNINCK, p. 118, Pl. 11, Fig. 8; Pl. 12, Fig. 2, 2*a*,-*d*.

1879. *Syringopora geniculata* PHILLIPS; H. A. NICHOLSON, p. 217, Pl. 10, Fig. 4-4*b*.
1883. *Syringopora geniculata* PHILLIPS; J. THOMSON, p. 330, Pl. 3, Fig. 25.
1913. *Syringopora geniculata* PHILLIPS; H. MANSUY, p. 150.
1920. *Syringopora* sp. B. YABE & HAYASAKA; H. YABE & J. HAYASAKA, p. 11, Pl. 2, Fig. 2*a*, *b*.
1933. *Syringopora geniculata* PHILLIPS; Y. S. CHI, p. 12, Pl. 3, Figs 1, 2*a-b*, 3*a-c*.
1950. *Syringopora geniculata* PHILLIPS; N. P. VASSILJUK, p. 144, Pl. 3, Fig. 1, 2.
1955. *Syringopora geniculata* PHILLIPS; H. FONTAINE, p. 67, Pl. 1, Figs 4-7.
1960. *Syringopora geniculata* PHILLIPS; N. P. VASSILJUK, p. 29, Pl. 6, Fig. 1*a-c*.

Diagnosis. — See VASSILJUK, 1960.

Material. — Four colonies from Czerna (ZPAL T IX/311-314) and three, large fragments of colonies from Czatkowice (ZPAL T IX/315-317).

Dimensions (in mm):

H×D	C-C	d	thw	dax	ds	s-s
max. to 150×200	(0.1)0.2-0.6(1.0)	(1.0)1.2-1.4(1.7)	(0.08)0.15-0.25(0.3)	0.2-0.4	(0.4)0.5-0.6(0.8)	(1.0)1.4-2.0(2.5)

Description. — Colonies dendroid, large, composed of very long, cylindrical, straight, subparallel corallites. Thickness of walls varying within broad limits. Epitheca very thin.

Connecting tubes relatively short, thick. Tabulae thin, funnel-like, sometimes strongly bent towards the lower part of corallite, forming in the middle of an individual tube a geniculate, zig-zagging, thin-walled axial canal, which is oval or round in transverse section. Sometimes, tabulae pass, through the connecting tubes, to adjacent corallites. Traces of mostly three to six tabulae may be observed in transverse sections of corallites. Septal spines numerous, short, poorly developed and preserved, arranged in vertical rows spaced at 0.15 to 0.2 mm intervals.

Fig. 17
Syringopora geniculata (PHILLIPS), Czatkowice (Cracow Region), Upper Visean, D_2, (ZPAL T IX/315): *A* — transversal section, *B* — longitudinal section; × 10.

Remarks. — As compared with a specimen from the L. Carboniferous of China (CHI, 1933), *Syringopora geniculata* from Poland differs in only slightly smaller spaces between connecting tubes and a higher degree of variability in the diameter of corallites. As compared with *S. geniculata* from the Tournaisian and Visean of China (FONTAINE, 1955), the form described above has corallites slightly smaller in diameter and more closely spaced in the colony, as well as spineless tabulae.

Distribution. — Belgium: Tournaisian; China, Indochina: Tournaisian to Visean; Spain, USSR: Lower Carboniferous; Great Britain: Visean to Namurian.

Syringopora hyperbolo-tabulata CHI, 1933

(Pl. XIX, Figs 1, 2*a-c*)

1933. *Syringopora hyperbolo-tabulata* CHI; Y. S. CHI, p. 20, Pl. 6, Fig. 1*a-c*.
1950. *Syringopora hyperbolo-tabulata* CHI; N. P. VASSILJUK, p. 145, Pl. 2, Fig. 3, 3*a*.
1960. *Syringopora hyperbolo-tabulata* CHI; N. P. VASSILJUK, p. 30, Pl. 6, Fig. 2, 2*a*.

Diagnosis. — See VASSILJUK, 1960.
Material. — Four colonies from Czatkowice (ZPAL T IX/322-325).
Dimensions (in mm):

C-C	d	thw	ds	s-s
(0.1)0.2-0.5(1.0)	(1.2)1.4-1.8(2.0)	0.2-0.3	0.5-0.6	(1.5)1.6-2.2(3.0)

Description. — Colonies large, dendroid, composed of long, cylindrical, straight or slightly twisted and subparallel corallites, which are sometimes laterally fused. In transverse sections, corallites are round, frequently elliptical or irregularly rounded. Walls typically concentric-lamellar in microstructure. Epitheca thin, to 0.06 mm in thickness. Connecting tubes short, thick, only slightly separated. Tabulae thin, funnel-like, simple in structure, not twisted, frequently hyperbolical in shape, forming, in the center of corallite tube, an axial canal variable in diameter and mostly geniculate. Sometimes, tabulae pass, through the connecting tubes, to adjacent corallites. Traces of one to five tabulae (mostly two to three) are observed in transverse sections of corallites. Septal spines numerous, very short, poorly developed and preserved, arranged in vertical (to twenty) rows, spaced at about 0.2 mm intervals.

Remarks. — *S. hyperbolo-tabulata* from Poland differs from the holotype (CHI, 1933) in a more closely spaced corallites and larger spaces between connecting tubes. *S. hyperbolo-tabulata* is most similar to *S. geniculata* PHILLIPS in the size of colonies, shape and distribution of corallites, as well as in the diameter of and spaces between connecting tubes. It differs, however, from *S. geniculata* in larger diameters of corallites, thinner walls, as well as less regular arrangement of tabulae, which in *S. hyperbolo-tabulata* may sometimes form vesicular zones on the peripheries of corallites.

Distribution. — China (Hunan Province): Tournaisian.

Syringopora lipoensis CHI, 1933
(Pl. XVIII, Fig. 1*a*, *b*; Text-fig. 18*A*, *B*)

1933. *Syringopora lipoensis* CHI; Y. S. CHI, p. 21, PL. 7, Fig. 3a, b.

Diagnosis. — (After CHI, 1933, revised): Corallites straight, long, spaced at 0.4 to 0.5 mm intervals. Corallites 1.0 to 1.1 mm in diameter. Walls 0.15 to 0.20 mm thick. Connecting tubes short, 0.4 to 0.5 mm in diameter, spaced at 1.4 to 1.6 mm intervals. Tabulae thin, funnel-like. Axial canal thin-walled, zig-zagging, 0.2 to 0.3 mm in diameter, occurring nearly over the entire length of corallite tube. Septal spines numerous, short, thick, arranged in 20 to 30 vertical rows.

Material. — Four almost complete colonies from Czerna (ZPAL T IX/326-329).

Dimesions (in mm):

C-C	d	thw	dax	ds	s-s
(0.1)0.4-0.5(1.0)	(0.9)1.0-1.1 (1.2)	0.15-0.20	0.2-0.3	(0.3)0.4-0.5(0.6)	(0.9)1.4-1.6(2.0)

Description. — Colonies dendroid, irregular, medium-sized, composed of long, almost straight, sometimes slightly zig-zagging, twisted and parallel corallites. Corallites cylindrical round in transverse section, less frequently oval. Walls relatively thick, typically concentric-lamellar in microstructure. Epitheca thin. Connecting tubes short.

Tabulae thin, funnel-like, simple in structure, relatively widely spaced and strongly oblique to corallite walls, forming a thin-walled zig-zagging (geniculate) axial canal in the center of the tube of an individual. This canal runs all along the corallite tube. Tabulae, pas-

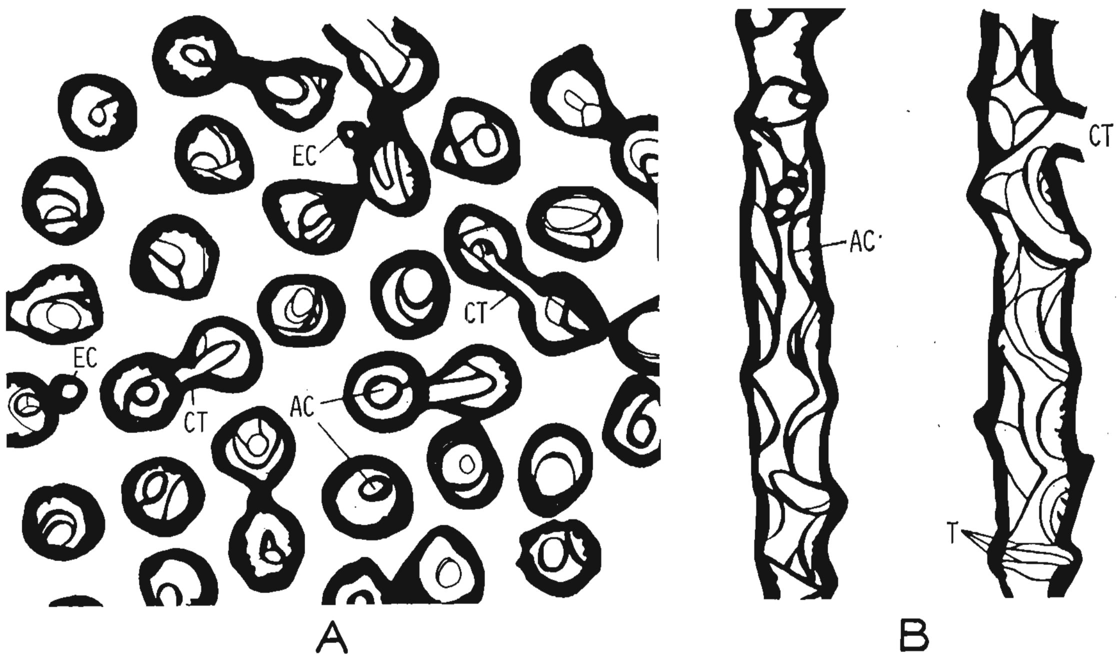

Fig. 18
Syringopora lipoensis CHI, Czerna — Wójcik's quarry (Cracow Region), Middle-Upper Visean, D_2, (ZPAL T IX/328): *A* — transversal section, *B* — longitudinal section; × 10.

sing through connecting tubes, reach adjacent corallites. Traces of mostly two to four tabulae are observed in transverse sections of corallites. Septal spines numerous, fine, short, very poorly preserved, arranged in 20 to 30 vertical rows. The colonies of the species described above are recrystallized and poorly preserved.

Remarks. — The diagnosis of the species *S. lipoensis* is here given by the writer on the basis of studies on the material from Poland and of CHI'S (1933) description of this species. The author of the species has not, however, given a diagnosis, but only a brief description and illustrations. *S. lipoensis* is known only from the L. Carboniferous (Visean) of China (CHI, 1933). The form described above differs from the holotype in slightly smaller diameters of corallites, more closely spaced connecting walls and the lack of a distinct vesicular zone near the inner surface of corallite walls, which probably results from a poor state of preservation of its specimens.

Distribution. — China (Hunan Province): Lower Carboniferous.

Syringopora sinusoidea sp. n.

(Pl. XX, Fig. 1*a*, *b*; Text-fig. 19*A*, *B*)

Holotype: ZPAL T IX/335; Pl. XX, Fig. 1*a*, *b*.
Type horizon: L, Carboniferous, M. Visean.
Type locality: Slopes of the Eliaszówka stream valley, Cracow Region.
Derivation of the name: *Lat. sinusoidea* — after a sinuosoidal shape of the axial canal.

Diagnosis. — Colonies irregularly spherical, 6.0 to 16.0 mm in diameter. Corallites long, radial or parallel, spaced at 0.3 to 0.8 mm intervals, round in transverse section, 1.1 to 1.2 mm in diameter. Calices sharp-edged, cuplike, to 2.0 mm deep. Walls 0.1 to 0.25 mm thick. Connecting tubes short, 0.6 to 0.7 mm in diameter, spaced at 1.3 to 2.2 mm intervals. Tabulae funnel-like, straight. Axial canal meandering or straight, 0.2 to 0.4 mm in diameter. Septal spines few, fine.

Material. — Four large, fragmentary colonies from Eliaszówka (ZPAL T IX/334-337).

Dimensions (in mm):

D	C-C	d	thw	dax	ds	s-s
6-16	(0.2)0.3-0.8(0.9)	(0.9)1.1-1.2(1.3)	(0.1)0.15-0.2(0.25)	(0.2)0.25-0.3(0.4)	(0.4)0.6-0.7(0.8)	(1.0)1.3-1.5(1.8) and (1.5)1.7-2.2(2.5)

Description. — Colonies large, dendroid, irregularly spherical, elongate or hemispherical. Corallites slightly arcuate, less frequently straight, long, radially diverging or parallel to each other, sometimes fused laterally. In transverse sections, corallites round or oval, less frequently irregularly rounded. Calices straight or very slightly cuplike with sharp edges, to 2.0 mm deep. Corallite walls typically concentric-lamellar in microstructure. Epitheca thin, folded. Connecting tubes on the whole well-developed, thick, perpendicular or oblique to corallite walls, very irregularly spaced. Tabulae numerous, funnel-like, well-developed, relatively thick, not very long, somewhat oblique to corallite walls, sometimes short, horizontal, less frequently irregularly twisted, forming an axial canal in the center of corallite.

Axial canal thin-walled, situated centrally or eccentrically, in longitudinal sections meandering, sinusoidal (not zig-zagging) or straight, in transverse sections round or oval, variable in diameter both over the length of an individual tube and in various corallites. Axial canals occur not over the entire length of corallites and communicate, in adjacent corallites, through the connecting tubes. Thin, horizontal or slightly oblique, mostly straight tabulae occur sometimes in axial canals. Septal spines not very numerous, poorly preserved, fine, short, pointed, forming vertical rows spaced at 0.15 to 0.20 mm intervals. No definite number of such rows could be established. Sometimes, single spines occur in calices.

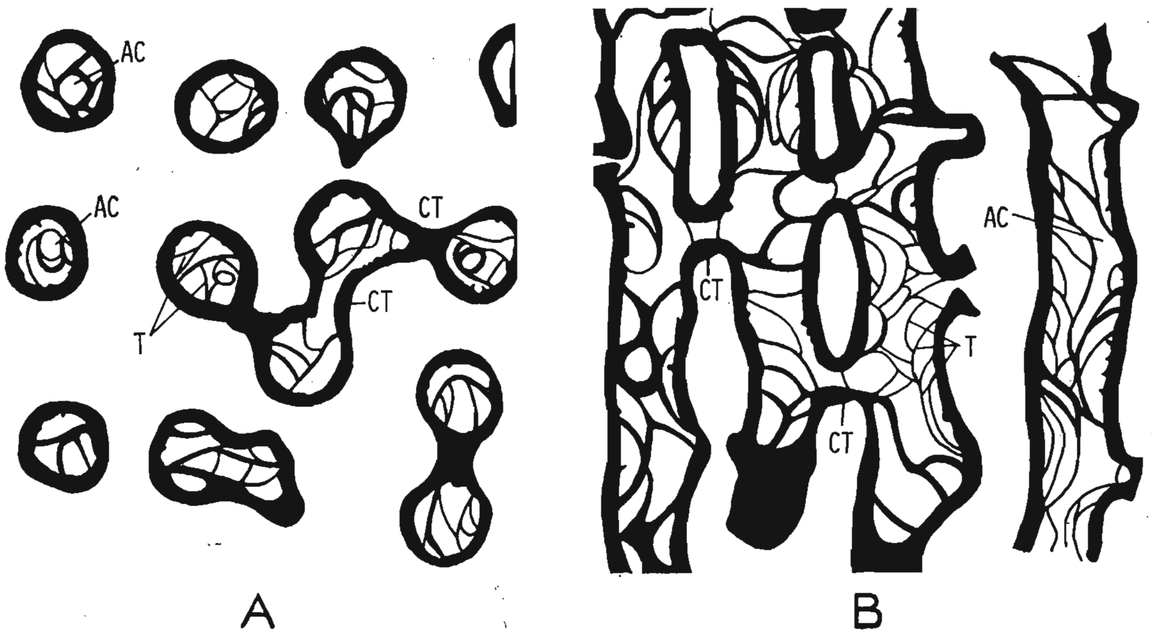

Fig. 19
Syringopora sinusoidea sp. n., Eliaszówka (Cracow Region), Middle Visean, holotype (ZPAL T IX/335): *A* — transversal section, *B* — longitudinal section; × 10.
Explanations to lithological and palaeontological sections (Text-fig. 4*A*, *B*).

Remarks. — Due to the meandering trace of its axial canal *Syringopora sinusoidea* sp. n differs from other L. Carboniferous species of this genus, although it displays a certain similarity to *S. gracilis* (KEYSERLING) and *S. porrecta* SOKOLOV. As compared with *S. gracilis* (KEYSERLING, 1846) from the L. Carboniferous of the USSR (Novaya Zemlya) and China (STUCKENBERG, 1895, 1904; GORSKY, 1935; CHI, 1933), the new species is similar in the size and structure of colony, as well as arrangement and diameter of corallites. However, it differs pronouncedly from *S. gracilis* in considerably smaller spaces between corallites, smaller diameter of connecting tubes, which are very irregularly spaced, and in a somewhat different arrangement and development of tabulae. The new species is also similar to *S. porrecta* from the Carboniferous of Taymyr (SOKOLOV, 1947) in the form of corallites, which are very irregularly spaced, thickness of corallite walls and diameter and irregular spacing of connecting tubes, differing from it in slightly smaller diameters of corallites, more strongly developed, funnel-like tabulae and axial canal and in the presence of septal spines.

Syringopora subgeniculata SOKOLOV, 1947
(Pl. XVII, Fig. 2; Pl. XVIII, Fig. 2*a*, *b*; Text-fig. 20*A*, *B*)

1947. *Syringopora subgeniculata* SOKOLOV; B. S. SOKOLOV, p. 22, Pl. 1, Figs 6 and 7.

Diagnosis. — Colony consisting of subparallel corallites, 1.1 to 1.3 mm in diameter, spaced at 0.3 to 1.3 mm intervals. Walls about 0.2 mm thick. Connecting tubes short, 0.5 to 0.6 mm in diameter, spaced at 2.5 to 3.0 mm intervals. Tabulae funnel-like, regular, straight. Axial canal 0.2 to 0.5 mm in diameter. Inter-tabular spaces amounting mostly to 0.5 mm. Spines numerous, fine, short, arranged in about 28 rows.

Material. — Two large, fragmentary colonies from Czerna (ZPAL T IX/318, 319) and two complete ones from Czatkowice (ZPAL T IX/320, 321).

Dimensions (in mm):

D	C-C	d	thw
80×50	(0.1)0.4-0.7(1.0)	(0.8)1.1-1.2(1.3)	(0.1)0.15-0.25

dax	ds	s-s	t-t
0.2-0.5	(0.4)0.5-0.6(0.7)	(2.0)2.5-3.0(3.5)	(0.3)0.5-0.6

Description. — Colonies not very large, dendroid, irregularly shaped, composed of long, straight, subparallel corallites, which are cylindrical, homogeneous and round, or, rarely, oval in transverse section. Walls typically concentric-lamellar in microstructure.

Connecting tubes short. Tabulae funnel-like, thin, very regular, straight, fairly frequently forming in the center of corallite tube, a thin-walled axial canal bent in a geniculate manner.

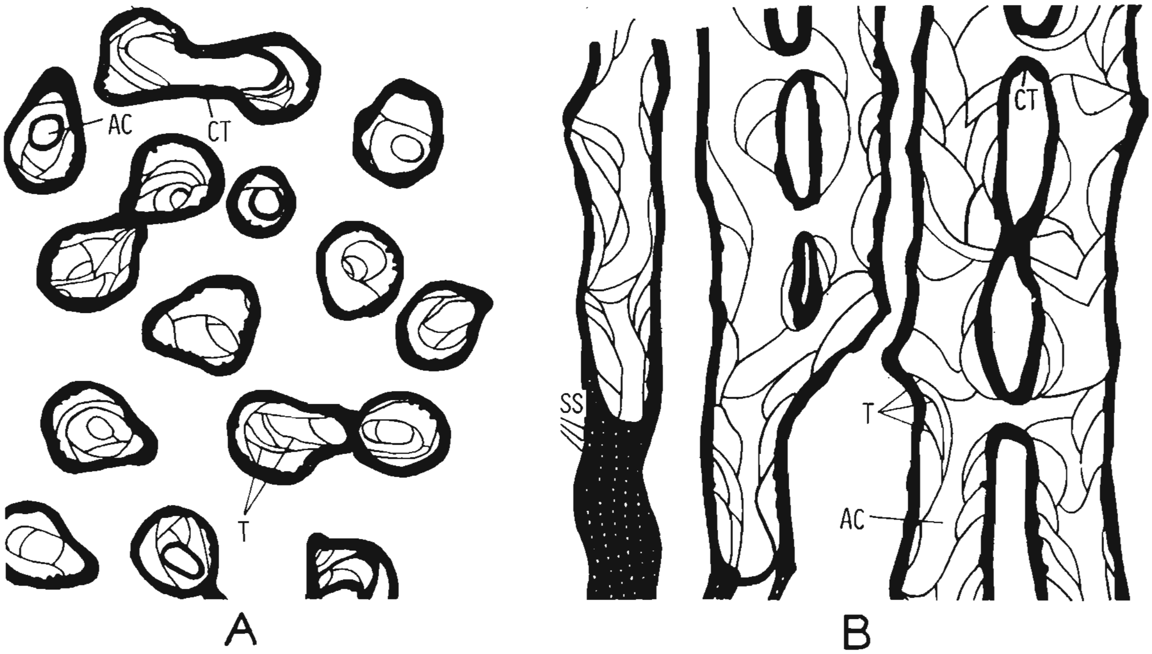

Fig. 20
Syringopora subgeniculata SOKOLOV, Czerna — Wójcik's quarry (Cracow Region), Middle-Upper Visean, D_2 (ZPAL T IX/318); *A* — transversal section, *B* — longitudinal section; × 10.

Transverse sections of the axial canal round or elliptical in outline. Traces of one, two, or, very rarely, three tabulae may be seen in transverse sections of corallites. Sometimes, only one outline of axial canal is seen in such sections. Septal spines numerous, arranged in vertical rows (to 28), very short and poorly developed. They are visible most frequently on a sectioned wall of corallite, spaced at about 0.15 mm intervals.

Remarks. — The present writer gives the diagnosis of *S. subgeniculata* on the basis of well-preserved colonies from Poland and SOKOLOV'S (1947) description. No diagnosis was given by the author of the species, except for a brief description and illustrations. *Syringopora subgeniculata* from the L. Carboniferous of the Cracow Region differs from the Carboniferous specimens from Taymyr (SOKOLOV 1947) only in somewhat smaller diameters of more thick-walled corallites, which completely corresponds with the variability range of this species. *S. subgeniculata* SOKOLOV is most closely related to *S. geniculata* PHILIPS (MANSUY, 1913; YABE & HAYASAKA, 1920; CHI, 1933). A comparison of the two species is given in SOKOLOV'S (1947) paper.

Distribution. — USSR (Taymyr): Lower Carboniferous.

Syringopora subreticulata sp. n.

(Pl. XIX, Fig. 3*a-c*; Text-fig. 21*A, B*)

Holotype: ZPAL T IX/332; Pl. XIX, Fig. 3*a-c*.
Type horizon: L. Carboniferous, M. Visean.
Type locality: Slopes of the Eliaszówka stream valley, Cracow Region.
Derivation of the name: *Lat. subreticulata* — similar to the species *Syringopora reticulata*.

Diagnosis. — Colonies irregularly spherical, to 150 mm in diameter. Corallites radially diverging or parallel, spaced at 0.1 to 0.3 mm intervals, round or oval in transverse section, 1.5 to 1.8 in diameter. Calices sharp-edged, cuplike, 2.0 to 2.5 mm deep. Walls 0.2 to 0.3 mm thick. Connecting tubes very short, thick, 0.6 mm in diameter, spaced at 1.5 to 2.5 mm intervals. Tabulae funnel-like. Axial canal zig-zagging, 0.2 to 0.5 mm in diameter. Septal spines numerous, pointed, arranged in 20 to 25 rows.

Material. — Two colonies from Eliaszówka stream (ZPAL T IX)/332, 333).

Dimensions (in mm):

D	C-C	d	thw	dax	ds	s-s
max. do 150	0.1-0.3(0.5)	(1.2)1.5-1.8(2.0)	(0.1)0.15-0.2(0.3)	0.2-0.5	(0.5)0.6-0.8(1.0)	(1.3)1.5-2.5(3.0)

Description. — Colonies large, dendroid, irregularly spherical or elongate, composed of long, straight or slightly bent corallites, radially diverging or parallel, very frequently contacting each other laterally. In transverse sections, corallites round or oval, less frequently irregularly round and elongate, very rarely polygonal in outline. Calices cuplike, with slightly extended apertures, sharp edges and 2.0 to 2.5 mm deep. Corallite walls typically concentric-lamellar in microstructure. Epitheca uneven, strongly folded, to 0.05 mm thick. Connecting tubes very short, on the whole slightly separated, thick, oblique or perpendicular to corallite walls. Tabulae numerous funnel-like, well-developed, not very thin, long, more or less twisted, sometimes passing in a vesicular tissue, strongly oblique to corallite walls, forming, in the center, an axial canal. Axial canal relatively thin-walled, in longitudinal sections zig-zagging, less frequently straight, in transverse sections round, or, more frequently, oval and displaying a variable diameter along the corallite tube. Axial canals occur not over the entire length of corallite and in adjacent corallites they communicate through the connecting tubes. Septal spines poorly preserved, numerous, relatively long, pointed, similar to those in *S. reticulata*, arranged in 20 to 25 vertical rows spaced at 0.15 to 0.20 mm intervals. Separate, smaller spines occur on tabulae and walls of axial canal.

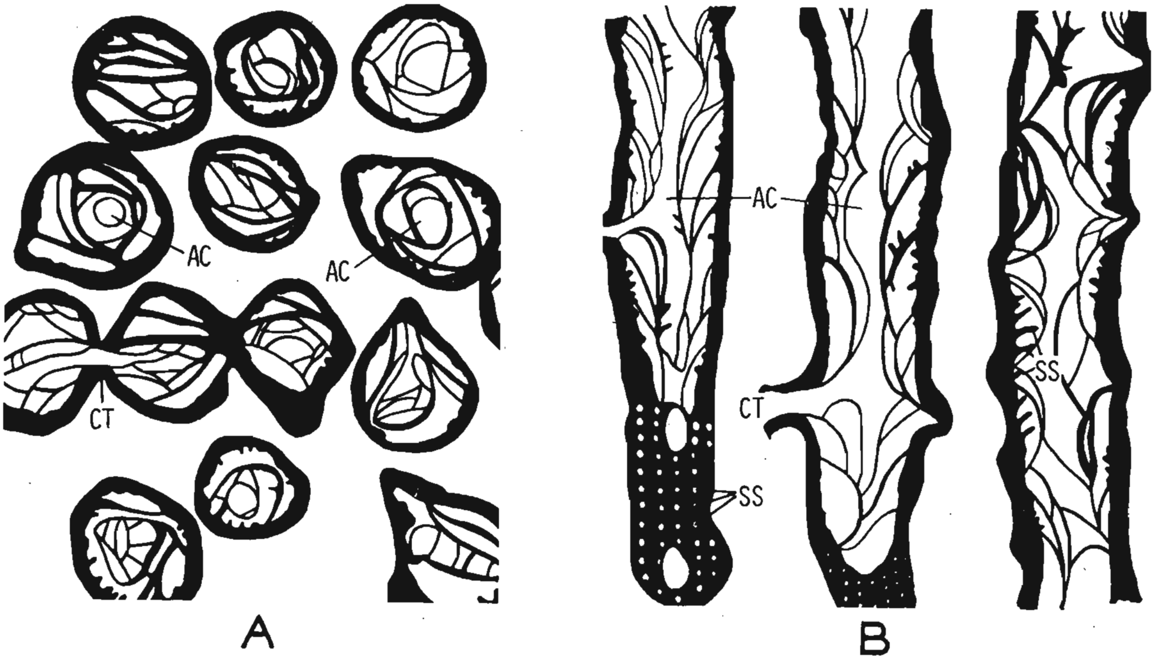

Fig. 21
Syringopora subreticulata sp. n., Eliaszówka (Cracow Region), Middle Visean, holotype (ZPAL T IX/332): *A* — transversal section, *B* — longitudinal section; × 10.

Remarks. — *S. subreticulata* sp. n. is similar to *S. reticulata* GOLDFUSS in the shape of colony, internal structure of corallites, form and arrangement of tabulae, diameter of connecting tubes, as well as development and arrangement of septal spines. It differs, however, from this species in smaller diameters of corallites, their thinner walls and closer spacing in colony, much smaller spaces between connecting tubes and a narrower, zig-zagging axial canal. In the arrangement and diameters of corallites, the new species displays similarity to the Carboniferous *S. parallela* FISCHER, *S. permiana* STUCKENBERG and *S. uralica* STUCKENBERG. As compared with *S. parallela* from the L. Carboniferous of Ural and China (FISCHER, 1828; STUCKENBERG 1895; CHI, 1933), it has a similar structure of colony, as well as arrangement and diameters of corallites, but differs from this species in a larger variability in inter-corallite spaces, thinner corallite walls, closer spacing of connecting tubes, quite different shape and arrangement of tabulae and the presence of a well-developed axial canal.

In regard to *S. permiana* from the U. Carboniferous of Ural (STUCKENBERG, 1895) the new species is similar to it in the structure and size of colony and very similar in the diameters of corallites, differing from it, however, in longer and more regularly distributed corallites, as well as in a different arrangement of tabulae and a well-developed axial canal.

As concerns *S. uralica* from the L. Carboniferous of Ural (STUCKENBERG, 1895), *S. subreticulata* resembles it in the form of and spaces between corallites, as well as in the spacing of connecting tubes, but differs from this species in a more regular shape, considerably less variable diameters of corallites having thinner walls and in a better developed septal apparatus.

Syringopora tenuitheca sp. n.

(Pl. XX, Fig. 2*a*, *b*)

Holotype: ZPAL T IX/339; Pl. XX, Fig. 2*a*, *b*.
Type horizon: Carboniferous, Upper Visean, D_2.
Type locality: Gałęzice (Todowa Grząba hill), Holy Cross Mts.,
Derivation of the name: *Lat*:. *tenuitheca* — having thin walls.

Diagnosis. — Colonies oval, up to 150 by 200 mm. Corallites long, straight, spaced at 0.5 to 1.5 mm intervals, in transverse section round, 2.5 to 2.8 mm in diameter. Walls 0.15 to 0.2 mm thick. Connecting walls short, 0.8 to 0.9 mm in diameter, spaced at 5.0 to 7.0 mm intervals. Tabulae thin, funnel-like, long, spaced at 0.5 to 1.5 mm intervals. Axial canal thin-walled, 0.2 to 0.7 mm in diameter. Septal spines rare, short, pointed.

Material. — Two colonies from Gałęzice (Todowa Grząba Hill); ZPAL T IX/338, 339.

Dimensions (in mm):

H×D	C-C	d	thw	dax	ds	s-s	t-t
180—200×150	(0.2)0.5-1.5(2.0)	(2.3)2.5-2.8(3.0)	0.15-0.2	0.2-0.7	(0.6)0.8-0.9(1.0)	5.0-7.0	(0.2)0.5-1.5(2.0)

Description. — Colonies large, dendroid, irregular or oval, composed of long, cylindrical, straight or slightly bent corallites, sometimes contacting by their walls. In transverse sections, corallites round, rarely slightly elliptical or triangular, rounded. Corallite walls relatively very thin, with a typical concentric-lamellar microstructure. Epitheca very thin. Connecting tubes relatively short, widely and irregularly scattered. Tabulae funnel-like, widely arcuate, long, thin, relatively widely spaced, forming an axial canal in the center of corallite tube. No vesicular structures recorded. Axial canal thin, walled, in transverse sections round or oval, sometimes eccentrically situated and occurring not over the entire length of corallite tube. Septal spines rare, relatively short, thick, pointed, arranged in vertical rows widely spaced (at about 0.5 mm intervals) on corallite walls. No spines occur on tabulae and walls of axial canal.

Remarks. — In the general structure of its colonies and corallites, *S. tenuitheca* sp. n. displays a certain similarity to *S. distans* FISCHER, *S. intermixa* REED, *S. ramulosa* GOLDFUSS and *S. hoffmani* STUCKENBERG. It resembles most closely the species *S. distans* widely distributed in the L. Carboniferous (FISCHER, 1828; M.-EDWARDS & HAIME, 1851, 1853; de KONINCK, 1872; THOMSON, 1883, STUCKENBERG, 1904, 1905; WILMORE, 1910; GABUNIA, 1919; TOLMATOCHOFF, 1924; FOMITCHEV, 1931; CHI, 1933; FONTAINE, 1955).

The similar characters of the two species are: the diameter of corallites, a well-developed axial canal, spaces between connecting tubes and, finally, the shape and arrangement of tabulae. The new species differs from *S. distans* in smaller spaces between corallites, considerably thinner corallite walls and the presence of septal spines which in *S. distans* are frequently absent.

The new species is also similar in the shape, arrangement and spacing of corallites and development of septal spines to *S. intermixa* from the Visean of China (REED, 1927; CHI, 1933), from which it differs in larger dimensions of colony, larger diameters of corallites, considerably thinner walls, as well as in the morphology and arrangement of tabulae which do not form vesicular zones in the new species.

Despite a similar diameter of corallites, similar spacing of connecting tubes and presence of axial canal, the new species differs from *S. ramulosa* in closer spacing of corallites, having considerably thinner walls, in wider spacing of tabulae, marked by a different morphology, and not forming vesicular zones, as well as more widely spaced and not so well-developed septal spines.

S. tenuitheca sp. n. displays a certain similarity, particularly in the shape and size of colony and spacing of corallites, to *S. hoffmani* from the L. Carboniferous of Ural (Stuckenberg, 1895), from which it differs in a slightly larger diameter of corallites and wider spacing of connecting tubes.

Syringopora pachysiphonata sp. n.

(Pl. XXI, Fig. 1*a-d*)

Holotype: ZPAL T IX/330; Pl. XXI, Fig. 1*a-d*.
Type horizon: L. Carboniferous, U. Visean — D_2.
Type locality: Gałęzice (railroad cut on the Ostrówka hill), Holy Cross Mts.
Derivation of the name: *Lat. pachysiphonata* — having a thick-walled axial tube.

Diagnosis. — Colony elongate, 60 by 50 mm in transverse section. Corallites spaced at 0.2 to 0.4 mm intervals, in transverse section irregularly round, 1.4 to 1.6 mm in diameter. Walls 0.2 to 0.5 mm thick. Connecting tubes 0.5 to 0.6 mm in diameter, spaced at 2.0 to 3.0 mm intervals. Tabulae thick, funnel-like. Axial canal thick-walled, 0.5 to 1.0 mm in diameter. Septal spines short, thick, obtuse.

Material. — Two colonies from Gałęzice (railroad cut on the Ostrówka hill); ZPAL T IX/330, 331.

Dimensions (in mm):

H×D	C-C	d	thw
50×60	(0.1)0.2-0.4(0.9)	(1.3)1.4-1.6(1.8)	(0.15)0.2-0.4(0.5)

dax	ds	s-s	t-t
(0.4)0.5-0.8(1.0)	(0.4)0.5-0.6(0.7)	2.0-2.2(3.0)	(0.3)0.5-0.8(1.2)

Description. — Colony dendroid, irregular in shape, elongate, composed of cylindrical, slightly bent, parallel corallites.

In transverse sections, corallites irregularly round, oval, slightly flattened, less frequently round, often contacting by lateral walls. Corallite walls relatively very thick, with a typical concentric-lamellar microstructure. Epitheca thin. Connecting tubes short. Tabulae funnel-like, arcuate, relatively thick and fairly rare. Axial canal thick-walled, varying in diameter, developed nearly over the entire length of corallite, mostly situated in the center, in transverse sections displaying a round or irregularly oval outline. Its walls, 0.08 to 0.3 and mostly 0.15 to 0.2 mm thick, have a distinct radial microstructure. In longitudinal sections, the fibers of stereoplasma are perpendicular to the walls of axial canal. Near connecting tubes, axial canal extends in a funnel-like manner and communicates, through the connecting tubes, with that of the adjacent individual. Thin, horizontal or oblique tabulae occur sometimes inside the axial canal. Septal spines numerous, short, very thick, bluntly terminating, deeply embedded in the stereoplasma of wall, distributed in a few or a dozen or so rows.

Remarks. — *Syringopora pachysiphonata* sp. n. differs from all Carboniferous species in its thick-walled axial canal and a strong development of septal spines deeply embedded in the wall at its various levels, in which it resembles the representatives of the genus *Neomultithecopora.*

Syringopora sp.
(Pl. XXI, Fig. 2)

Material. — Two small, fragmentary colonies from the U. Givetian of Dubie (ZPAL T IX/226, 227).

Dimensions (in mm):

C-C	d	thw	dax
3.0-3.5	4.0-4.5	0.3-0.5	to 1.2

Description. — Colony dendroid, of an unknown size and shape, resembling, simple, cylindrical corallites. In transverse sections, corallites round, its walls relatively thick and with a typically concentric-lamellar microstructure. Epitheca very thin, only slightly separated. The diameter and spacing of connecting tubes unknown. Tabulae numerous, funnel-like, thick, long, forming a wide axial canal halfway the axis of corallite. Axial canal thick-walled, in transverse section round in outline. Septal spines invisible.

Remarks. — In its general morphology and shape of tabulae, *Syringopora* sp. is most similar to *S. vulgaris* YANET from the Eifelian of the eastern slopes of the Ural Mts. (DUBATOLOV, 1959), from which it differs, however, in a smaller diameter of more widely spaced corallites, thinner corallite walls and lack of septal spines.

Family MULTITHECOPORIDAE SOKOLOV, 1950
Genus **MULTITHECOPORA** YOH, 1927

Type species: *Multithecopora penchiensis* YOH, 1927.

Diagnosis. — See WILSON, 1963. In supplementing the diagnosis, it should be added that some species of *Multithecopora* display a strong development of the septal apparatus and a geniculate shape of corallites resembling those of the genus *Cladochonus*. In connection with the last-named character, some of the *Multithecopora* were even described as *Cladochonus*.

Remarks. — The most typical characters of the genus *Multithecopora* are: a very thick corallite wall, strongly contracted visceral chamber, strong reduction of connecting tubes, non-funnell-like, simply built tabulae and a poor development of the septal apparatus. Detailed characteristics of *Multithecopora* and its comparison with related genera were given by YOH (1927), GORSKY (1951), SOKOLOV (1950, 1952), VASSILJUK (1960), FONTAINE (1961), WILSON, (1963), KATCHANOV (1967) and OEKENTORP & KAEVER (1970).

This genus differs from the related *Neomultithecopora* KATCHANOV in very widely spaced and poorly developed connecting tubes, arrangement of the fibers of stereoplasma in corallite walls parallel to epitheca, less strongly developed septal apparatus and, finally, straighter and more widely spaced tabulae.

The genus *Multithecopora* includes *Syringopora syrinx* ETHERIDGE from the U. Visean of Australia (ETHERIDGE, 1900; HILL, 1934; PICKETT, 1966) which displays all typical characters of this genus (OEKENTROP & KAEVER, 1970).

Due to very thick walls of their corallites, strong reduction of connecting tubes and simple structure of tabulae, some species of the genus *Syringopora* (*S. latisiphon*, *S. spinifera*, *S. distincta*, *S. pachytcheca*) should also be assigned to the genus *Multithecopora*. *Multithecopora berkhi*, described by GORSKY (1951) from the U. Visean and Namurian of Novaya Zemlya and Ural, is, as follows from KATCHANOV'S (1967) studies, a species of *Neomultithecopora*.

So far, twenty-five species of the genus *Multithecopora* have been described from deposits ranging from the Carboniferous through M. Permian. One species comes from the Silurian.

Distribution. — L. Silurian (Llandoverian): Norway; L. Carboniferous: Poland (Holy Cross Mts.), USSR (Taymyr), Australia; L.-U. Carboniferous: USSR (Moscow and Donetsk basins, Ural, Timan), Central Asia; M.-U. Carboniferous: Southern Europe, North America; U. Carboniferous through Lower Permian: China, Spitsbergen; M. Permian: Iran, Afghanistan.

Multithecopora spinosa sp. n.

(Pl. XXII, Figs. 2*a-c*, 3*a-b*, 4*a*-b)

Holotype: ZPAL T IX/352; Pl. XXII, Fig. 2*a-c*.
Type horizon: Lower Carboniferous, Upper Visean — D_2.
Type locality: Gałęzice (railroad cut on the Ostrówka hill), Holy Cross Mts.
Derivation of the name: *Lat. spinosa* — having spines.

Diagnosis. — Colonies irregular, to 150 mm in diameter. Corallites tubular, short, variously twisted, round in transverse section, 1.5 to 2.0 mm in diameter, spaced at 1.7 to 4.0 mm intervals. Calices funnel-like and cup-like, deep. Walls 0.35 to 0.70 mm thick. Fibers of stereoplasma oblique to epitheca. Septal spines numerous, thick, deeply embedded in the stereoplasma of wall. Tabulae thin, horizontal and oblique, bent, spaced at 0.1 to 0.5 mm intervals.

Material. — Seven colonies from Gałęzice (railorad cut on the Ostrówka Hill); ZPAL T IX/350-356.

Dimensions (in mm):

D	C-C	d	dv	thw	t-t
50-150	(1.0)1.7-4.0(5.0)	(1.4)1.5-2.0(2.4) and 1.6-1.8×2.0-2.4	(0.4)0.5-0.9 and 0.7-0.8× 1.0-1.4	(0.25)0.35-0.7(1.0)	0.1-0.5

Description. — Colonies dendroid, very irregular in shape. Corallites cylindrical or slightly flattened lateraly, cylindrical over short sectors, in longitudinal sections sometimes geniculate or slightly zig-zagging and bent at an angle of 135 to 155° or irregularly twisted in various directions. They are distributed over the colony very widely and irregularly, sometimes fused laterally by their walls, two to three corallites each. Budding frequent. Young corallites grow from adults at an angle of 65 to 95°. Connecting tubes thick, very rarely occurring.

Calices funnel-like and cuplike, 2.0 to 3.0 mm deep, with thin, sharp edges, in transverse section round, less frequently oval, with a diameter equalling that of corallites or slightly larger.

In transverse sections corallites are round. Visceral chamber strongly contracted as a result of a considerable thickness of walls. Its diameter and outlines of transverse sections are subject to considerable fluctuations along a single corallite tube. In transverse sections visceral chamber is round, oval, fissured or irregular.

Corallite walls thick or even very thick, displaying a considerable variability in thickness along a single corallite tube. Microstructure concentric-lamellar, frequently in the form of separate, distinct lamellae. Fibers of stereoplasma strongly oblique to epitheca, which is very thin (to 0.05 mm) and has fibro-radial microstructure.

Septal spines numerous, well-developed, thick, blunted, frequently bent, arranged at various angles to corallite walls and deeply embedded in the stereoplasma of corallite walls.

Tabulae thin, horizontal and oblique, bent, less frequently straight, occurring in local zones of concentration.

Colonies of *Multithecopora spinosa* sp. n. are frequently intertwined by those of *M. polonica* sp. n. and *Sinopora polonica* sp. n.

Remarks. — Due to a strong development of its septal apparatus and arrangement of the fibers of stereoplasma of wall oblique to epitheca, the new species is strongly related to some representatives of the genus *Neomultithecopora*, such as *N. simplex* KATCHANOV and *N. berkhi* (GORSKY) from the Visean and Namurian of Ural and Novaya Zemlya (KATCHANOV, 1967), but differs from *Neomultithecopora* in short, strongly twisted corallites, rare tabulae, which are considerable simpler in structure, and primarily in an unusually rare occurrence of connecting tubes. The new species differs from known representatives of *Multithecopora* in a strongly developed septal apparatus and slightly geniculate corallites. In the diameter of its corallites and arrangement and spacing of tabulae, *M. spinosa* is similar to *M. sokolovi* from the Carboniferous of the Donetsk Basin (VASSILJUK, 1960).

Multithecopora polonica sp. n.

(Pl. XXI, Figs. 3*a-b*, 4; Pl. XXII, Fig. 1*a, b*)

Holotype: ZPAL T IX/344; Pl. XXI, Fig. 3*a, b*.
Type horizon: L. Carboniferous, U. Visean — D_2.
Type locality: Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts.
Derivation of the name: Lat. *polonica* — from Poland.

Diagnosis. — Colonies irregular, to about 160 mm in diameter. Corallites tabular, short, variously twisted, in transverse sections round, 1.1 to 1.5 mm in diameter, or oval, spaced at 0.8 to 2.0 mm intervals. Calices funnel-like, deep. Walls 0.3 to 0.6 mm thick. Septal spines numerous, deeply embedded in the stereoplasma of corallite walls. Tabulae, thin, horizontal and oblique, spaced at 0.15 to 0.4 mm intervals.

Material. — Ten colonies from Gałęzice (railroad cut on the Ostrówka Hill); ZPAL T IX/340-345 and 347-349; A I-35/346.

Dimensions (in mm.):

D	C-C	d	dv	thw	t-t
80-160	(0.7)0.8-2.0(2.5)	(0.9)1.1-1.5(1.7) and 1.0-1.4×1.2-1.6	(0.2)0.3-0.8(1.0) and 0.3-0.5×0.5-0.7	(0.2)0.3-0.6(0.7)	0.15-0.4

Description. — Colonies dendroid, very irregular in shape, composed of single corallites irregularly scattered at very large intervals. Some corallites are fused together by their lateral walls, forming groups of two to three individuals. Corallites tabular, frequently geniculate and zig-zagging and bent at an angle of 120 to 155° or irregularly twisted in various directions. Budding frequent. Juvenile corallites grow from adults at an angle of 60 to 90°. Connecting tubes poorly developed and very rare. Calices funnel-like, cuplike or bulgy, 1.0 to 2.0 mm and mostly 1.2 to 1.6 mm deep, with thin, sharp edges, in transverse sections round or, less frequently, oval, with their diameters equalling or slightly exceeding those of corallites. Corallites round or suboval in transverse section. Visceral chamber strongly contracted. Its diameter and outline in transverse section are subject to considerable changes all along the corallite tube. In transverse sections, the chamber is round, oval, fissured or irregular. Corallite walls thick, displaying a considerable variability within a single corallite. Microstructure concentric-lamellar. Short fibers of stereoplasma are parallel to epitheca, which is very thin (to 0.05 mm) with indistinct radial microstructure. Septal spines numerous, thick, bluntly terminating, sometimes pointed, arranged in vertical rows spaced at 0.1 to 0.15 mm intervals, frequently arcuate and situated at various angles to corallite walls. They are deeply embedded in the stereoplasma of wall, reaching various depths. Sometimes, fine spines occur in calices.

Tabulae thin, sometimes secondarily thickened, horizontal, less frequently strongly oblique, straight, rarely bent, occurring in local zones of concentration. In colonies of *Multithecopora polonica* sp. n., numerous corallites of *M. spinosa* sp. n. and *Sinopora polonica* sp. n. occur among the corallites of these colonies.

Remarks. — *Multithecopora polonica* sp. n. differs considerably from most representatives of this genus in a well-developed septal apparatus. From *M. spinosa* sp. n. it differs in smaller diameters of corallites, fibers of stereoplasma of walls arranged parallel to epitheca, as well as in smaller and more widely spaced septal spines. The new species is related to *M. tanaica* from the Upper Visean of the Donetsk Basin (VASSILJUK, 1960). In the two species, corallites are short, irregularly and sometimes geniculately twisted and displaying similar diameters, thickness of wall and spacing. *M. polonica* differs from the species from the Donetsk Basin in the presence of septal spines and more frequent occurrence of tabulae. The new species also displays similarity to *M. tchernychevi* from the lowermost U. Carboniferous of the Donetsk Basin (SOKOLOV, 1950; VASSILJUK, 1963) in the spacing of corallites and thickness of their walls, diameter of visceral chamber and presence of septal spines. *M. polonica* sp. n. differs from the last-named species in smaller diameters of corallites, very rarely occurring connecting tubes and more strongly bent tabulae.

Genus **SYRINGOPORELLA** KETTNER, 1934

Type species: *Syringopora moravica* F. A. ROEMER, 1855 (= *Syringoporella moravica* KETTNER, 1934).

Diagnosis (after DUBATOLOV, 1963, supplemented). — Colonies dendroid, irregularly elliptical or hemispherical, composed of very fine, cylindrical, long and straight corallites, mostly diverging radially. Walls varying in thickness. Connecting tubes, rare, relatively long, thick, irregularly scattered. Tabulae thin, horizontal, straight or slightly bent, rare or very rare. Septal spines absent.

Remarks. — *Syringoporella* is a very little-known genus. The lack of septal spines (although their presence in calices was mentioned by SOKOLOV in 1952) and the presence of rare, horizontal, straight tabulae are its most characteristic feature. *Syringoporella* is most closely related to the genus *Multithecopora* from which it differs, however, in thinner walls and a wider visceral chamber.

Its detailed characteristics and comparison with related genera were given by KETTNER (1934, 1937), SOKOLOV (1952, 1962), DUBATOLOV (1963) and TALENT (1963). Three species of this genus have so far been described.

S. irregularis from the Upper Silurian of Taymyr described by TCHERNYCHEV (1941), is assigned at present to the genus *Syringoporinus* SOKOLOV, 1952. From the territory of Poland only *Syringoporella* sp. was described from the Givetian of Miasto 1 borehole (STASIŃSKA, 1969).

Distribution — Givetian; Czechoslovakia, Poland (north-eastern area, Miastko 1 borehole), USSR (Kuznetsk Basin); M. — U. Devonian: USSR (Ural Region, Kolyma Basin); U. Visean: Poland (Holy Cross Mts. — Gałęzice).

Syringoporella longituba sp. n.

(Pl. XXIII, Fig. 1*a*, *b*)

Holotype: ZPAL T IX/360; Pl. XXIII, Fig. 1*a*, *b*.
Type horizon: Lower Carboniferous, Upper Visean — D_3.
Type locality: Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts.
Derivation of the name: *Lat. longituba* — having long connecting tubes.

Diagnosis. — Colonies hemispherical, 50 by 90 by 60 mm. Corallites straight, diverging radially from the base, spaced at 0.4 to 1.5 mm intervals, round and oval in transverse sections, 0.5 to 0.7 mm in diameter. Visceral chamber narrow, 0.2 to 0.4 mm. Walls 0.1 to 0.2 mm thick. Connecting tubes rare, very long (0.7 to 1.1 mm), with a diameter smaller than or equal to that of corallites. Tabulae and septal spines absent.

Material. — Six colonies from Gałęzice (railroad cut on the Ostrówka Hill) (ZPAL T IX/357-362).

Dimensions (in mm):

H×D	C-C	d	dv	thw	s-s
50×60×90	(0.4)0.5-1.2(1.5)	(0.4)0.5-0.7(0.8)	(0.08)0.2-0.4	0.1-0.22	(1.2)1.5-2.5(3.0)

Description. — Colonies dendroid, plano-convex or hemispherical, composed of fine, relatively long, cylindrical or slightly flattened, straight or slightly twisted corallites, diverging radially from the base and opening at a right angle on the surface of colony. In transverse sections, corallites are frequently arranged in more or less regular tetragons and are round or suboval. Visceral chambers of corallites narrow, sometimes even very strongly contracted, in transverse sections displaying characteristic, very irregularly frayed outlines, oval or round in general shape.

Walls varying in thickness along the corallite tube. In longitudinal sections, they display strong, irregular, frequently frayed thickenings and swellings and, consequently, visceral chambers have many irregular contractions and distentions. Due to the poor state of the preservation of colony, the microstructure of walls is unidentified. Epitheca not separated. Connecting tubes rare, well-developed, very long, straight or slightly bent, mostly somewhat oblique and less frequently perpendicular to corallite walls. Their length is mostly equal to a space between corallites. In transverse sections, connecting tubes round, suboval and similar to corallites in the structure and thickness of wall, their diameter being equal to or somewhat smaller than that of corallites. Tabulae and septal spines absent.

Remarks. — The presence of very long and thick connecting tubes and absence of tabulae are the most characteristic features, differing *Syringoporella longituba* sp. n. from all known species of this genus. The new species differs from *S. moravica* (F. A. ROEMER, 1885) from REMES's collection (DUBATOLOV, 1963) in a flattened colony, larger space between and larger diameters of corallites (although specimens from F. A. ROEMER's collections, described by KETTNER, 1937, pp. 9-11, Figs 3 and 4, had corallites 0.7 mm in diameter) and a wider visceral chamber.

S. longituba sp. n. is similar to *S. prisca* (SOKOLOV, 1952) in the size and shape of colony and the shape, arrangement and, in part, diameter of corallites. The new species differs from it in a considerably wider spacing of corallites, larger number of corallites having smaller diameters, larger thickness of corallite walls and larger diameter of connecting tubes.

Order AULOPORIDA SOKOLOV, 1962
Family AULOPORIDA MILNE-EDWARDS & HAIME, 1851
Genus AULOPORA GOLDFUSS, 1829

Type species: *Aulopora serpens* GOLDFUSS, 1829 (*A. repens* MILNE-EDWARDS & HAIME, 1851).

Diagnosis. — See SOKOLOV, 1952.

Remarks. — Characteristics of the genus *Aulopora* and its comparisons with related genera were presented by LECOMPTE (1939), TCHERNYCHEV (1941), SOKOLOV (1952, 1955, 1962) and DUBATOLOV (1972). A hundred and twenty species of this genus have so far been described from the deposits ranging from the Ordovician through Permian. Five species of the genus *Aulopora* have hitherto been known from Poland. They are: *A. repens* GOLDFUSS, *A. repens* MILNE-EDWARDS & HAIME and *A. tubaeformis* GOLDFUSS from the Middle and Upper Devonian of the Holy Cross Mts. (ZEUSCHNER, 1879; SOBOLEV, 1925), *A. serpens* GOLDFUSS from the Middle Devonian of the Kielce Region (SIEMIRADZKI, 1909, SOBOLEV, 1909) and from the Upper Devonian of the Sudeten (GUNIA, 1968) and *A.* sp. from the Upper Carboniferous of Upper Silesia (KUNTH, 1869).

Distribution. — Ordovician: USSR (Baltic Coast, Podolia, Siberian Platform); Silurian through Devonian: USSR (Kuznetsk Basin, Kazakhstan, Altay); Silurian through Carboniferous: USSR (Siberia, Kolyma Basin); Silurian through Permian: Western and Southern Europe, USSR (Ural, Timan, Tien-Shan), South-eastern Asia, China, North America, Australia; Carboniferous: USSR (Donetsk Basin).

Aulopora sp.
(Pl. XXIII, Figs 3-5)

Material. — Three small, fragmentary colonies from the Middle Frasnian of Żbik (ZPAL T IX/(228—230); two small, fragmentary colonies from the Upper Givetian of Dębnik (Czarna Góra) (ZPAL T IX/231, 233); two small, fragmentary colonies from the Lower Frasnian of Dębnik (Rokiczany Dół) (ZPAL T IX/233, 234).

Dimensions (in mm):

d	dv	thw	t-t
0.8-1.2 and 0.8-1.4×1.2-1.9	0.3-0.9 and 0.3-0.6×0.6-0.9	(0.15)0.25-0.5(0.6)	0.2-0.7

Description. — Colonies very small of indeterminate general outline and size. The angle between two adjacent corallites — unknown, type and place of budding indeterminate. Corallites short, straight or very slightly bent, subconical, sometimes dichotomously branching or laterally fused. Calices subconical or cuplike with sharp edges, round or oval in transverse section. Corallites round, oval or elliptical in this same section. Visceral chamber round or oval in this section. Microstructure of stereoplasma concentric-lamellar, with a characteristic, slightly pinnate arrangement of fibers. Strongly elongate, 0.8 by 1.2 mm vesicles, whose longer axes run in the direction of the growth of corallites are sometimes observed in corallite walls. Epitheca very thin. Septal spines absent. Tabulae rare, very thin, slightly bent, horizontal or oblique, forming zones.

Remarks. — The impossibility of measuring the length of corallites and an angle of their branching poses a considerable problem in comparing this with other species. In the diameters of their corallites, the colonies described are somewhat similar to *A. serpens* GOLDFUSS from the Givetian to Frasnian of Belgium (LECOMPTE, 1939) and *A. verticillata* SOKOLOV from the Frasnian of the Southern Ural and the Central Devonian Field (SOKOLOV, 1952), but differ from it in the thickness of corallite walls, lack of septal spines and simpler tabulae.

Family MONILOPORIDAE GRABAU, 1899
Genus CLADOCHONUS MC COY, 1847

Type species: *Cladochonus tenuicollis* MC COY, 1847.

Diagnosis. — See SOKOLOV, 1950.

Remarks. — Characteristics of the genus *Cladochonus* and its comparisons with related genera were presented by HILL & SMYTH (1938), LECOMPTE (1939), EASTON (1944, 1946), MOORE & JEFFORDS (1945), SOKOLOV (1955) and ROWETT (1966, 1969).

More than 50 species of this genus have so far been described from the deposits ranging from the L. Devonian to U. Permian. From the territory of Poland two species of the genus *Cladochonus* are known: *C. alternans* ROEMER from the M. Devonian of the Kielce Region (SOBOLEV, 1909) and *C.* aff. *michelini* MILNE-EDWARDS & HAIME from the L. Carboniferous (MILLER & ZWIERZ, 1970).

Distribution. — Lower to Upper Devonian: Germany; Middle Devonian: Poland, Canada; M. Devonian through L. Carboniferous: Czechoslovakia, Belgium, France, England, East India; M. Devonian through Upper Permian: North America (USA); L. Carboniferous: Poland, USSR (Kuznetsk Basin, Donetsk Basin, Bashkiria, Timan); Lower through U. Carboniferous. The Carnian Alps, Argentina; L. Carboniferous through U. Permian: USSR (Ural), Australia; U. Carboniferous: Hungary; U. Carboniferous through L. Permian: Ireland; U. Carboniferous through U. Permian: Central Asia, Spitsbergen; Lower through U. Permian: Northern and Southern China, Eastern India, Island of Timor, Iran; U. Permian: Yugoslovia.

Cladochonus sp.
(Pl. XXIII, Fig. 2)

Material. — Two small fragmentary colonies from the U. Visean of Gałęzice (railroad cut on the Ostrówka Hill). ZPAL T IX/363, 364.

Dimensions (in mm):

d	dv	thw	t-t
(0.9)1.0-1.1(1.2)	(0.2)0.3-0.4(0.5)	0.3-0.35(0.45)	0.3-0.4

Description. — Colonies small, dendroid. The length of branches indeterminate, but not smaller than 20 mm. Corallites zig-zagging, geniculate, mostly arranged in one plane at an angle of 130° to 145°. Corallites subconical or cylindrical, with a slightly separated calice and 3.0 to 4.0 mm long, in transverse section round. Visceral chamber strongly contracted, round or, rarely, suboval in transverse section. Corallite walls thick, the greatest thickness occurring near corallite apertures. Microstructure of walls concentric-lamellar, typical of this genus. Short fibers of stereoplasma are arranged concentrically and parallel to epitheca, which is very thin, reaching a bare 0.05 mm. Tabulae rare, horizontal, straight, less frequently bent meniscoidally, arranged at regular intervals and occurring not along the entire corallite tube. Septal spines poorly developed, fine, rare, deeply embedded in the stereoplasma of wall and rarely entering the visceral chamber.

Remarks. — The small size of the fragments of colony and the impossibility of studying the structure of calices in *Cladochonus* sp. preclude comparing it with other species. The form described differs from most Carboniferous representatives of this genus in the presence of tabulae and septal spines, very rare characters of *Cladochonus*. *C. socialis* SOKOLOV, described from the U. Visean of the Donetsk Basin (SOKOLOV, 1950), is a somewhat similar species having rare tabulae and septal spines. However, *Cladochonus* sp. differs from it in smaller diameters and considerably smaller length of corallites.

Family SINOPORIDAE SOKOLOV, 1955

Genus **SINOPORA** SOKOLOV, 1955 (= **MONILOPORA** YOH, 1932)

Type species: *Monilopora dendroides* YOH, 1932.

Diagnosis. — See SOKOLOV, 1955.

Remarks. — Characteristics of this genus and comparisons with related genera, that is, *Cylindrostylus* SOKOLOV, 1955 (= *Edwardsiella* RUKHIN, 1937) and *Rossopora* SOKOLOV, 1955 were presented by SOKOLOV (1955, 1962), KLAAMANN (1966), ROWETT (1969, 1971). Seven species of the genus *Sinopora* have been described so far. It has hitherto been unknown in Poland.

Distribution. — Silurian (Llandoverian): USSR (Estonia); Carboniferous: Poland (Holy Cross Mts.); Middle and U. Carboniferous: USSR (European part and Ural); L. Permian: China, Iran, South-western Asia; Permian: Island of Timor; Lower Permian: Alaska.

Sinopora polonica sp. n.

(Pl. XXIII, Figs 6, 7; Pl. XXIV, Figs. 1*a-c*, 2)

Holotype: ZPAL T IX/365; Pl. XXIV, Fig. 1*a-c*.
Type horizon: Lower Carboniferous, Upper Visean — D_2.
Type locality: Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts.
Derivation of the name: *Lat. polonica* — coming from Poland.

Diagnosis. — Colonies irregular, dendroid, to 100 mm in diameter. Corallites strongly twisted in various directions, distributed at 1.5 to 4.5 mm intervals, round and oval in transverse sections, 2.0 to 2.5 mm in diameter. Calices cuplike, deep, sharp-edged. Connecting tubes absent. Walls 0.4 to 0.8 mm thick, composed of two layers: thick outer and thin inner, both of lamellar microstructure. Septal spines rare. Tabulae lacking.

Material. — Eight colonies from Gałęzice (ZPAL T IX/365-369, 371, 372) and A I-35/370.
Dimensions (in mm):

D	C-C	d	dv	thw
80-100	(1.0)1.5-6.2(8.0)	(1.7)2.0-2.5(2.8) and 1.6-2.4×2.0-3.0	(0.2)0.4-0.9(1.8) and 0.6-1.4×0.8-1.9	(0.3)0.4-0.8(1.0)

Description. — Colonies irregular, dendroid. Corallites short, tubular, strongly twisted in various directions, very irregularly distributed, frequently fusing laterally, forming groups of two to three corallites each. Calices funnel-like, cuplike or bulgy in transverse section or, less frequently oval, relatively shallow, 2.0 to 3.0 mm in depth, sharp-edged and having diameters approximating those of corallites. In transverse sections, corallites are round or rounded, oval or, very rarely, irregular. Their diameters strongly vary over the length of a single corallite tube. Visceral chamber strongly contracted, in transverse sections round, oval, irregularly rounded or fissured, displaying a considerable variability in both diameter and shape occurring along the corallite tube. Corallite walls thick or even very thick, composed of two layers: outer, thick, concentric-lamellar in microstructure and inner, relatively thin (to 0.2 mm) lining the visceral chamber, also lamellar but having considerably thinner fibers of stereoplasma. The thickness of this layer is subject to considerable variability all along the corallite tube, so that it frequently disappears at all. Epitheca thin, varying in thickness from 0.05 to 0.2 mm, radial in microstructure. Connecting tubes do not occur. Septal spines very rare, short, thick, pointed, shallowly embedded in the stereoplasma of wall and widely spaced arranged in 10 to 15 vertical rows, best developed in the upper parts of corallites. Tabulae do not occur.

Remarks. — *Sinopora polonica* sp. n. differs from all other known species of this genus in large diameters of corallites and a bilaminar structure of walls. The new species is similar to the type species, *S. dendroides*, from the Permian of Southern China (YOH & HUANG, 1932; SOKOLOV, 1955) in the shape of corallites and thickness of their walls. It differs from the latter in a somewhat wider spacing of corallites and in the presence of septal spines. The new species differs from *S. beecheri* from the Permian of the Island of Timor (GRABAU, 1899; GERTH, 1921) in considerably larger diameters of corallites and larger colonies and from *S. crassa* (Mc COY) from the Permian of Timor (GERT, 1921) only in considerably smaller diameters of corallites.

The colonies of *S. polonica* sp. n. are interlaced by those of *Multithecopora polonica* sp. n. and *M. spinosa* sp. n.

Order CHAETETIDA

Family CHAETETIDAE MILNE-EDWARDS & HAIME, 1850 (emend. SOKOLOV, 1939)

Subfamily CHAETETINAE MILNE-EDWARDS & HAIME, 1850

Genus **CYCLOCHAETETES** SOKOLOV, 1955

Type species: *Cyclochaetetes grandis* SOKOLOV, 1955.

Diagnosis. — See SOKOLOV, 1955.

Remarks. — As opposed to typical Chaetetida, the representatives of the genus *Cyclochaetetes* are marked by variably irregular or, less frequently, bulbous shape of colonies, strongly and equally thickened corallite walls, transverse sections of whose visceral chambers display round or oval outlines, and by the presence of short, blunt septal tubercles on inner surfaces of corallite walls. This genus is characteristic of the M. Devonian and rarely occurs in the L. Carboniferous.

Chaetetes rotundus LECOMPTE, 1939, commonly occurring in the Eifelian of Western and Eastern Europe, is assigned to the genus *Cyclochaetetes*.

Six species of this genus have so far been described from the deposits ranging from the M. Devonian to the L. Carboniferous. From the territory of Poland, only *C. rotundus* has hitherto been known from the Eifelian Miastko 1 borehole, North-western Poland (STASIŃSKA, 1969).

Distribution. — M. Devonian (Eifelian): Belgium, Poland (Miastko 1 borehole), USSR (Ural, Vorkuta, Kuznetsk Basin, Kazakhstan), Central Asia; L. Carboniferous: Poland (Holy Cross Mts.), Central Asia.

Cyclochaetetes tuberculosus sp. n.

(Pl. XXIV, Fig. 3*a-c*)

Holotype: ZPAL T IX/373; Pl. XXIV, Fig. 3*a-c*.
Type horizon: Lower Carboniferous, Upper Visean — D_2.
Type locality: Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts.
Derivation of the name: *Lat. tuberculosus* — having characteristic nodular pseudoseptal projections.

Diagnosis. — Colonies flat and irregular, 20 to 30 by 50 by 60 mm. Corallites straight. Corallite lumina 0.15 to 0.2 mm in diameter. Walls 0.04 to 0.05 mm thick. Tabulae thick, complete, horizontal, straight or slightly bent, on equal levels in adjacent corallites, spaced at 0.15 to 0.3 mm intervals. Pseudoseptal projections numerous, in the form of short, blunt bosses.

Material. — Two almost complete colonies from Gałęzice (ZPAL T IX/373, 374).

Dimensions (in mm):

H×D	d	thw	t-t
20-30×50×60	(0.1)0.15-0.2(0.25)	(0.02)0.04-0.05	(0.05)0.15-0.3(0.4)

Description. — Colonies small, irregular, flattened or flat, mostly formed by a single, strongly bent and variously folded layer 2.0 to 5.0 mm thick. Growth interruptions in the form of elongate cavities and flat fissures, filled with colonies of the Bryozoa of the genus *Fistulipora* or with a mudy intercalations frequently occur in colonies. Longitudinal sections reveal a laminar growth of colony, emphasized by thicker tabulae, arranged on equal levels in adjacent corallites. These layers are 0.5 to 1.5 mm thick.

Corallites thick-walled, short, straight, less frequently twisted, closely adhering to each other, arranged perpendicularly to the basal epitheca and opening at a right angle to the surface of colony. In transverse sections, visceral chamber round, oval or rounded, sometimes polygonal-rounded in outline. Locally, as a result of the thickening of walls, the lumen of corallite is strongly contracted in some parts of colony.

Walls solid, not revealing a microstructure, sometimes having a very faint median suture.

Tabulae relatively thick, complete, horizontal, straight, rarely somewhat bent, mostly distributed on identical levels in adjacent corallites.

Pseudoseptal projections numerous occurring in the form of blunt tubercles.

Remarks. — *Cyclochaetetes tuberculosus* sp. n. differs from all other known species of this genus in the pattern of colony, very small diameters of visceral chambers and many pseudoseptal tubercles.

Genus CHAETETELLA SOKOLOV, 1939

Type species: *Chaetetella filiformis* SOKOLOV, 1939.

Diagnosis. — See SOKOLOV, 1950.

Remarks. — The genus *Chaetetella* was separated by SOKOLOV from *Chaetetes* mostly on the basis of differences in the structure of colonies, shape of corallites and development of septal apparatus (SOKOLOV, 1939, 1946, 1950, 1955, 1962). In contrast to *Chaetetes*, the colonies of the genus *Chaetetella* are tabular, rarely hemispherical and with a well-developed basal epitheca. Corallites are less regular in outline and as a rule have smaller diameters than those of *Chaetetes*, their pseudoseptal elements being very rare. A subgenus, *Ch.* (*Chaetetiporella*) marked by corallites strongly varying in diameters, mostly grouped to form local concentrations and having walls variable in thickness, has been separated by SOKOLOV (o. c.). Such species of *Chaetetes* as *Ch. depressa* FLEMING, 1828 and *Ch. volgensis* STUCKENBERG, 1905 are assigned to the genus *Chaetetella*, while *Chaetetes fischeri* STUCKENBERG, 1888 is assigned to the subgenus *Ch.* (*Chaetetiporella*). Fifteen species of the genus *Chaetetella*, including four of subgenus *Ch.* (*Chaetetiporella*), have hitherto been described from deposits ranging between the M. Silurian and U. Carboniferous. No representatives of this genus have so far been described from the territory of Poland.

Distribution. — U. Ordovician: USSR (Kolyma Basin), the Arctic part of Canada; M. Devonian: USSR (Kuznetsk Basin, Ural), Central Asia; L. Carboniferous: Western Europe, USSR (Moscow and Donetsk Basins, Ural, Timan), Central Asia, China, North America; U. Carboniferous: USSR (Donetsk Basin).

Chatetella repens SOKOLOV, 1950
(Pl. XXVI, Fig. 3*a*, *b*)

1950. *Chaetetella repens* SOKOLOV; B. S. SOKOLOV, p. 74, Pl. 10, Figs. 1-3.

Diagnosis. — See SOKOLOV, 1950.

Material. — Five almost complete colonies from Gałęzice (ZPAL T IX/375-379).

Dimensions (in mm):

H×D	d	thw	t-t
3-12×38×40	(0.18)0.2-0.3(0.32)	(0.02)0.03-0.04(0.05)	(0.1)0.2-0.5(1.0)

Description. — Colonies very flat, crustose, trailing on the substrate, sometimes strongly folded or plano-convex, small. Transverse sections distinctly reveal the lamination of colony parallel to the trace of the basal epitheca or, in the case of plano-convex colonies, parallel to the upper surface of colony. The lamination is frequently emphasized by tabulae, which are arranged on equal levels in adjacent corallites. Basal epitheca thin, in the form of a dark line. Corallites closely adhering to each other, straight or twisted, parallel to each other and perpendicular to the surface of basal epitheca. In plano-convex colonies, they, diverge in a pinnate manner and open perpendicularly to their upper surfaces. In transverse sections, corallites are as a rule irregularly polygonal (penta-, hexa- and, less frequently, tetragonal), frequently elongate, polygonal in internal outline and with considerably variable diameters. Small and large corallites are grouped in local centers, irregularly scattered over colony. Corallite walls varying in thickness regardless of the diameter of corallite, sometimes secondarily thickened. Corallites with thick and thin walls are grouped in local clusters, irregularly scattered over colony. Median suture sometimes well visible in the form of a dark line. Tabulae regular, complete, horizontal or, very rarely, slightly oblique or somewhat bent towards the lower part of corallite, distributed as a rule on identical levels in adjacent corallites forming a pseudolamination of colony. Pseudoseptal tubercles very rarely observed, poorly preserved.

Remarks. — *Chaetetella repens* from the U. Visean of the Holy Cross Mts. differs from the type species from the Visean of the Moscow Basin only in slightly larger colonies, more variable diameters of corallites (the smallest diameters amounting sometimes to 0.15 mm), more variable spacing of tabulae and insignificantly thicker corallite walls. The comparisons of this species with related ones, in particular with *Ch. volgensis* (STUCKENBERG, 1905) were presented by SOKOLOV (1950).

Distribution. — USSR (Moscov Basin): Visean.

Chaetetella cellulata SOKOLOV, 1950

(Pl.XXV, Fig. 1*a*, *b*)

1950. *Chaetetella cellulata* SOKOLOV; B. S. SOKOLOV, p. 72, Pl. 11, Figs. 3 and 4.

Diagnosis. — See SOKOLOV, 1950.

Material. — Two almost complete colonies from Gałęzice (railroad cut on the Ostrówka Hill) (ZPAL T IX/380-381).

Dimensions (in mm):

H×D	d	thw	t-t
15-20×60×100	(0.2)0.23-0.26(0.3)	0.02-0.03(0.05)	(0.1)0.2-0.4(0.5)

Description. — Colonies very flat, crustose, trailing on the substrate and not folded. Growth discontinuities in the form of elongate cavities filled with colonies of the bryozoan *Fistulipora* or with a clayey deposit are frequently observed in colonies. Local lamination of colony, parallel to the basal epitheca and emphasized by thicker tabulae, arranged on identical levels in adjacent corallites, occurs in transverse sections. These laminae are 1.0 to 2.0 mm thick. Corallites long, thin, prismatic, capillary, straight, parallel and closely adhering to each other, locally slightly bent, parallel to the basal epitheca and opening at a right angle to the upper surface of colonies where they form deep, flattened calices. In transverse sections, corallites regularly polygonal (penta- and hexagonal), resembling a honeycomb. Widely scattered, local centers in which corallites are irregularly polygonal or elongate in outline and have considerably thick walls are sometimes visible in colony. Diameters of corallites constant. Lumina polygonal-rounded. Thickness of corallite wall constant. Microstructure of walls fibro-radial. Fibers perpendicular to the surface of corallite walls. Median suture indistinct. Tabulae regular, thin, complete, straight or slightly bent, horizontal, distributed on different levels in adjacent corallites. Pseudoseptal tubercles occurring rarely and only in the zones of disorders in the growth of colony.

Remarks. — *Chaetetella cellulata* from the U. Visean of Gałęzice differs from the type species only in somewhat more closely spaced tabulae and slightly better developed pseudoseptal protuberances.

Distribution. — USSR (Voronezh region): Upper Visean.

Subgenus **Chaetetella (Chaetetiporella)** Sokolov, 1939

Type species: *Chaetetiporella crustacea* Sokolov, 1939.

Diagnosis. — See Sokolov, 1950.

Chaetetella (Chaetetiporella) heterozoa sp. n.
(Pl. XXV, Figs 2*a*, *b*, 3)

Holotype: ZPAL T IX/384; Pl. XXV, Fig. 2*a*, *b*.
Type horizon: Lower Carboniferous, Upper Visean — D_2.
Type locality: Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts.
Derivation of the name: *heterozoa* — having variable corallites.

Diagnosis. — Colonies flat, bulbous, to 4 to 10 by 75×95 mm. Corallites straight or twisted, irregularly polygonal and elongate, 0.2 to 0.3 mm in diameter. Walls 0.04 to 0.1 mm thick. Tabulae thin, complete, horizontal, straight, spaced at 0.15 to 0.4 mm intervals, mostly arranged on identical levels in adjacent corallites. Pseudoseptal protuberances very rare.

Material. — Five almost complete colonies from Gałęzice (ZPAL T IX/382-386).

Dimensions (in mm):

H×D	d	thw	t-t
4-10×75×95 and 70×75×95	(0.15)0.2-0.3(0.35)	(0.04)0.05-0.08(0.1)	0.15-0.4

Description. — Colonies flat, encrusting, folded, frequently thickening and strongly convex. Sometimes a flat colony strongly thickens. Growth interruptions in the form of elongate cavities or wide fissures, filled in flat colonies by the bryozoan *Fistulipora* or with a clayey deposit are very frequently observed in colonies. In longitudinal sections, colonies display a distinct lamination parallel to the surface of basal epitheca or upper surface of colony. This lamination is frequently emphasized by tabulae arranged at identical levels in adjacent corallites. The thickness of layers in a colony amounts to 0.5 to 0.3 mm. Corallites closely adhering to each other, straight, more often twisted in various directions, parallel to each other and perpendicular to the surface of basal epitheca, opening perpendicularly to the upper surface of colony. In transverse sections, corallites irregularly polygonal (penta-, hexa- and, rarely, tetragonal), rarely regular, frequently elongate, strongly varying in diameter. Small and large corallites are grouped in local centers irregularly scattered over the colony. Their lumina irregularly polygonal or, in case of thick walls, more or less regularly rounded. Corallite walls varying in thickness regardless of diameter, sometimes so strongly thickened that the visceral chamber becomes strongly contracted or filled completely. Corallites with thick and thin walls are grouped to form local centers, irregularly scattered over colony. Tabulae thin, regular, complete, horizontal, straight, very rarely slightly oblique and bent towards the bottom of corallite, mostly arranged on identical levels in adjacent corallites. Pseudoseptal tubercles very rare, fine and poorly preserved.

Remarks. — *Chaetetella (Chaetetiporella) heterozoa* sp. n. displays characters transitional between these *Ch. repens* from the Visean of the Moscow Basin (SOKOLOV, 1950) and those of *Ch. (Ch.) rotai* (SOKOLOV, 1950).

It is partly similar to *Ch. repens* in the form of its colony and variability in the diameter of irregularly polygonal corallites. Its similarity to *Ch. (Ch.) rotai* is expressed in the form, size and, in part, internal structure of colony, as well as in the thickness of the walls of corallites, sometimes so completely filled with a secondary stereoplasma that the visceral chamber disappears. The new species differs from the two forms mentioned above in a strongly folded colony, which make take an irregularly bulbous form, and in a very strong differentiation in the diameters of corallites (0.1 to 0.4 mm), which resembles that of *Chaetetella superior* var. *heteropora* (SOKOLOV, 1950).

Chaetetella (Chaetetiporella) rotaiformis sp. n.

(Pl. XXVI, Figs 1*a*, *b*, 2; Pl. XXVII, Fig. 1)

Holotype: ZPAL T IX/390; Pl. XXVI, Fig. 1*a*, *b*.
Type horizon: Lower Carboniferous, Upper Visean — D_2.
Type locality Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts.
Derivation of the name: *Lat. rotaiformis* — similar to the species *Chaetetella (Chaetetiporella) rotai* SOKOLOV.

Diagnosis. — Colonies flat, laminar, 8-25 by 70 by 70 mm. Corallites straight, parallel to each other, 0.2 to 0.3 mm in diameter. Visceral chamber round or oval in transverse section. Walls 0.02 to 0.06 mm thick. Tabulae thin, complete, horizontal, straight, spaced at 0.2 to 0.8 mm intervals, distributed on different levels in adjacent corallites. Pseudoseptal tubercles short, occurring rarely in large and thick-walled corallites.

Material. — Seven complete colonies from Gałęzice; ZPAL T IX/387-393.

Dimensions (in mm):

H×D	d	thw	t-t
8-25×70×70	(0.15)0.2-0.3(0.35)	(0.01)0.02-0.05(0.07)	0.2-0.4(0.8)

Description. — Colonies small, flat, plano-convex, lenticulate or crustose and very slightly folded. Growth interruptions in the form of irregular elongate cavities, filled with flat colonies of the bryozoan *Fistulipora* or with a clayey deposits occur rarely in colonies. Longitudinal sections reveal the laminar structure of colony emphasized by strongly thickened tabulae, arranged on identical levels in adjacent corallites. These laminae run on the whole parallel to basal epitheca and to the upper surface of colony. The thickness of laminae in a colony amounts on the average to 1.5 to 5.0 mm. Corallites relatively long, straight or slightly bent, arranged close and parallel to each other, in thickened and plano-convex parts of colony diverging radially and opening perpendicularly to the surface of colony. In transverse sections, corallites relatively regular in their polygonal and rounded (penta- and hexagonal, less frequently tetragonal) outlines, rarely irregularly polygonal and elongate, displaying a considerable variability in diameter. Lumina of thick-walled corallites rounded or oval and of thin-walled ones more or less irregularly polygonal. Small and large corallites are grouped in local centers, irregularly scattered over colony. Corallite walls varying in thickness regardless of corallite diameters, locally secondarily thickened. Thick- and thin-walled corallites are grouped in local centers, irregularly scattered over colony. Median suture invisible. Tabulae thin, regular, complete, or, very rarely incomplete, horizontal, straight, very rarely slightly oblique and bent, mostly arranged on different levels in adjacent corallites. Thick tabulae, demarcating laminae in colony, are arranged on this same level in adjacent corallites. Pseudoseptal projections short, nodular, occurring only in thick-walled corallites having large diameters. They are as a rule poorly preserved.

Remarks. — *Ch.* (*Chaetetiporella*) *rotaiformis* sp. n. displays the largest similarity to the subspecies *Ch.* (*Ch*). *rotai* (SOKOLOV). It is expressed in the external shape and internal structure of colony, in the outlines of transverse sections of corallites and in the spacing of tabulae. The new subspecies differs from *Ch.* (*Ch.*) *rotai* in larger colonies composed of layers which nearly are not folded, in a larger variability in the diameter of corallites and in considerably thinner walls of corallites with slightly contracted visceral chambers. *Ch.* (*Ch.*) *rotaiformis* is similar to *Ch.* (*Ch.*) *heterozoa* sp. n. described before in the dimensions and form of colony, range of variability and diameters of corallites and spacing of tabulae. *Ch.* (*Ch.*) *rotaiformis* differs from *Ch.* (*Ch.*) *heterozoa* in a considerably simpler internal structure of colony, more regular transverse sections of corallites and considerably thinner walls.

Subfamily CHAETETIPORINAE SOKOLOV, 1955

Genus **CHAETETIPORA** STRUVE, 1898

Type species: *Chaetetipora confluens* STRUVE, 1898.

Diagnosis. — See SOKOLOV, 1950.

Remarks. — The genus *Chaetetipora*, erected by STRUVE (1898) displays a considerable similarity to the Silurian (Wenlockian) genus *Desmipora* NICHOLSON, 1886 and the L. Carboniferous genus *Fistulimurina* SOKOLOV, 1947. According to HILL (1956), *Chaetetipora* is a synonym of *Chaetetes*. Characteristics and comparisons with related genera were presented by SOKOLOV (1947, 1950, 1962), TESAKOV (1960), DUBATOLOV (1963), DUBATOLOV & TONG-DZUY-THANH (1965) and TONG-DZUY-THANH (1967). Fifteen species of this genus have been described until now from the deposits ranging between the M. Devonian and U. Carboniferous. No representatives of *Chaetetipora* have so far been described from Poland.

Distribution. — M. Devonian: USSR (Kuznetsk Basin, Ural, Vorkuta), Central Asia, Vietnam; Carboniferous: Poland (Holy Cross Mts.), England, USSR (Moscow Basin, Donetsk Basin, Ural), Central Asia, China.

Chaetetipora confluens Struve, 1898

(Pl. XXVII, Fig. 2*a-b*)

1898. *Chaetetipora confluens* STRUVE; A. STRUVE, p. 91, Pl. 5, Figs 4 and 5.

Diagnosis. — Colonies hemispherical 50 by 80 to 100 mm. Corallites parallel, in transverse sections meandering, 0.35 to 0.7 by 4.0 mm. Visceral chamber on the average 0.2 to 0.35 mm wide. Walls slightly folded, 0.1 to 0.17 mm thick, trabecular in microstructure. Tabulae thin, horizontal, straight or bent and slightly oblique, spaced at 0.2 to 0.6 mm intervals. Pseudoseptal protuberances rare, short, thick, nodular, rarely spiny.

Material. — Two complete colonies from Gałęzice (railroad cut on the Ostrówka Hill), (ZPAL T IX/394, 395).

Dimensions (in mm):

H×D	d	thw	t-t
50×80×100	(0.35)0.4-0.6(0.7)×0.1-4.0	0.1-0.15(0.17)	0.2-0.5(0.6)

Description. — Colonies not very large, hemispherical, composed of radially diverging or parallel corallites, opening perpendicularly to the surface of colony. Laminar growth zones, varying in thickness from 1.0 to 8.0 mm and parallel to a hemispherical upper surface of colony, are visible in longitudinal sections of colonies. Growth interruptions in the form of fissures, filled with flat colonies of the bryozoan *Fistulipora* or a clayey deposit, occur sometimes in colonies.

Corallites relatively long, straight, closely adhering to each other, sometimes slightly bent, in transverse sections meandering, strongly elongate or irregularly rounded, less frequently elliptical or round. A maximum length of meandering corallites, marked by an incomplete division, reaches 4.0 mm. Corallite walls slightly folded, variable in thickness, frequently having rounded swellings. Microstructure of walls distinctly trabecular. Median suture invisible. Tabulae thin, horizontal, straight, frequently more or less oblique and bent, sometimes intersecting each other, distributed on different levels in adjacent corallites. Pseudoseptal projections rare, short, thick, nodular, less frequently spiny.

Remarks. — *Ch. confluens* from the U. Visean of Gałęzice differs from *Ch. confluens* from the Visean of the Moscow Basin (STRUVE, 1898) only in a somewhat larger width of visceral chambers of corallites.

Distribution. — USSR (Moscow Basin): Visean.

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ALPHABETICAL INDICES

I. INDEX OF AUTHORS

II. PALAEONTOLOGICAL INDEX

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Numerals which indicate the page, on which the species is cited only, are standart; numerals which indicate pages with descriptions, are bold.

PLATES

A. NOWIŃSKI: TABULATA AND CHAETETIDA OF POLAND

PLATE I

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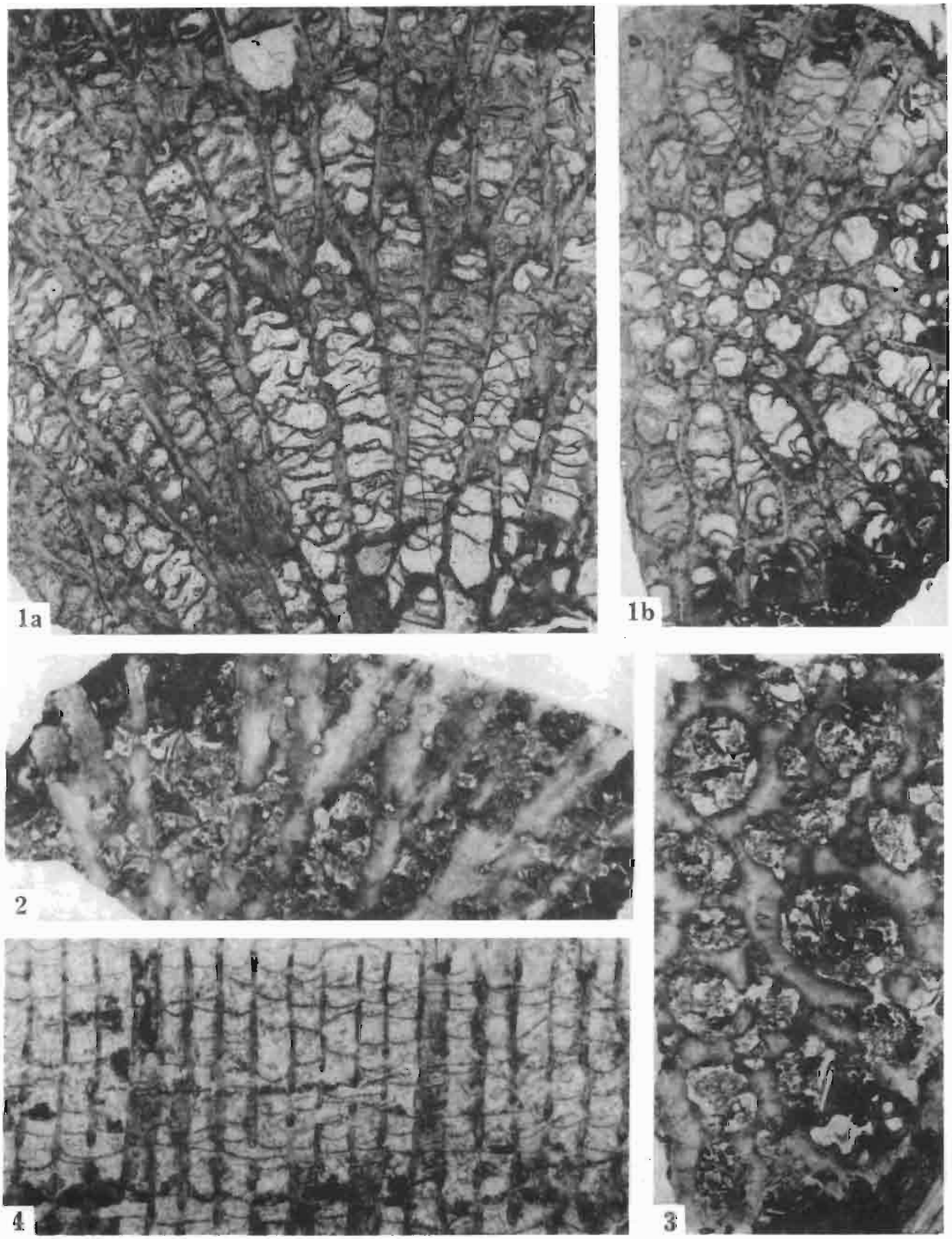
Squameofavosites megasquamatus sp. n. 42

Fig. 1 (a) Longitudinal section, × 5; (b) transversal section, × 5; holotype (ZPAL T IX/247).
Fig. 2 Longitudinal section, × 10; (ZPAL T IX/250.)
Fig. 3 Tangential section through the surface of colony, × 10; (A I-35/250).
Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., U. Visean, D_2.

Squameofavosites (Dictyofavosites) pachyfavositoides sp. n. 44

Fig. 4 Longitudinal section, × 10; (ZPAL T IX/3).
Dębnik (Żarnówczany Dół — ravine), Cracow region, U. Frasnian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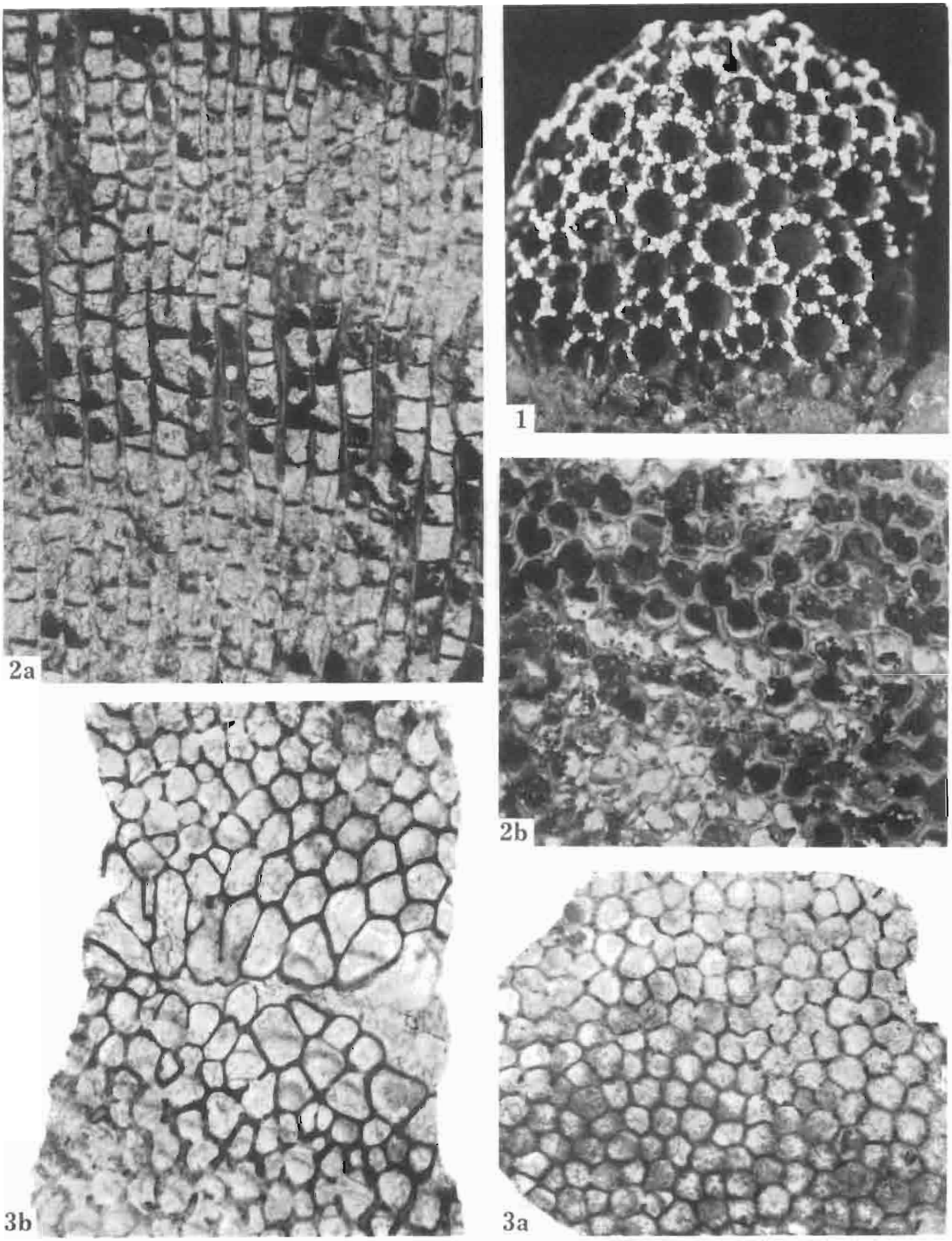
A. NOWIŃSKI: TABULATA AND CHAETETIDA OF POLAND

PLATE II

Fig. 1 General view of colony, × 3; (ZPAL T IX/253); Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., U. Visean, D_2.

Fig. 2 (a) Longitudinal section, × 10; (b) transversal section, × 10; holotype (ZPAL T IX/1); Żbik, Cracow region, M. Frasnian.

Fig. 3 (a) Transversal section, × 10; (b) transversal section through the young part of a colony, × 10; (ZPAL T IX/3); Dębnik, Żarnówczany Dół — ravine, Cracow region, U. Frasnian.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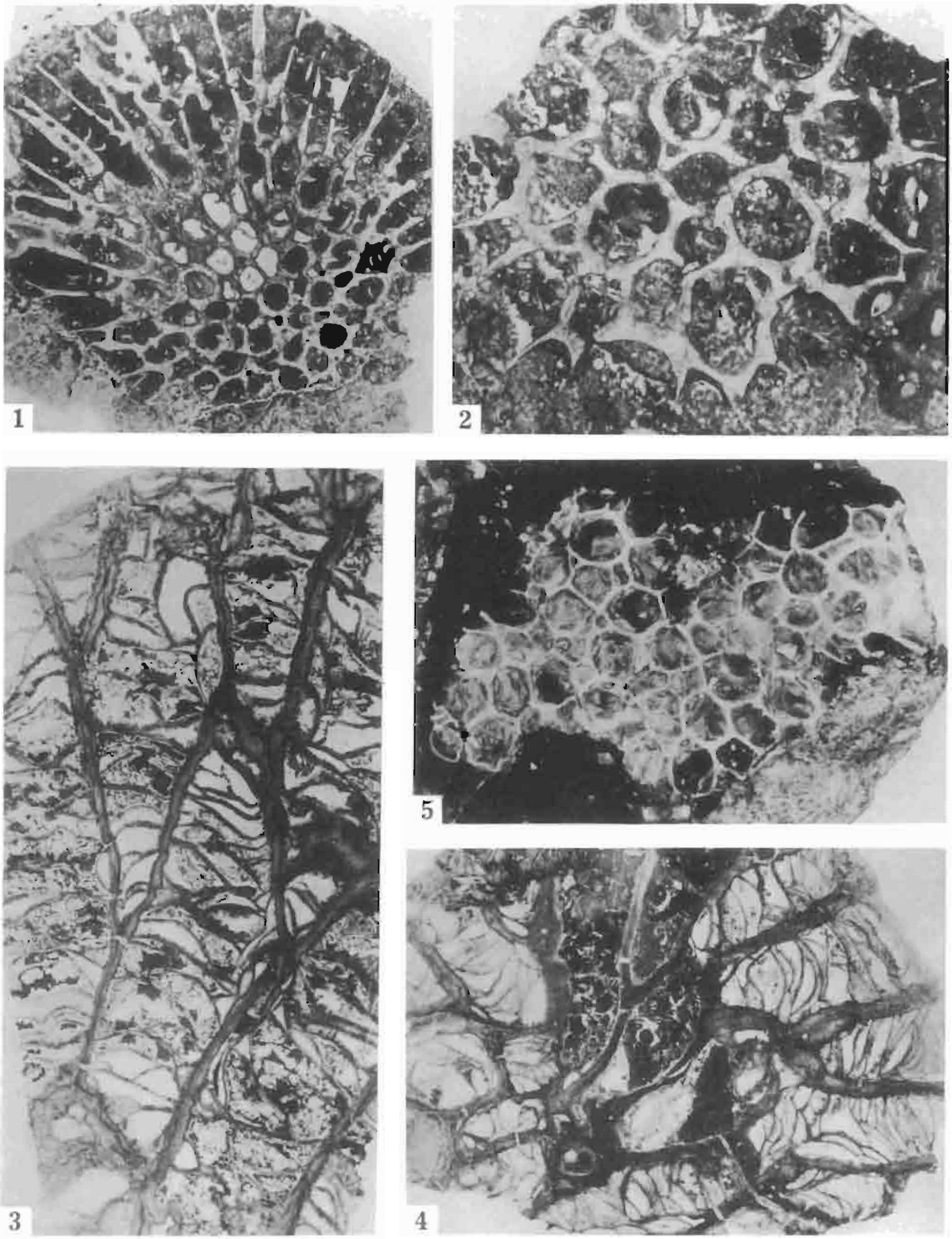
A. NOWIŃSKI: TABULATA AND CHAETETIDA OF POLAND

PLATE III

Fig. 1. Longitudinal and transversal sections, × 5; holotype (ZPAL T IX/264).
Fig. 2. Transversal section, × 10; (A I-35/269).

Fig. 3. Longitudinal section, × 3; (ZPAL T IX/271).
Fig. 4. Longitudinal section through the young part of a colony, × 3; (A I-35/278).
Fig. 5. Tangential section through calices, × 1; ZPAL T IX/280.

Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., U. Visean, D_2.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A. NOWIŃSKI: TABULATA AND CHAETETIDA OF POLAND

PLATE IV

Page

Michelinia tenuisepta (PHILLIPS) 48

Fig. 1. Longitudinal section through a colony, × 1; (ZPAL T IX/280).
Fig. 2. Transversal section, × 5; (A I-35/276).
Fig. 3. Transversal section, × 3; (ZPAL T IX/268).
Fig. 4. Longitudinal section through corallites with oblique tabulae, × 3; (A I-35/273).

Michelinia aseptata sp. n. 49

Fig. 5. Transversal section, × 5; holotype (ZPAL T IX/285).
Fig. 6. Longitudinal section, × 5; (ZPAL T IX/287).
Fig. 7. Longitudinal section, × 5; (ZPAL T IX/286).
Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts. U. Visean, D_2.

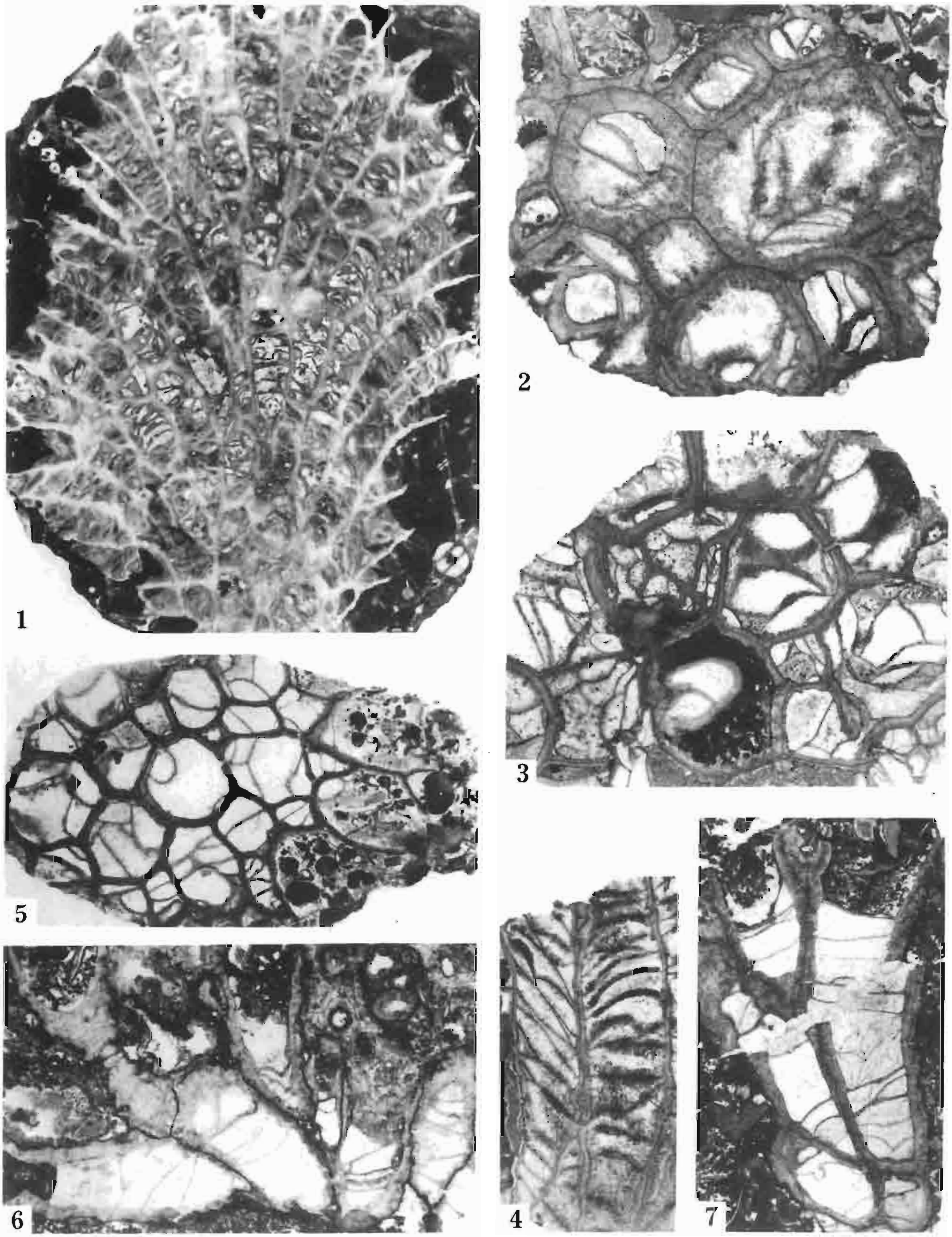
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PLATE V

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Palaeacis orlei sp. n. 51

Fig. 1. (a) Upper view of a colony, × 5; (b) lateral view of a colony, × 5; holotype (A I-35/290).
Fig. 2. (a) Transversal section of a calice, × 10; (b) lateral view of a calice, × 10; (A I-35/289).
Zalas (the Orlej River gorge), Cracow Region, Upper Visean, D_1

Thamnopora boloniensis (GOSSELET) 53

Fig. 3. Transversal section, × 10; (ZPAL T IX/25).
Fig. 4. Transversal section, × 10; (ZPAL T IX/37).
Fig. 5. Transversal section of a young colony, × 5; (ZPAL T IX/38).
Fig. 6. Longitudinal and tangential sections, × 5; (ZPAL T IX/29).
Fig. 7. Longitudinal section of the axial zone of a colony, × 5; (ZPAL T IX/39).
Fig. 8. Transversal section, × 5; (ZPAL T IX/28).
Dubie, Cracow region, U. Givetian.

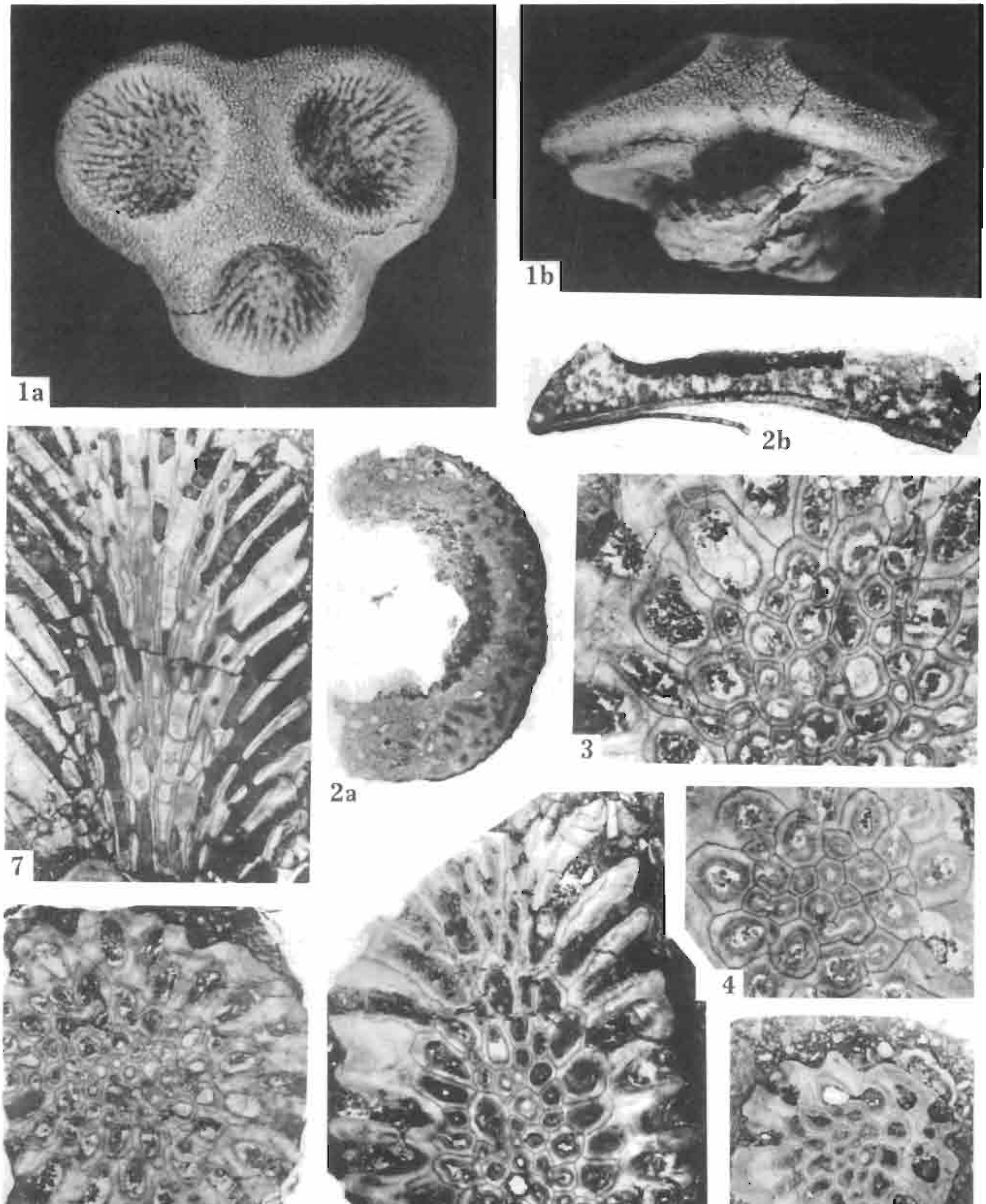
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PLATE VI

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Thamnopora striatoporoides sp. n. 55

Fig. 1. (a) Longitudinal section, × 10; (b) transversal section, × 10; (c) transversal section, × 10; holotype (ZPAL T IX/236).

Fig. 2. Tangential section of the surface zone of a colony, × 10 (ZPAL T IX/239).

Fig. 3. (a) Transversal section of the fused branches of a colony, × 10; (b) longitudinal section, × 10; (c) longitudinal section, × 10; (ZPAL T IX/235).

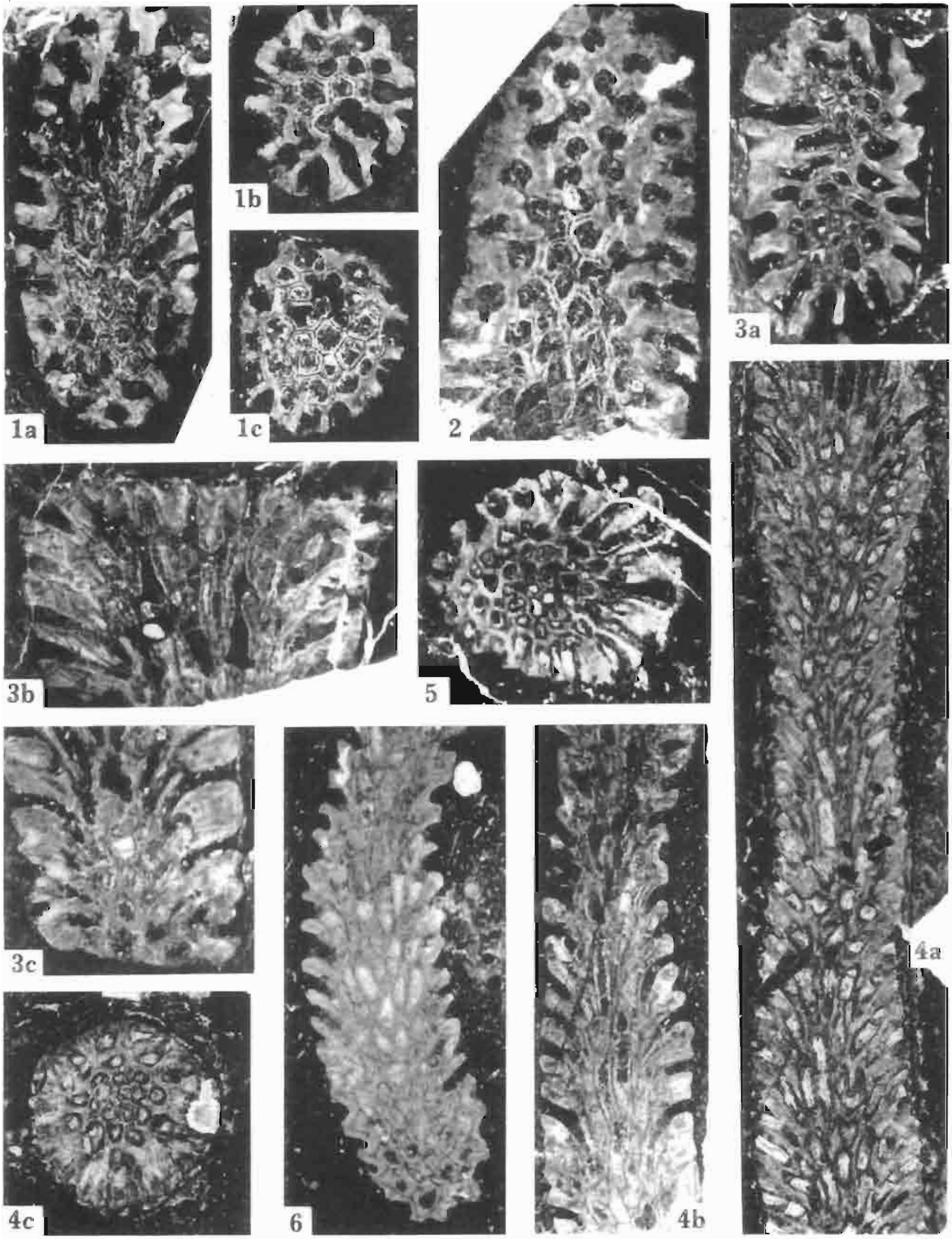
Dębnik (Czarna Góra — Hill), Cracow region, U. Givetian.

Cladopora gracilis Lecompte 57

Fig. 4. (a) Longitudinal section, × 10; (b) longitudinal section, × 10; (c) transversal section, × 10; (ZPAL T IX/49); Żbik, Cracow region, M. Frasnian.

Fig. 5. Transversal section, × 10; (ZPAL T IX/67); Dębnik (Żarnówczany Dół — ravine), Cracow region, M. Frasnian.

Fig. 6. Longitudinal section, × 10; (ZPAL T IX/66); Żbik, Cracow region, M. Frasnian.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A. NOWIŃSKI: TABULATA AND CHAETETIDA OF POLAND

PLATE VII

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Alveolitella fecunda (LECOMPTE) 61

Fig. 1. (a) Longitudinal section, × 10; (b) transversal section, × 10; (c) transversal section of a colony, × 5; (ZPAL T IX/92); Dębnik (Żarnówczany Dół — ravine), Cracow Region, U. Frasnian.

Alveolitella ramosa (F. A. ROEMER) 61

Fig. 2. (a) and (b) — transversal sections, × 10; (c) transversal section of a colony, × 5; (ZPAL T IX/94); Żbik, Cracow region, M. Frasnian.

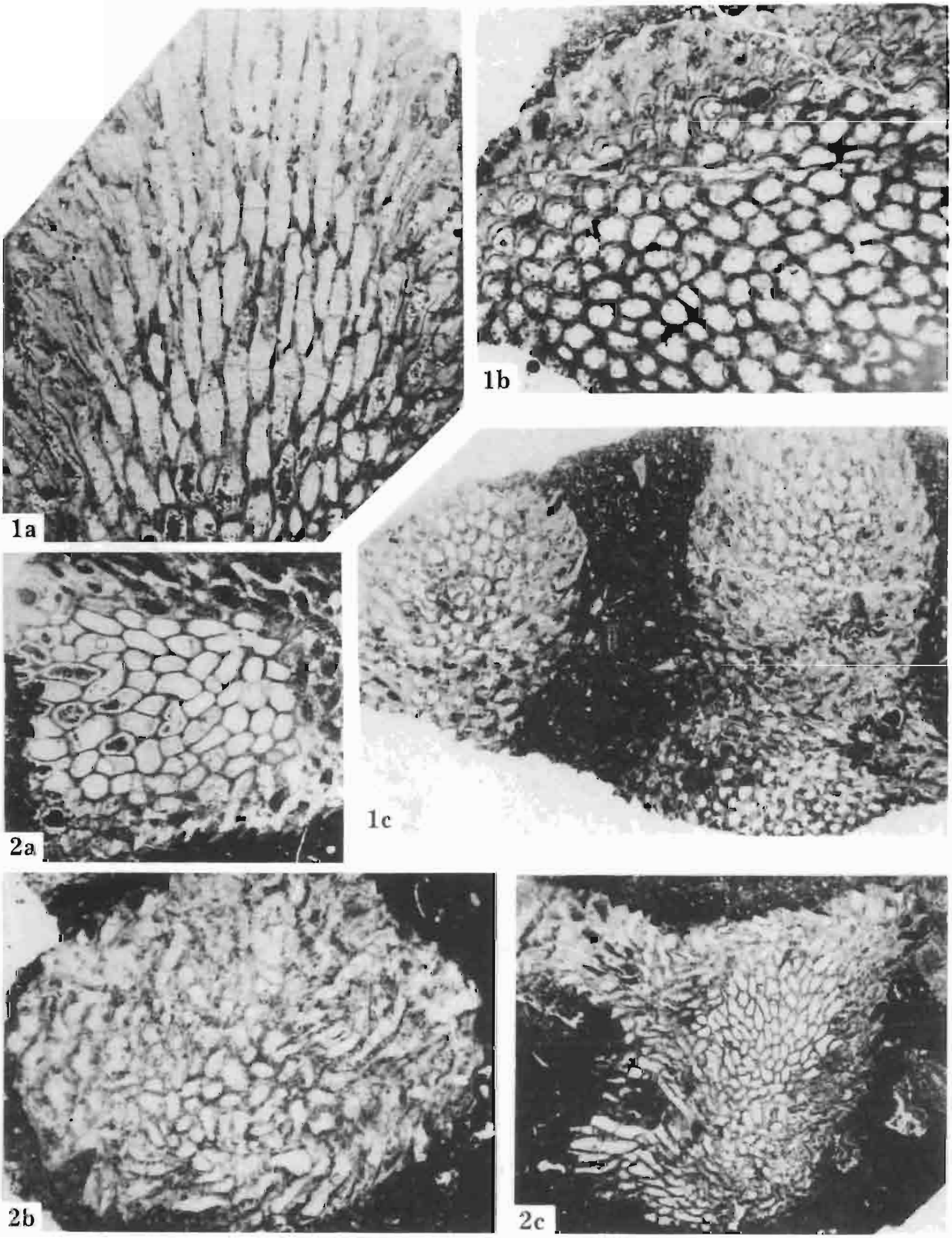
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PLATE VIII

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Alveolitella ramosa (F. A. ROEMER) 61

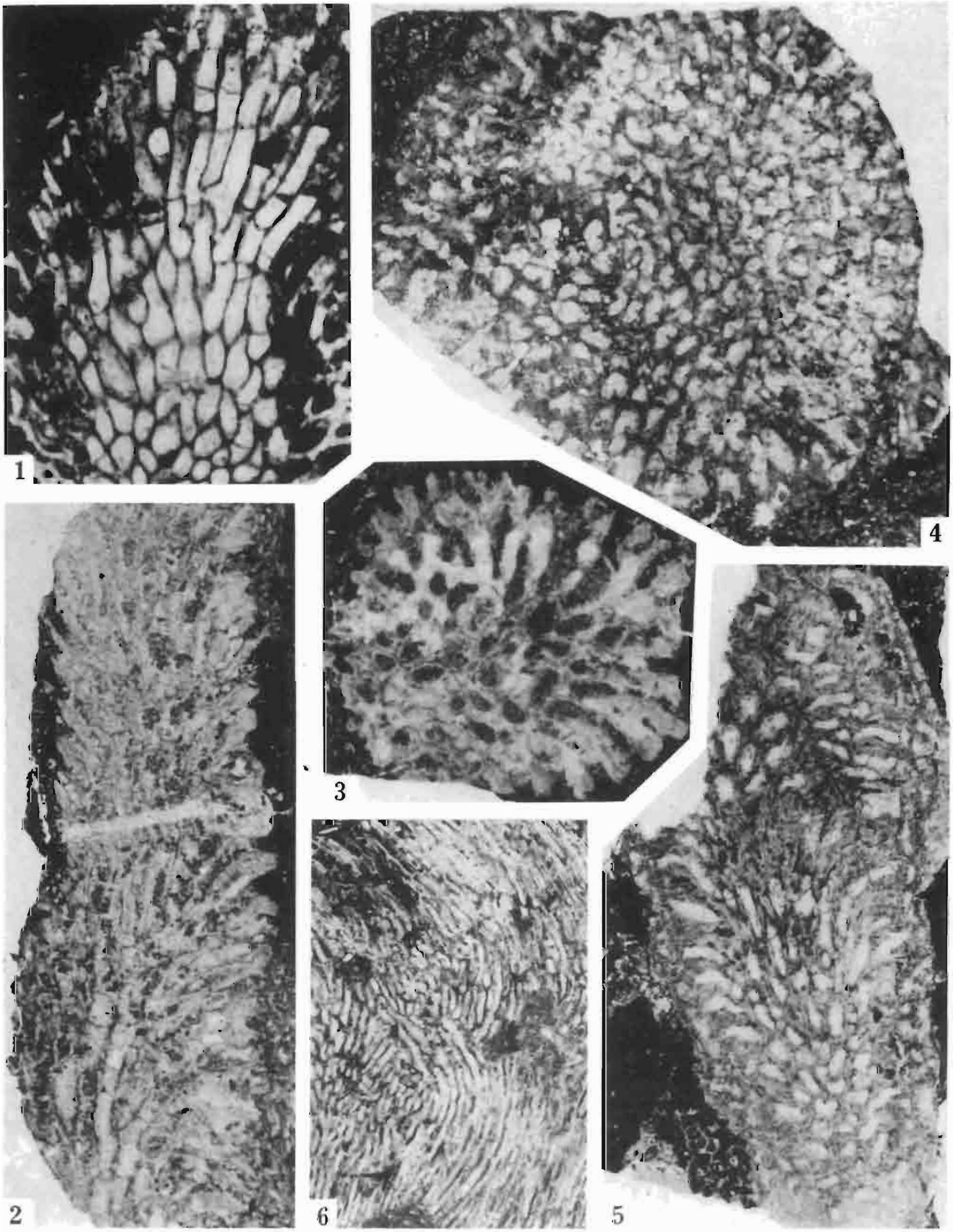
Fig. 1. Longitudinal section, × 10; (ZPAL T IX/94); Żbik, Cracow region, M. Frasnian.

Alveolitella rarispinosa sp. n. 63

Fig. 2. Longitudinal section, × 10; (ZPAL T IX/101); Żbik, Cracow region, M. Frasnian.
Fig. 3. Transversal section, × 10; (ZPAL T IX/96); Żbik, Cracow region, M. Frasnian.
Fig. 4. Transversal section, × 10; holotype (ZPAL T IX/97); Żbik, Cracow region, M. Frasnian.
Fig. 5. Tangential section, × 10; (ZPAL T IX/103); Dębnik (Rokiczany Dół — ravine), Cracow region, L. Frasnian.

Alveolites taenioformis SCHLÜTER 59

Fig. 6. Longitudinal section, × 10; (ZPAL T IX/91); Dębnik, (Żarnówczany Dół — ravine); Cracow region, U. Frasnian.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A. NOWIŃSKI: TABULATA AND CHAETETIDA OF POLAND

PLATE IX

Fig. 1. (a) Longitudinal section, × 5; (b) longitudinal section, × 10; (c) transversal section, × 5; (ZPAL T IX/85).
Fig. 2. Transversal section, × 10; (ZPAL T IX/76).
Dubie, Cracow region, U. Givetian

Fig. 3. Transversal section, × 10; (ZPAL T IX/91); Dębnik (Żarnówczany Dół — ravine), Cracow region, U. Frasnian.

Fig. 4. Longitudinal section, × 10; (ZPAL T IX/123).
Fig. 5. Transversal section, × 10; holotype (ZPAL T IX/121).
Dubie, Cracow region, U. Givetian

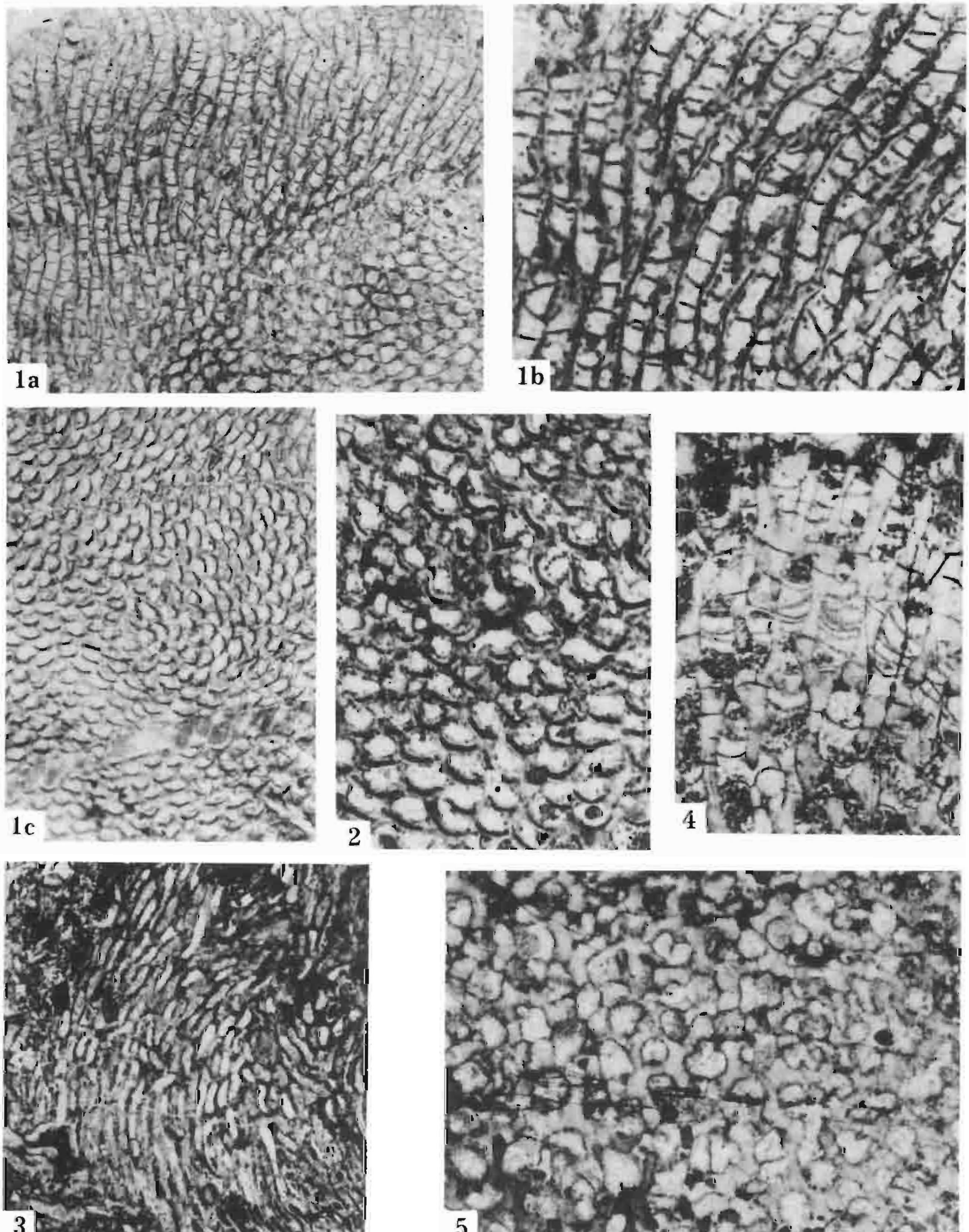
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PLATE X

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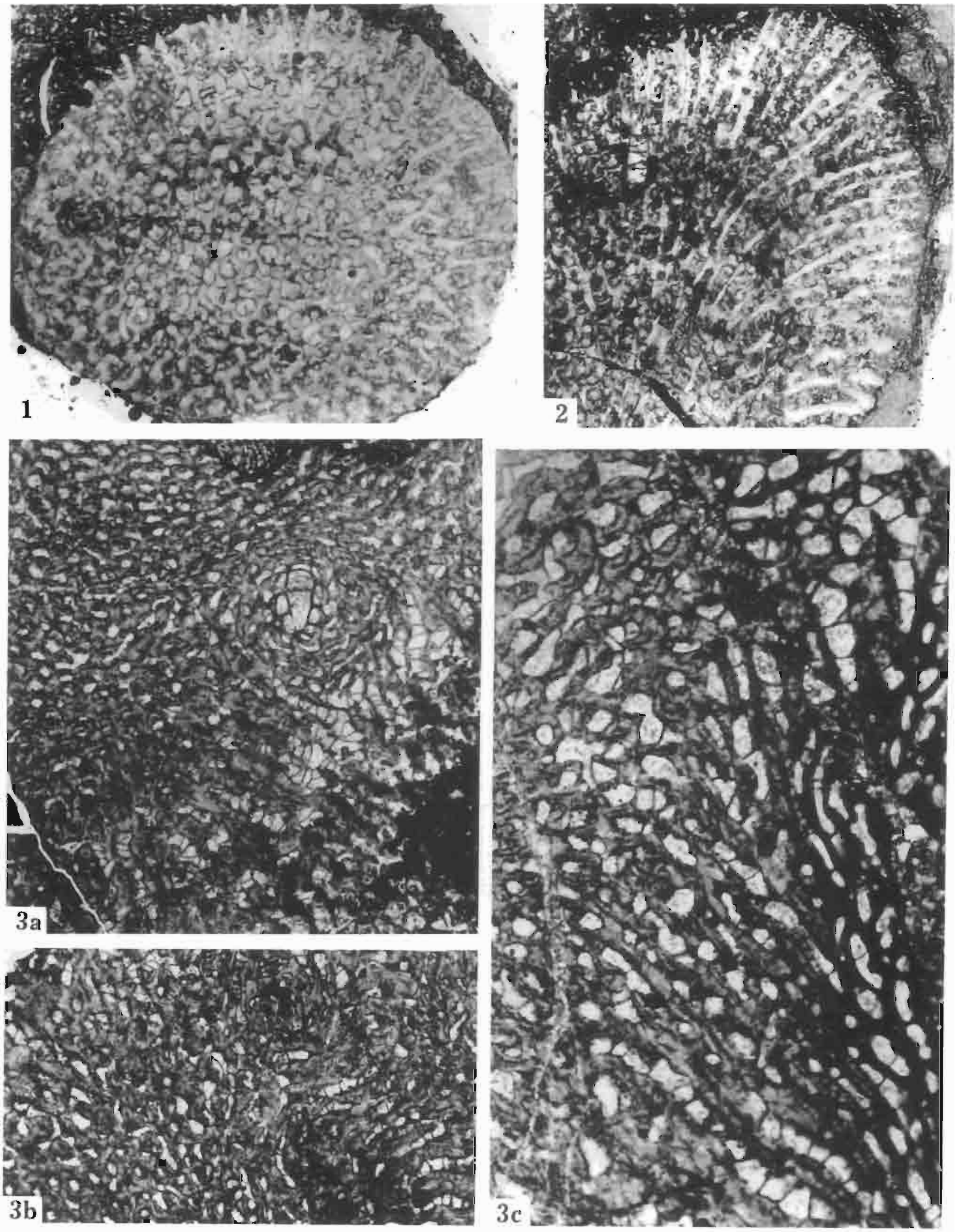
Crassialveolites polonicus sp. n. 65

Fig. 1. Transversal section, × 5; holotype (ZPAL T IX/121).
Fig. 2. Longitudinal section, × 4; (ZPAL T IX/122).

Placocoenites medius (LECOMPTE) 69

Fig. 3. (a) Transversal section of the digital process of a colony, × 5; (b) longitudinal section, × 5; (c) longitudina section, × 10; (ZPAL T IX/163).

Dubie, Cracow region, U. Givetian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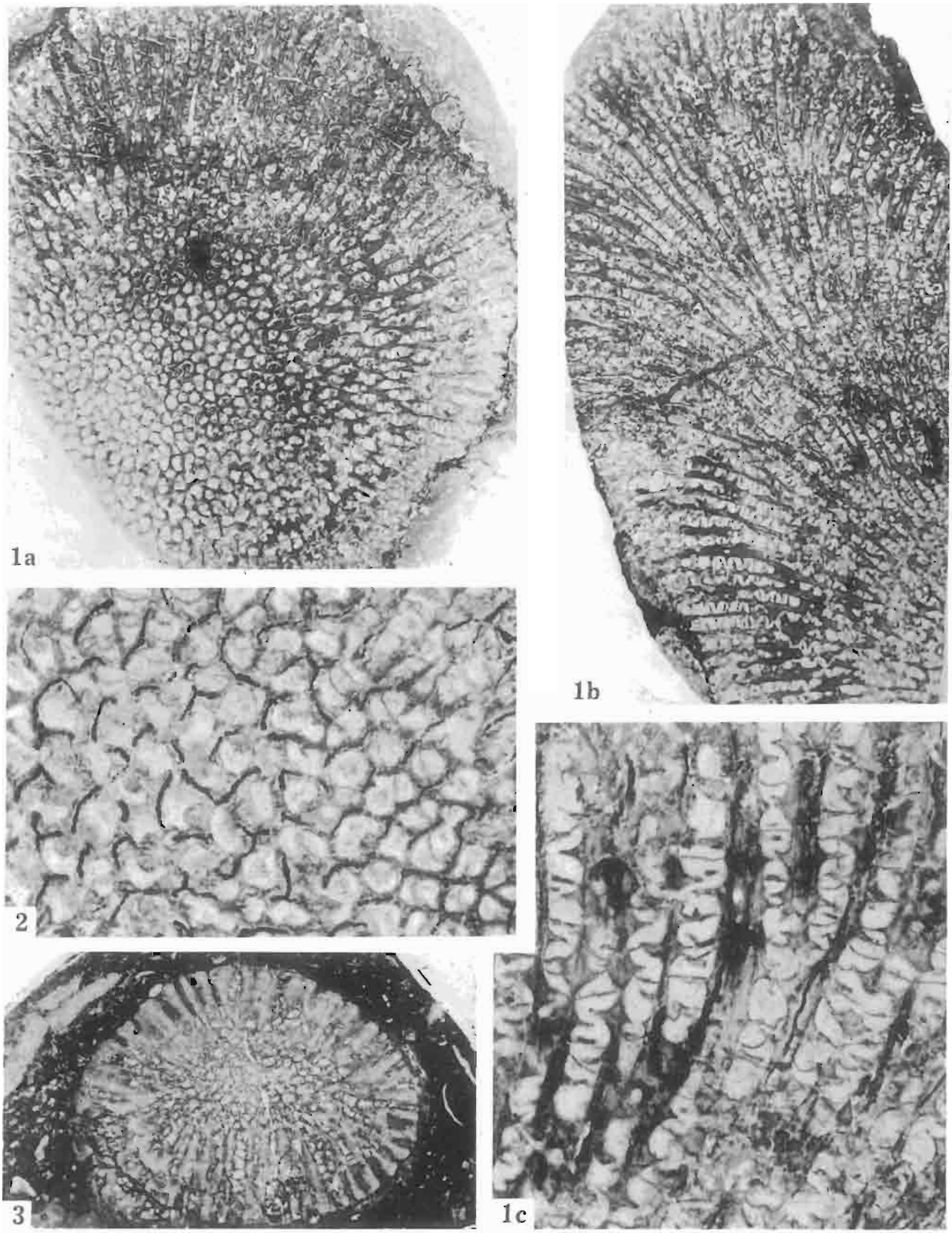
A. NOWIŃSKI: TABULATA AND CHAETETIDA OF POLAND

PLATE XI

Fig. 1. (a) Transversal section, × 3; (b) longitudinal section, × 3; (c) longitudinal section, × 10; (ZPAL T IX/153).
Fig. 2. Transversal section, × 10; (ZPAL T IX/139).

Fig. 3. Transversal section of a young colony, × 5; (ZPAL T IX/193).

Dubie, Cracow region, U. Givetian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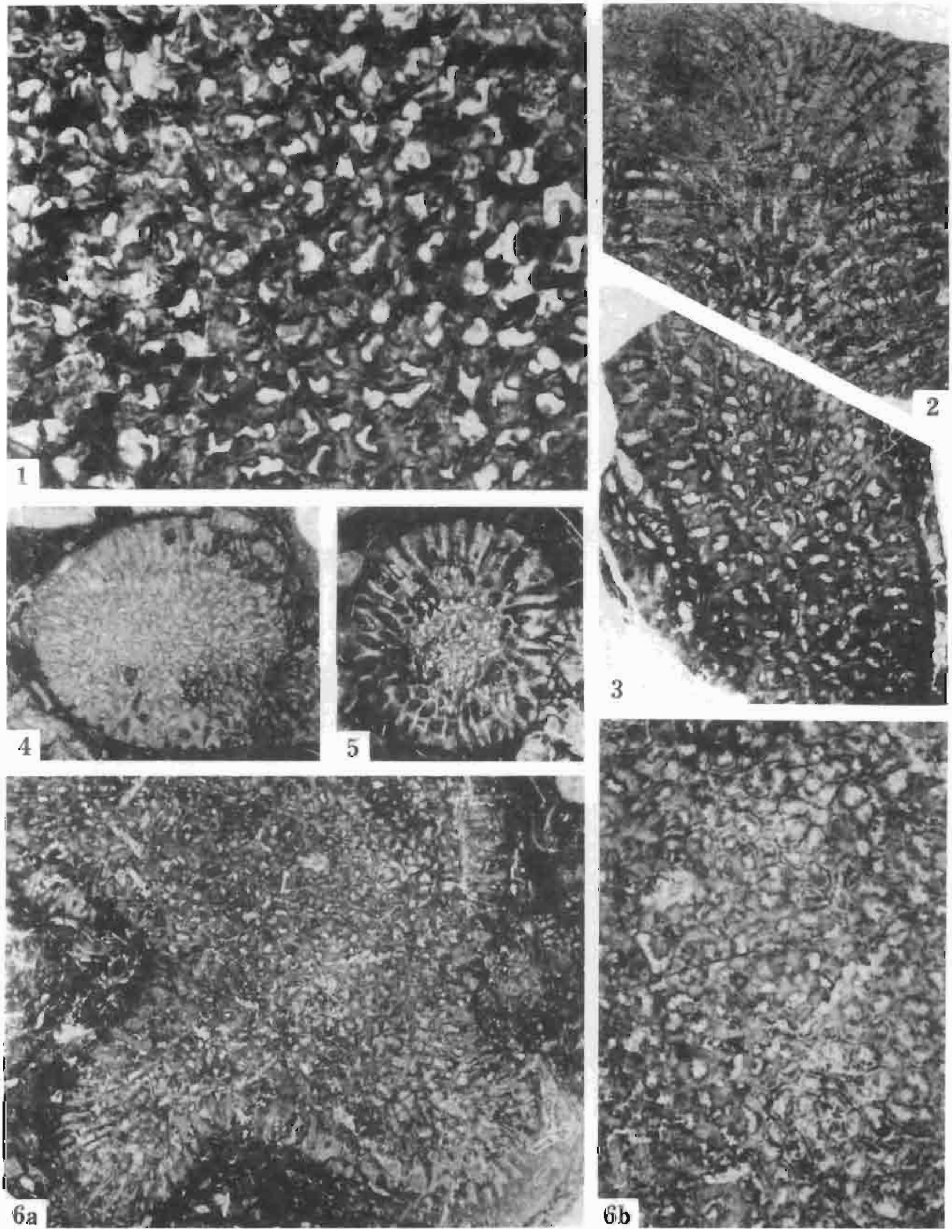
A. NOWIŃSKI: TABULATA AND CHAETETIDA OF POLAND

PLATE XII

Fig. 1. Transversal section of the surface zone of a colony, × 10; (ZPAL T IX/188).
Fig. 2. Longitudinal section, × 5; (ZPAL T IX/171).
Fig. 3. Tangential section of the surface of a colony, × 5; (ZPAL T IX/183).
Fig. 4. Transversal section of a young colony, × 5; (ZPAL T IX/189).
Fig. 5. Transversal section of a young colony, × 5; (ZPAL T IX/193).

Fig. 6. (a) Transversal section of a colony, × 5; (b) transversal section, × 10; (ZPAL T IX/204).

Dubie, Cracow region, U. Givetian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A. NOWIŃSKI: TABULATA AND CHAETETIDA OF POLAND

PLATE XIII

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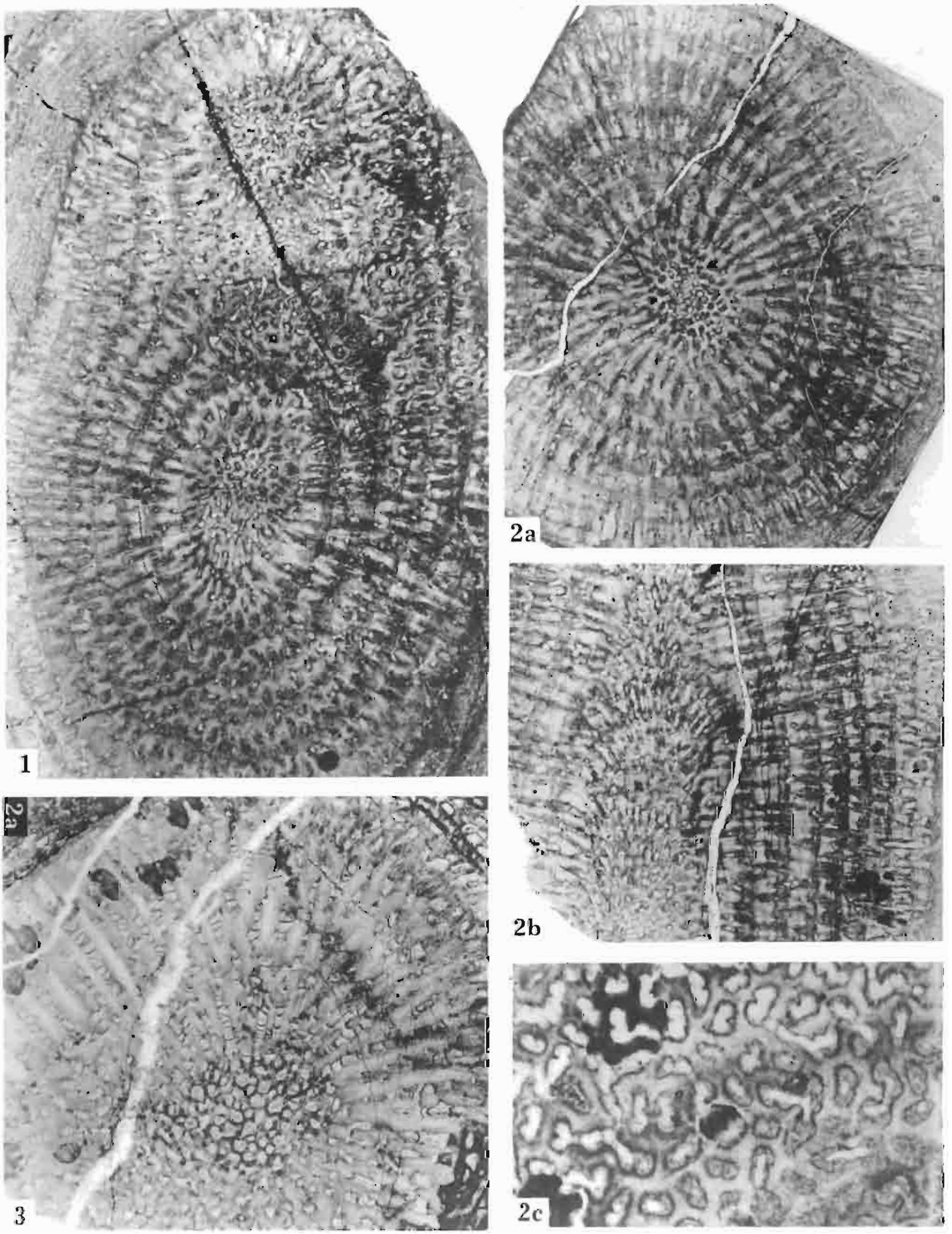
Natalophyllum dubiensis sp. n. 73

Fig. 1. Transversal section of fused branches, × 4; (ZPAL T IX/214).
Fig. 2. (a) Transversal section, × 4; (b) longitudinal section, × 4; (c) transversal section of calices, × 10; holotype (ZPAL T IX/213).

Natalophyllum giveticum RADUGUIN 71

Fig. 3. Transversal section, × 5; (ZPAL T IX/207); Dubie, Cracow region, U. Givetian.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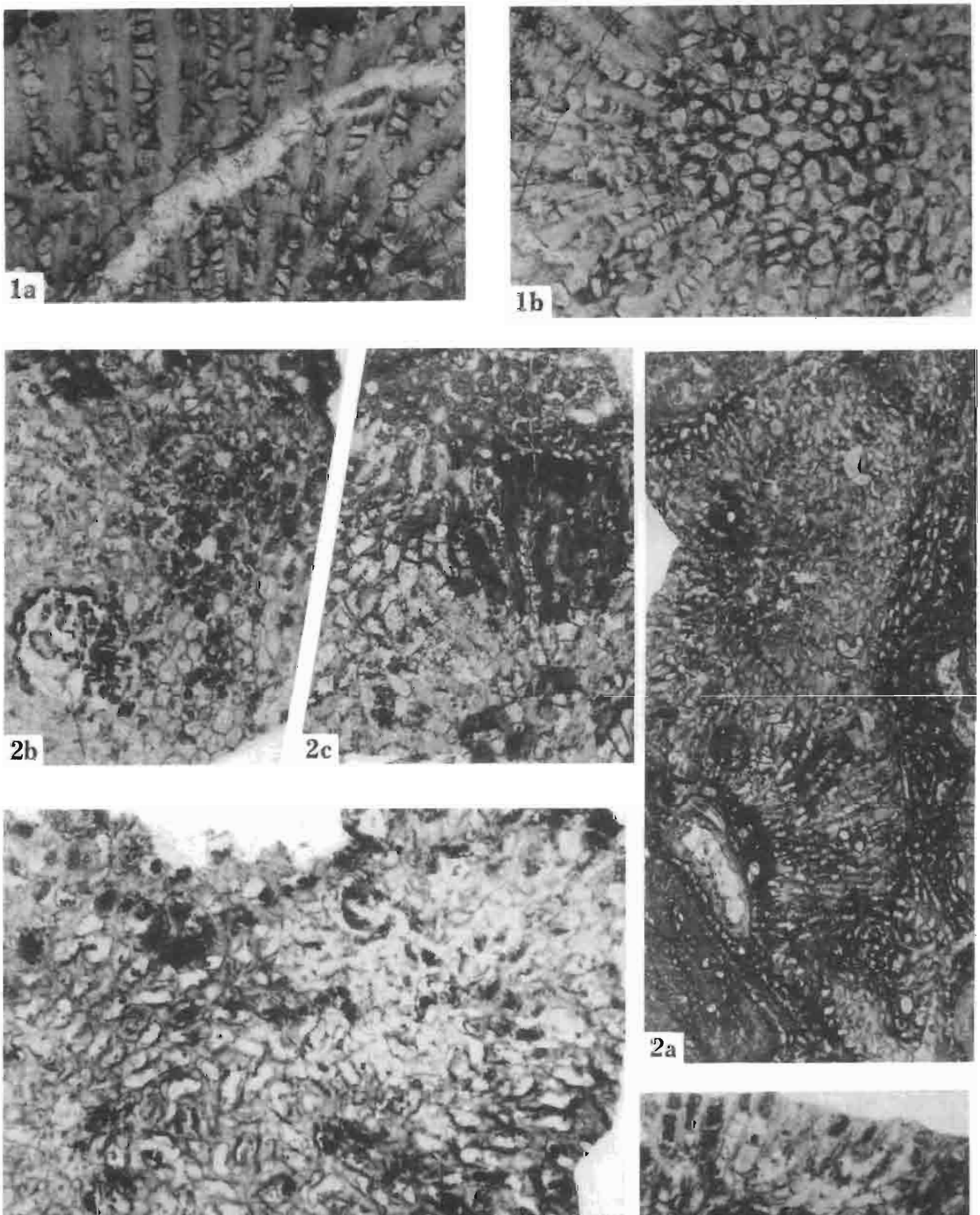
A. NOWIŃSKI: TABULATA AND CHAETETIDA OF POLAND

PLATE XIV

Fig. 1. (a) Longitudinal section of the peripheral zone of a colony, × 10; (b) transversal section of the axial zone of a colony, × 10; (ZPAL T IX/207); Dubie, Cracow region, U. Givetian.

Fig. 2. (a) Longitudinal section of a colony, × 5; (b) transversal section of the zone of thin-walled corallites, × 10; (c) longitudinal section, × 10; (ZPAL T IX/219); Dubie, Cracow region, U. Givetian.

Fig. 3. (a) Transversal section of a colony, × 10; (b) longitudinal section, × 10; holotype (ZPAL T IX/223); Żbik, Cracow region, M. Frasnian.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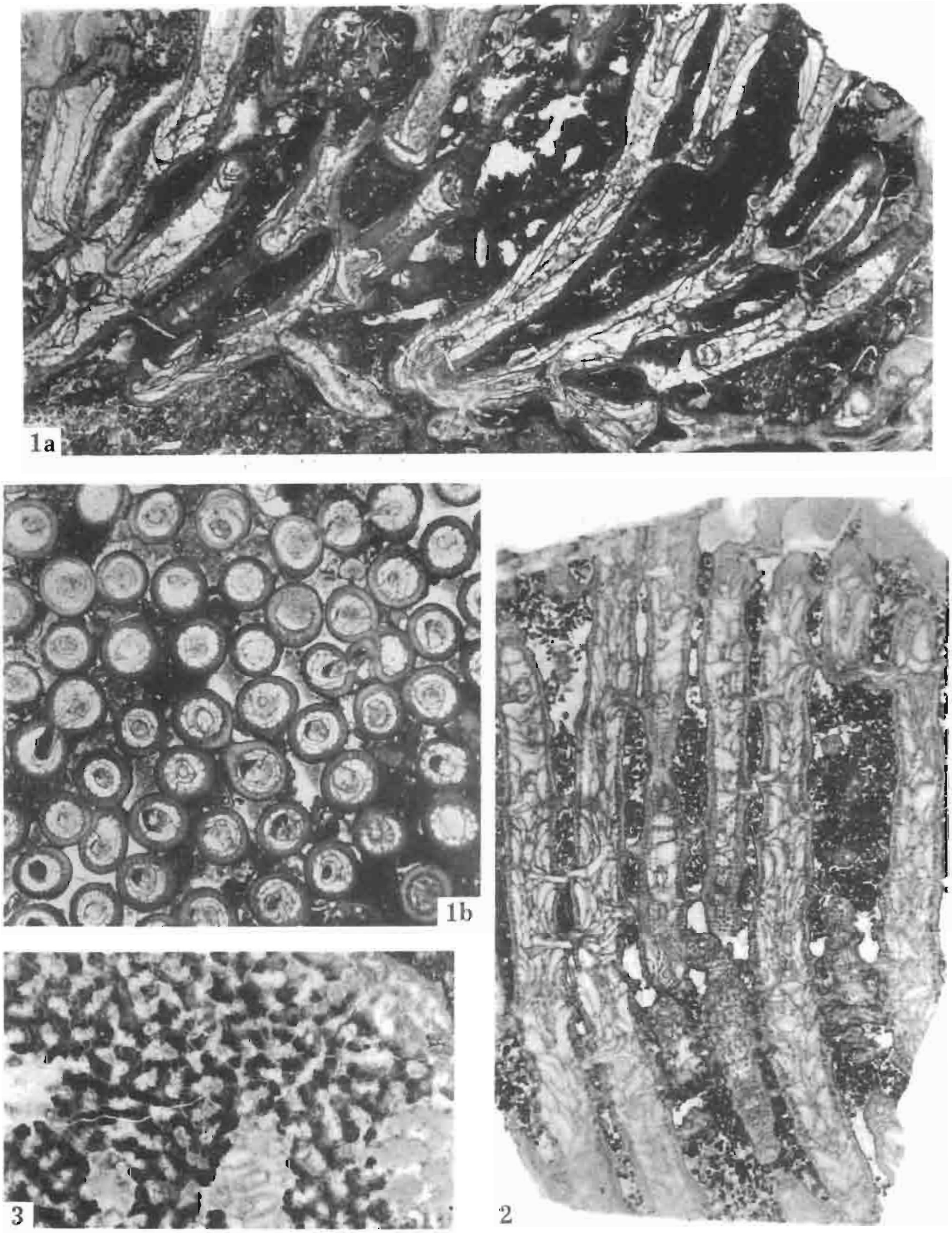
A. NOWIŃSKI: TABULATA AND CHAETETIDA OF POLAND

PLATE XV

Fig. 1. (a) Longitudinal section, × 5; (b) transversal section, × 5; (ZPAL T IX/295); Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., U. Visean, D_2.
Fig. 2. Longitudinal section, × 5; (ZPAL T IX/298); Eliaszówka, Cracow region, M. Visean.

Fig. 3. Tangential section of the surface of a colony, × 10; (ZPAL T IX/207); Dubie, Cracow region, U. Givetian.



A. NOWIŃSKI: TABULATA AND CHAETETIDA OF POLAND

PLATE XVI

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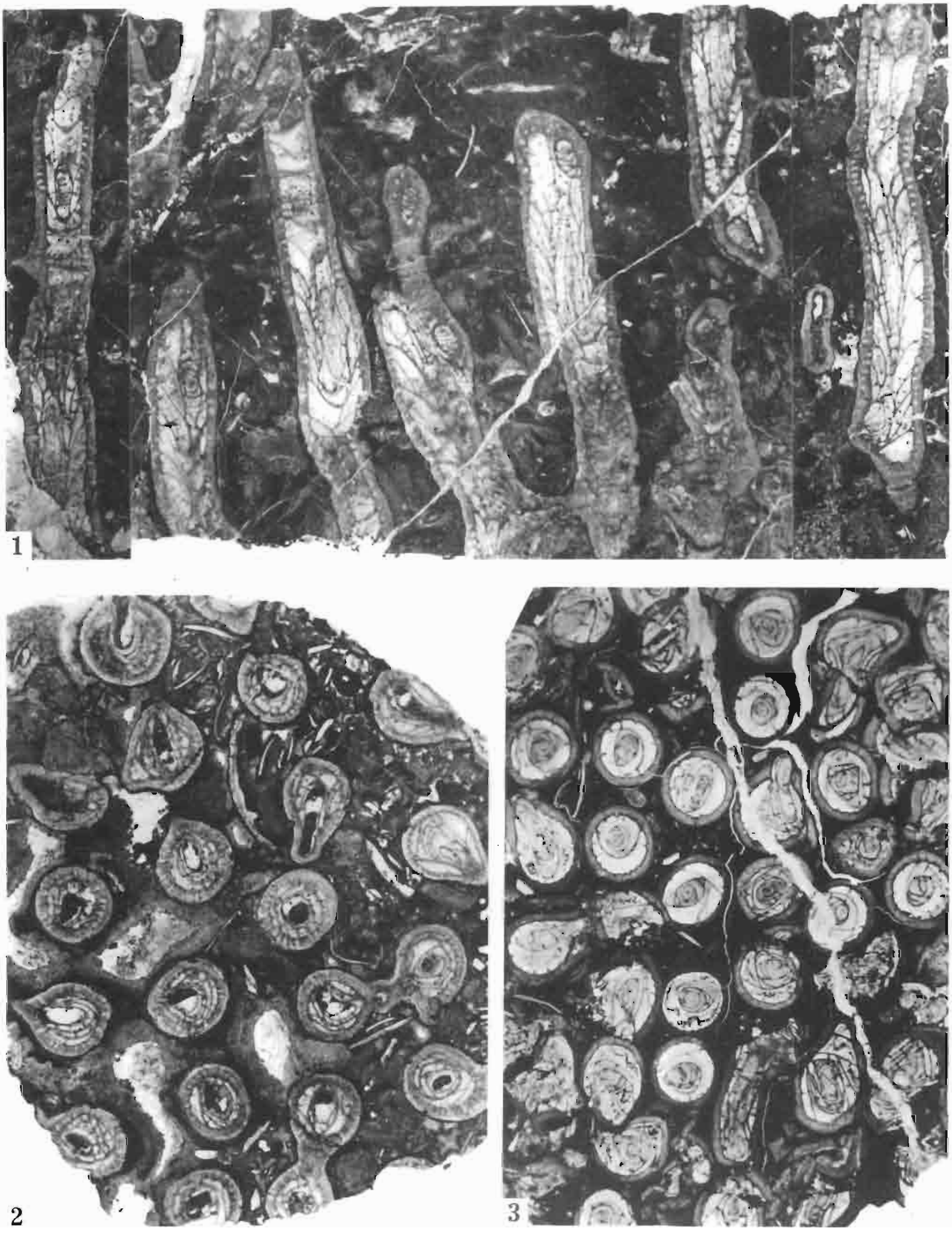
Syringopora ramulosa GOLDFUSS 80

Fig. 1. Longitudinal section, × 5; (A I-35/303).
Fig. 2. Transversal section, × 5; (ZPAL T IX/304).
Fig. 3. Transversal section, × 5; (ZPAL T IX/305).
Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., U. Visean, D_2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A. NOWIŃSKI: TABULATA AND CHAETETIDA OF POLAND

PLATE XVII

Fig. 1. Longitudinal section, × 10; (ZPAL T IX/304); Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., U. Visean, D_2.

Fig. 2. Longitudinal section, × 5; (ZPAL T IX/318); Czerna (Wójcik's Quarry), Cracow region, Middle to U. Visean, D_2.

Fig. 3. (a) Longitudinal section, × 5; (b) transversal section, × 5; (ZPAL T IX/312); Czerna (Wójcik's Quarry), Cracow region, Middle to U. Visean, D_2.

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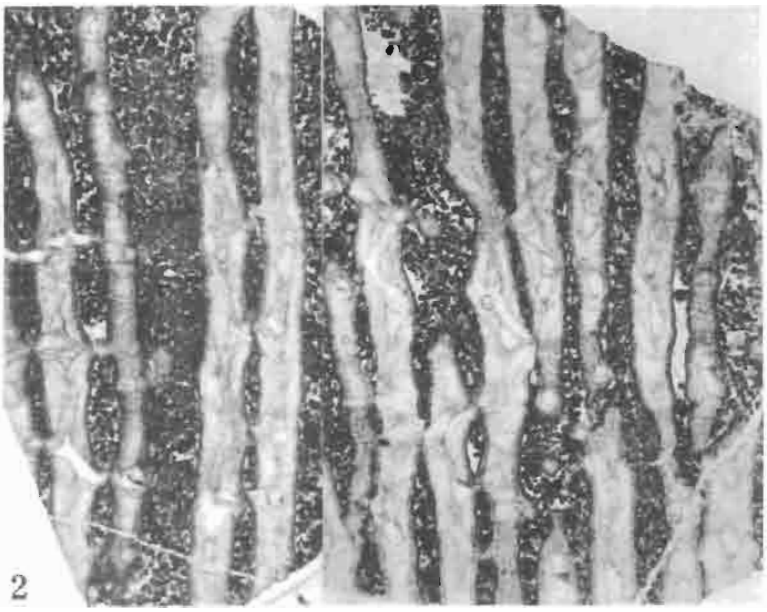

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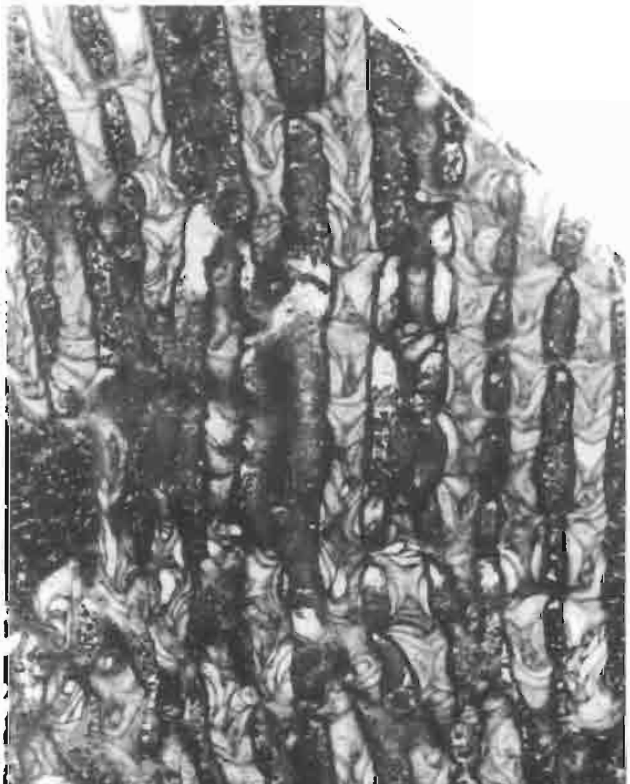

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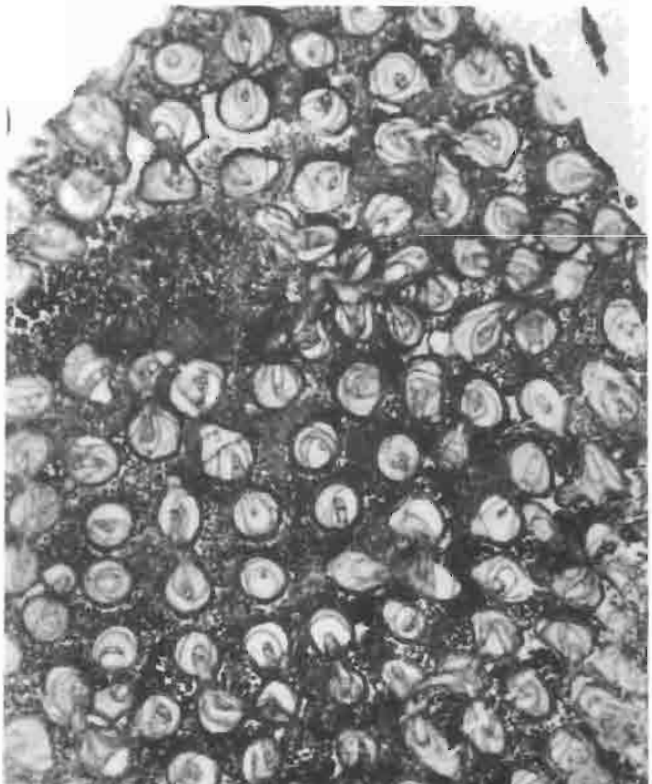

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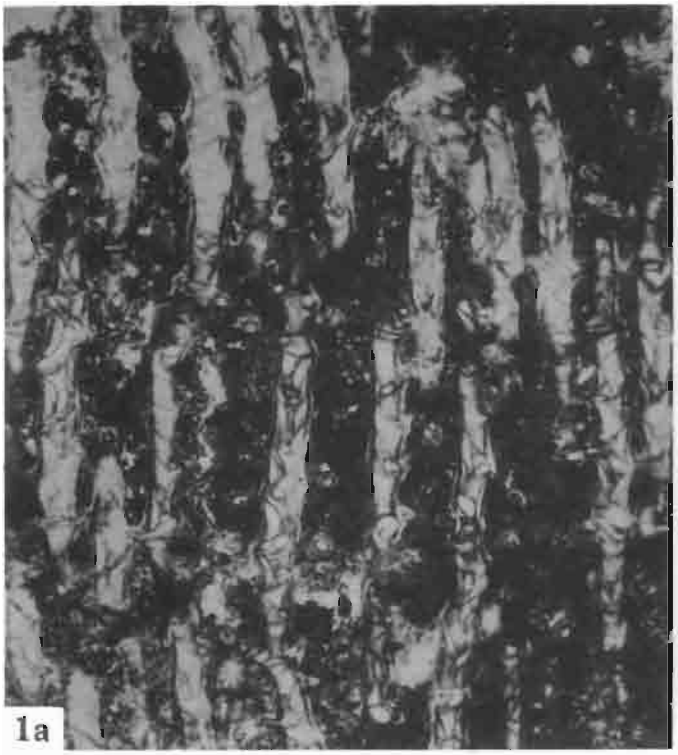
A. NOWIŃSKI: TABULATA AND CHAETETIDA OF POLAND

PLATE XVIII

Fig. 1. (a) Longitudinal section, × 5; (b) transversal section, × 5; (ZPAL T IX/328).

Fig. 2. (a) Longitudinal section, × 5; (b) transversal section, × 5; (ZPAL T IX/318).
Czerna (Wójcik's Quarry), Cracow region, Middle to U. Visean, D_2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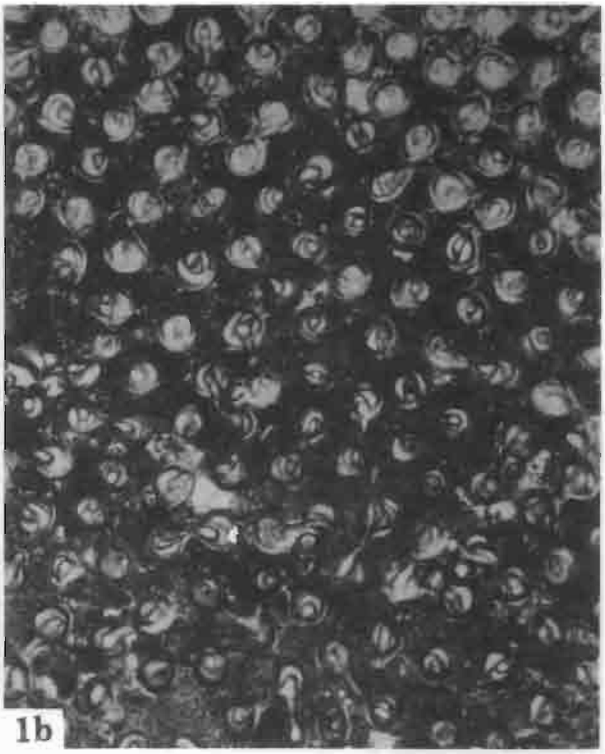
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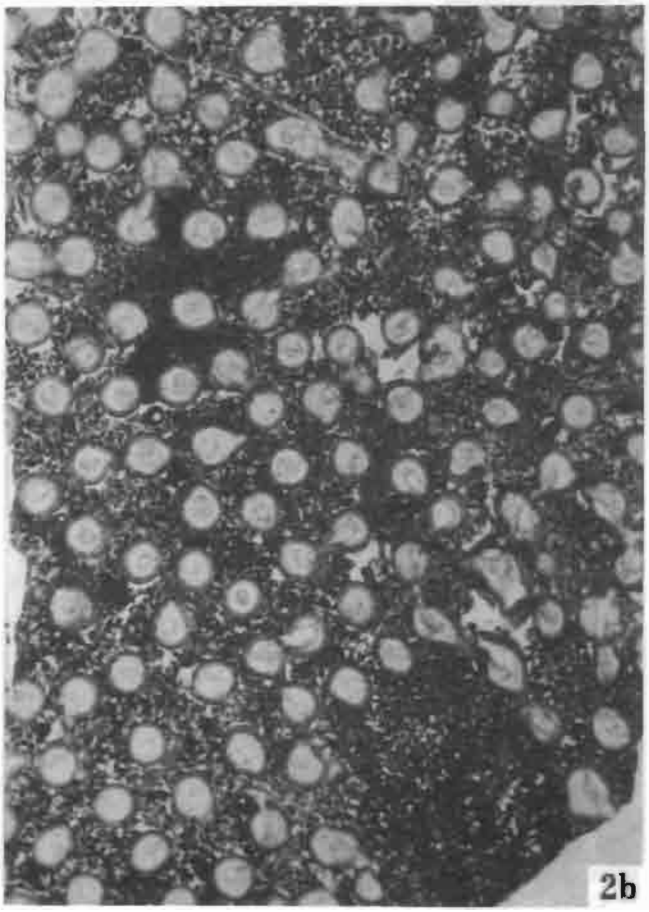
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PLATE XIX

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Syringopora hyperbolo-tabulata CHI 84

Fig. 1. Transversal section, × 5; (ZPAL T IX/322).
Fig. 2. (a) Longitudinal section, × 10; (b) longitudinal section, × 5; (c) transversal section, × 5; (ZPAL T IX/323); Czatkowice, Cracow region, U. Visean, D_2.

Syringopora subreticulata sp. n. 89

Fig. 3. (a) Transversal section, × 5; (b) longitudinal section, × 5; (c) longitudinal section, × 5; holotype (ZPAL T IX/332); Eliaszówka, Cracow region, M. Visean.

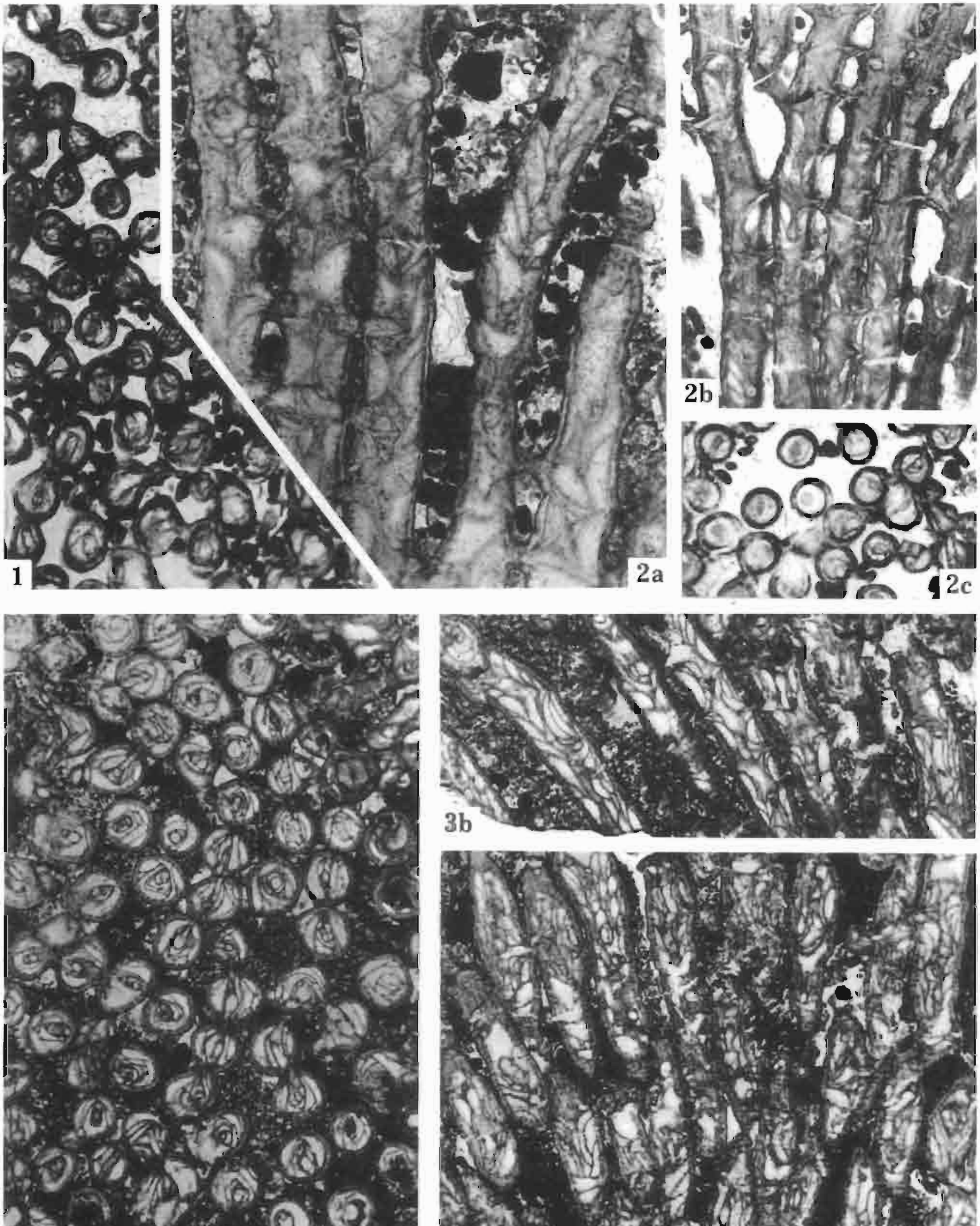
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PLATE XX

Fig. 1. (a) Longitudinal section, × 5; (b) transversal section, × 5; holotype (ZPAL T IX/335); Eliaszówka, Cracow region, M. Visean.

Fig. 2. (a) Transversal section, × 5; (b) longitudinal section, × 5; holotype (ZPAL T IX/339); Gałęzice (Todowa Grząba), Holy Cross Mts., U. Visean, D_1.


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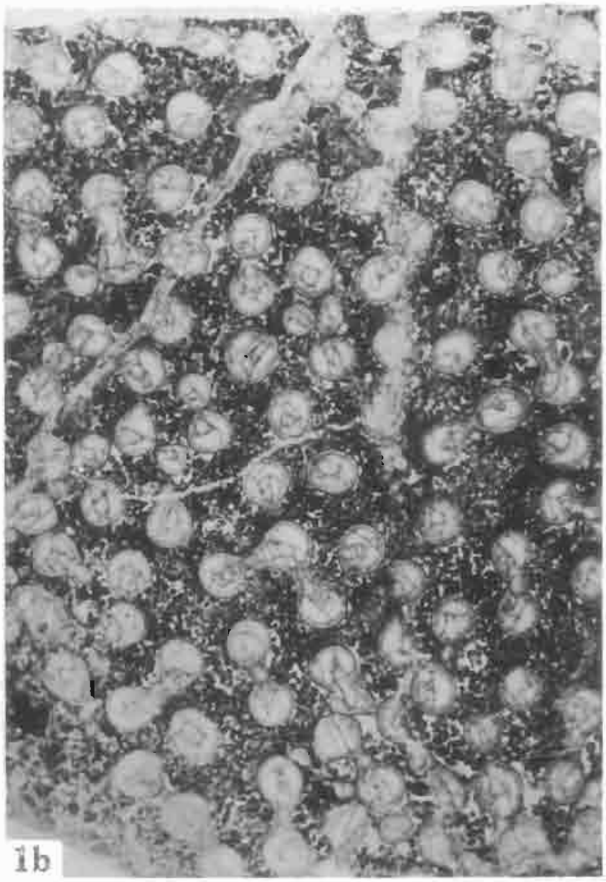
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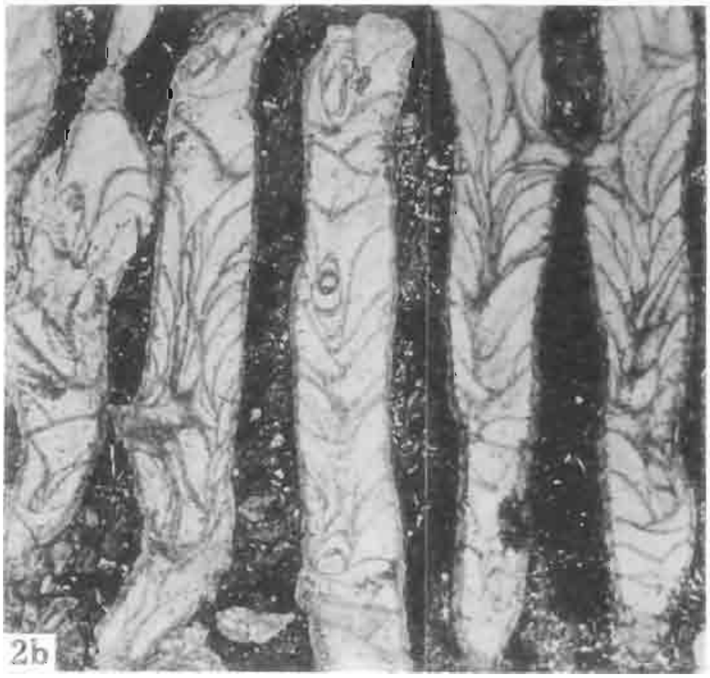
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PLATE XXI

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Syringopora pachysiphonata sp. n. 92

Fig. 1. (a) Longitudinal section, × 5; (b) transversal section, × 5; (c) longitudinal section of a single corallite, × 10; (d) transversal section, × 10; holotype (ZPAL T IX/330); Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., U. Visean, D_2.

Syringopora sp. 93

Fig. 2. Transversal section, × 5; (ZPAL T IX/226); Dubie, Cracow region, U. Givetian.

Multithecopora polonica sp. n. 95

Fig. 3. (a) Longitudinal and transversal sections, × 5; (b) longitudinal section, × 5; holotype (ZPAL T IX/334).
Fig. 4. Transversal section, × 5; (ZPAL T IX/340); Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., U. Visean, D_2.

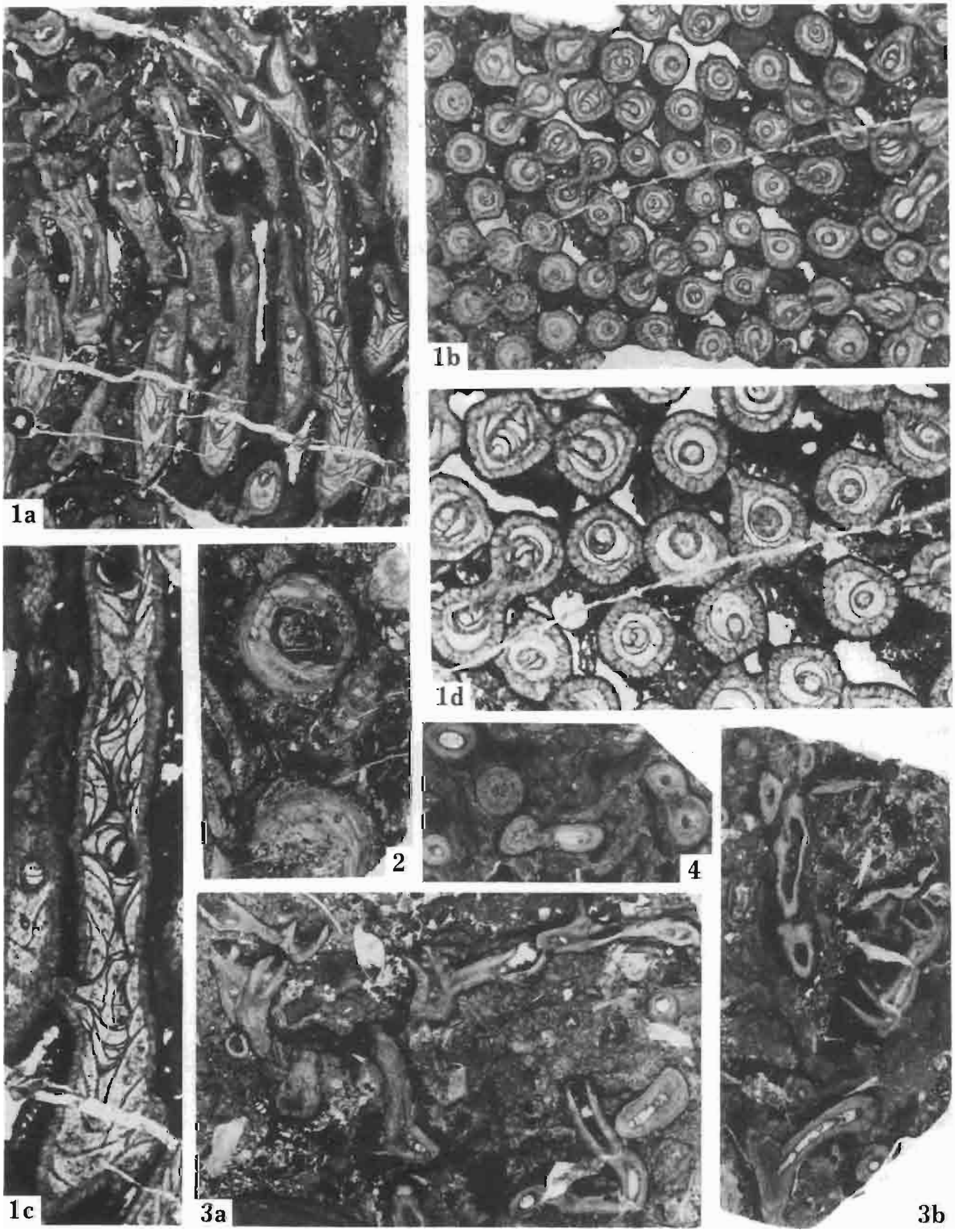
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PLATE XXII

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Multithecopora polonica sp. n. 95

Fig. 1. (a) Longitudinal section, × 5; (b) longitudinal and transversal sections, × 5; (ZPAL T IX/343).

Multithecopora spinosa sp. n. 94

Fig. 2. (a) Transversal section, × 10; (b) longitudinal section, × 5; (c) longitudinal section, × 5; holotype (ZPAL T IX/352).

Fig. 3. (a) Longitudinal section, × 5; (b) longitudinal section, × 5; (ZPAL T IX/354).

Fig. 4. (a) Transversal section of a single corallite, × 10; (b) tangential section of a single corallite, × 10; (ZPAL T IX/350).

Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., U. Visean, D_1

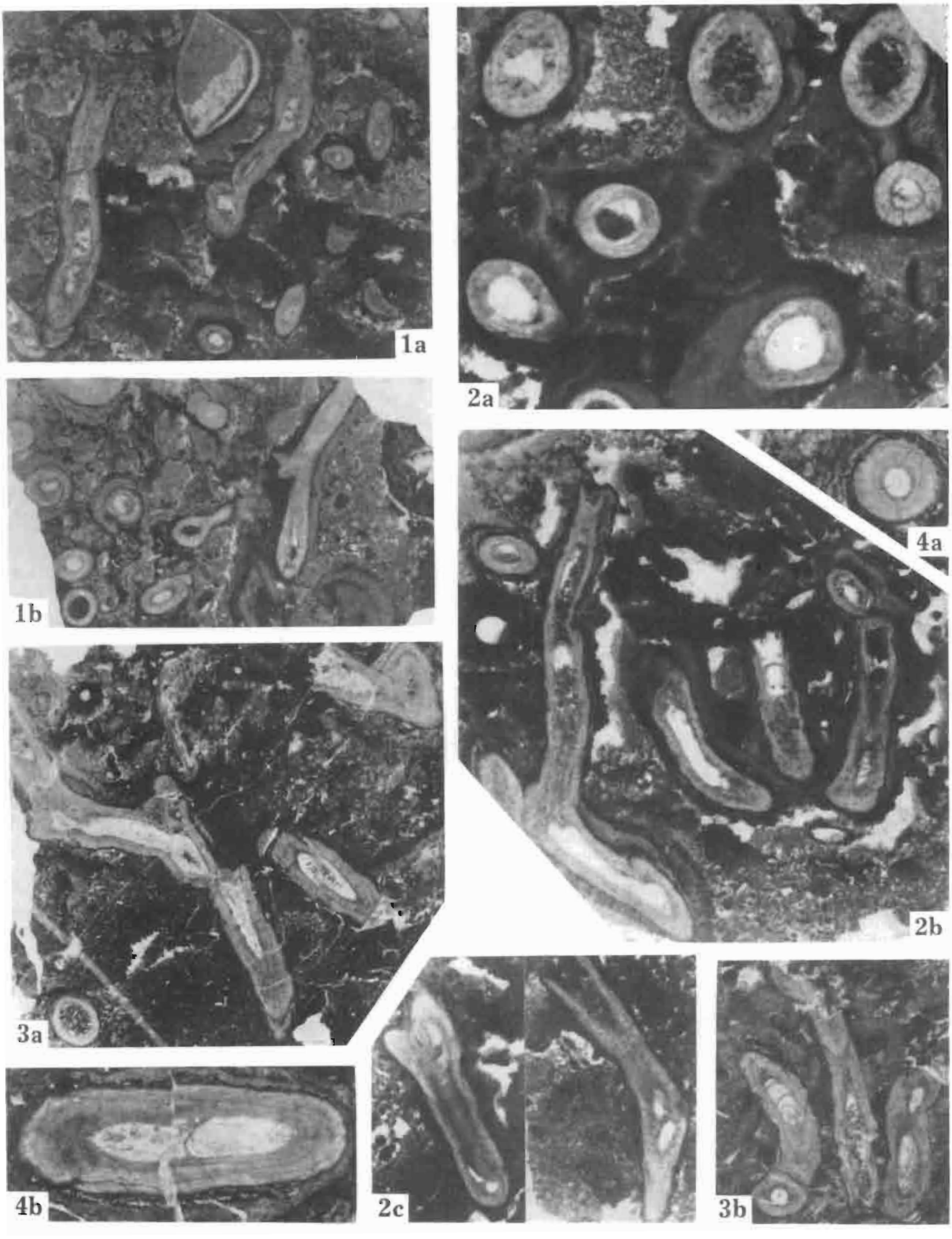
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PLATE XXIII

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Syringoporella longituba sp. n. 97

Fig. 1. (a) Longitudinal section, × 5; (b) transversal section, × 5; holotype (ZPAL T IX/360).

Cladochonus sp. 99

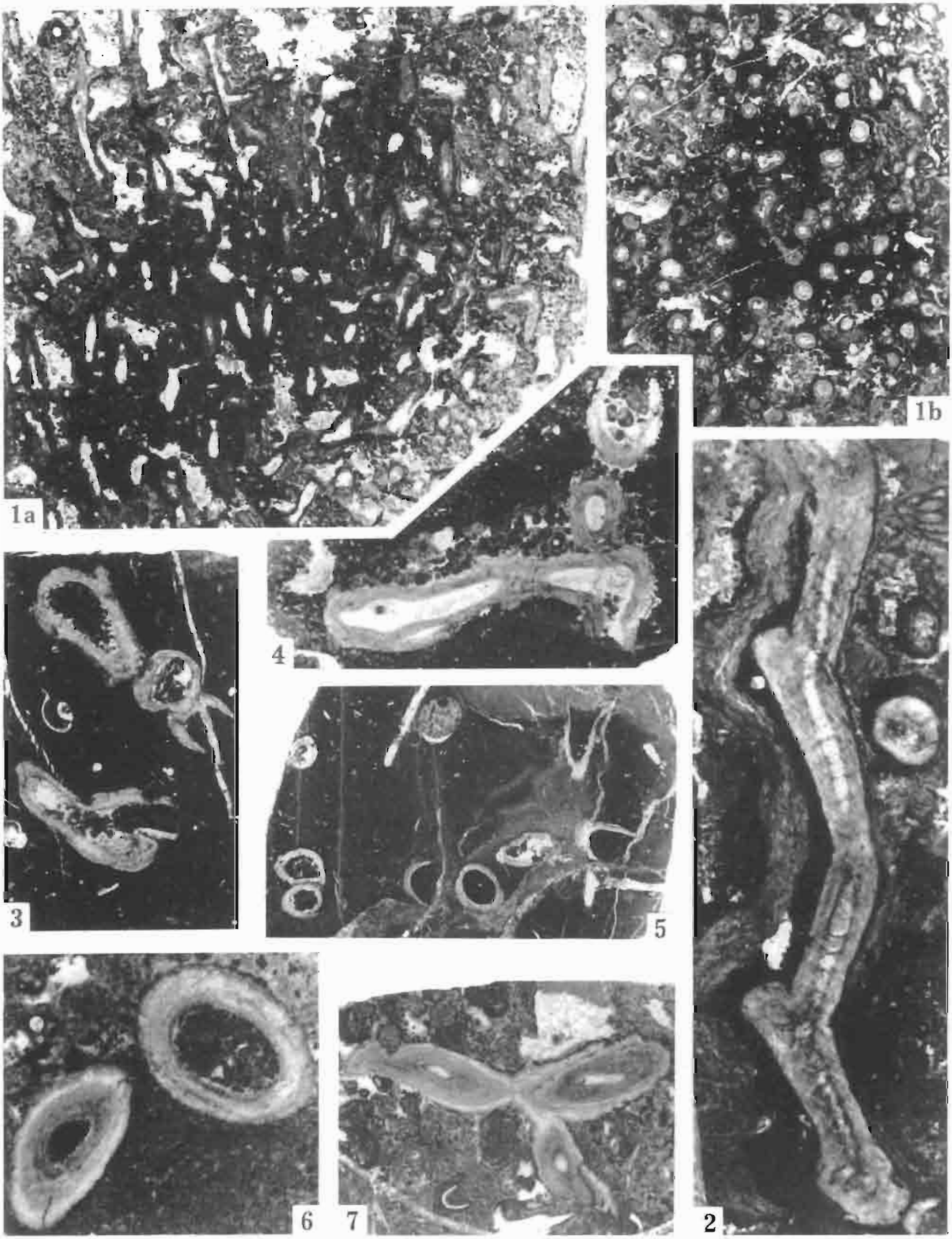
Fig. 2. Longitudinal and transversal sections, × 10; (ZPAL T IX/363).
Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., U. Visean, D_2

Aulopora sp. 98

Fig. 3. Longitudinal section, × 10; (ZPAL T IX/232); Dębnik (Czarna Góra — Quarry), Cracow region, U. Givetian
Fig. 4. Longitudinal section, × 10; (ZPAL T IX/229); Żbik, Cracow Region, M. Frasnian.
Fig. 5. Transversal section, × 5; (ZPAL T IX/321); Dębnik, (Czarna Góra — Quarry), Cracow region, U. Givetian.

Sinopora polonica sp. n. 100

Fig. 6. Transversal section, × 5; (ZPAL T IX/367).
Fig. 7. Transversal section of branching corallites, × 5; (ZPAL T IX/369); Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., U. Visean, D_2.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A. NOWIŃSKI: TABULATA AND CHAETETIDA OF POLAND

PLATE XXIV

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Sinopora polonica sp. n. 100

Fig. 1. (a) Transversal section, × 5; (b) longitudinal and transversal sections, × 5; (c) longitudinal section of a single corallite, × 10; holotype (ZPAL T IX/365).

Fig. 2. Transversal section of a budding corallite, × 10; (ZPAL T IX/368).

Cyclochaetetes tuberculosus sp. n. 102

Fig. 3. (a) Transversal section of a colony, × 5; (b) longitudinal section of a colony, × 5; (c) transversal section, × 10; holotype (ZPAL T IX/373).

Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., U. Visean, D_1.

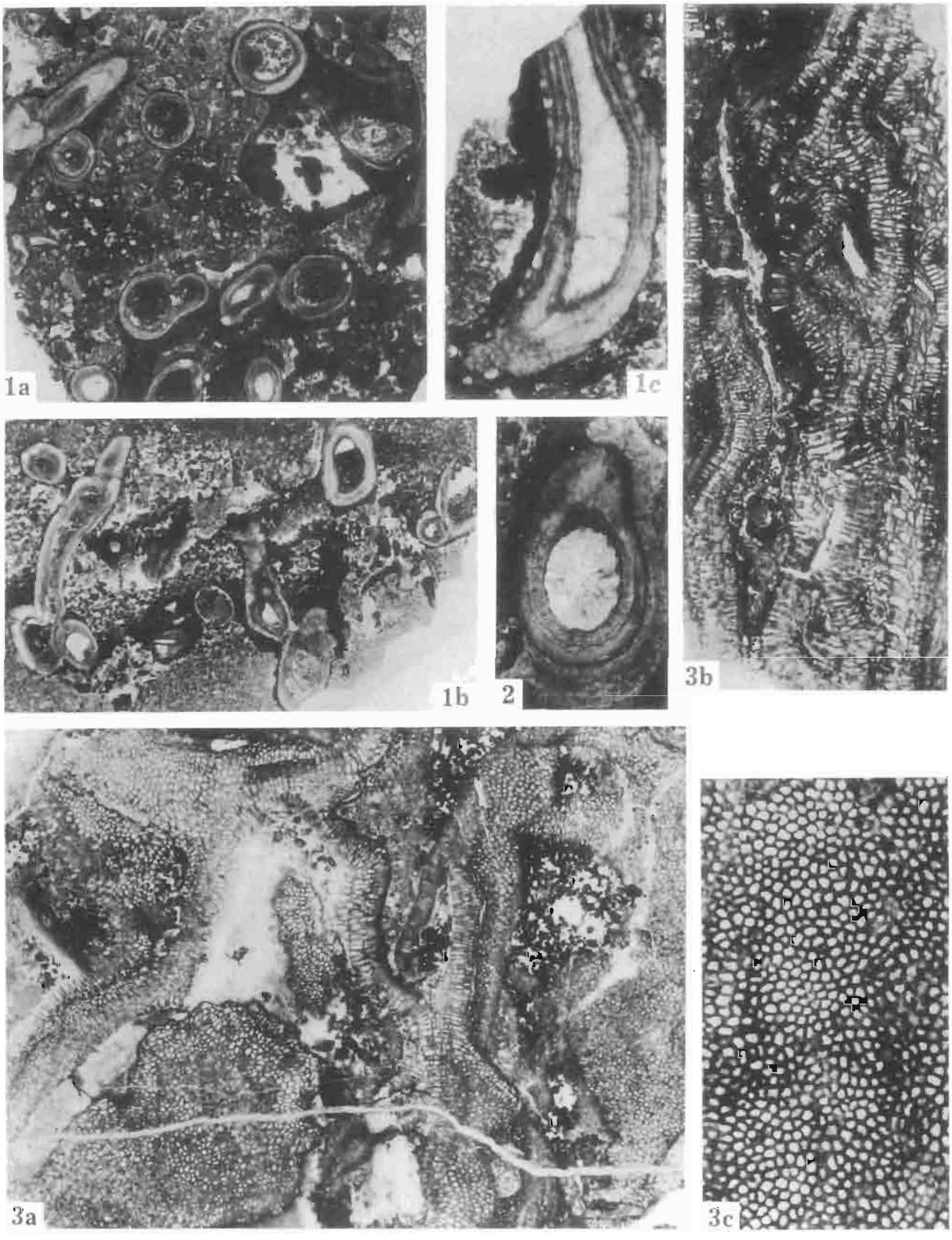
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PLATE XXV

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Chaetetella cellulata SOKOLOV 104

Fig. 1. (a) Transversal section, × 5; (b) longitudinal section, × 5; (ZPAL T IX/380).

Chaetetella (Chaetetiporella) heterozoa sp. n. 105

Fig. 2. (a) Transversal section of a colony, × 5; (b) longitudinal section, × 10; holotype (ZPAL T IX 384).
Fig. 3. Transversal section, × 10; (ZPAL T IX/385).

Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., U. Visean, D_2

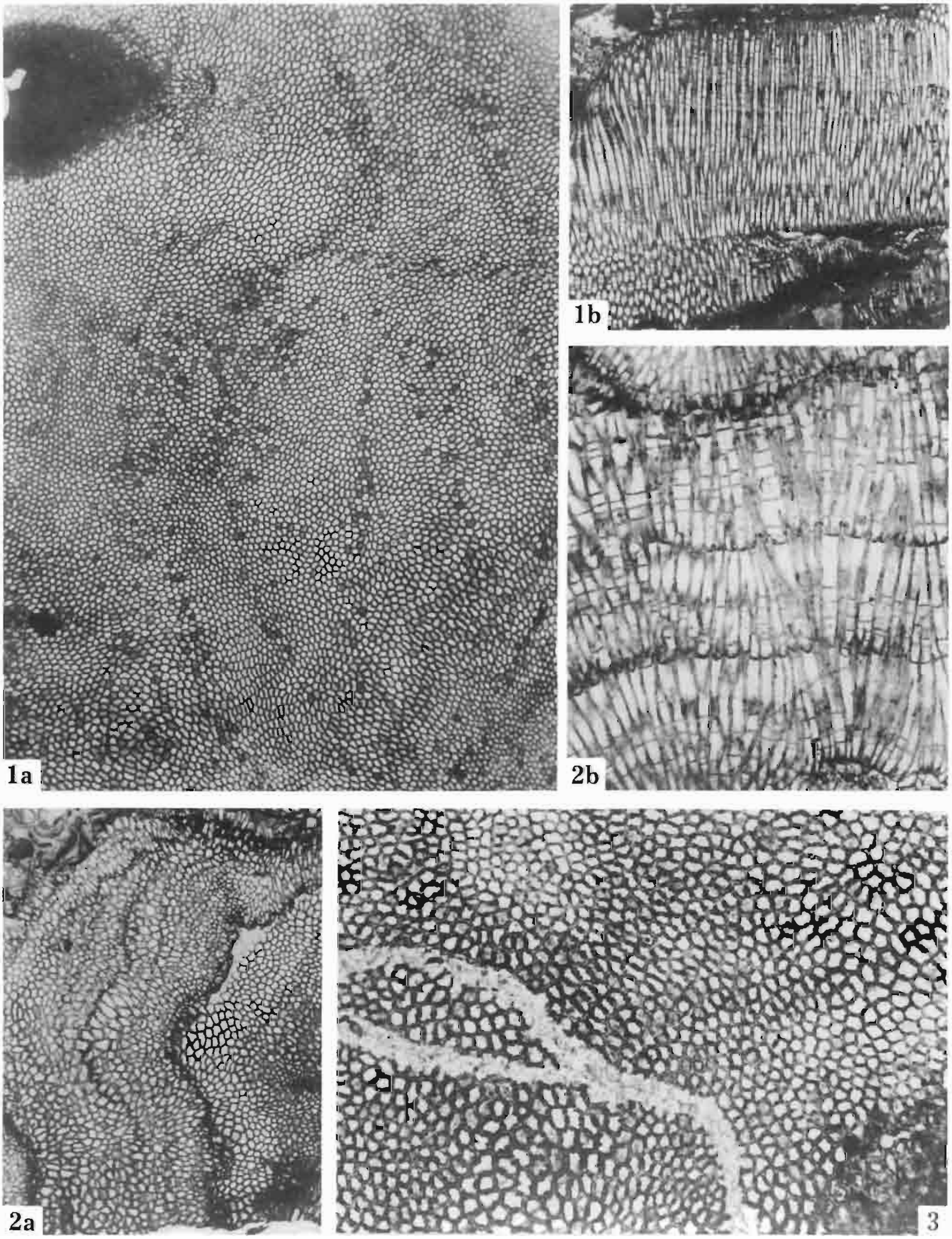
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PLATE XXVI

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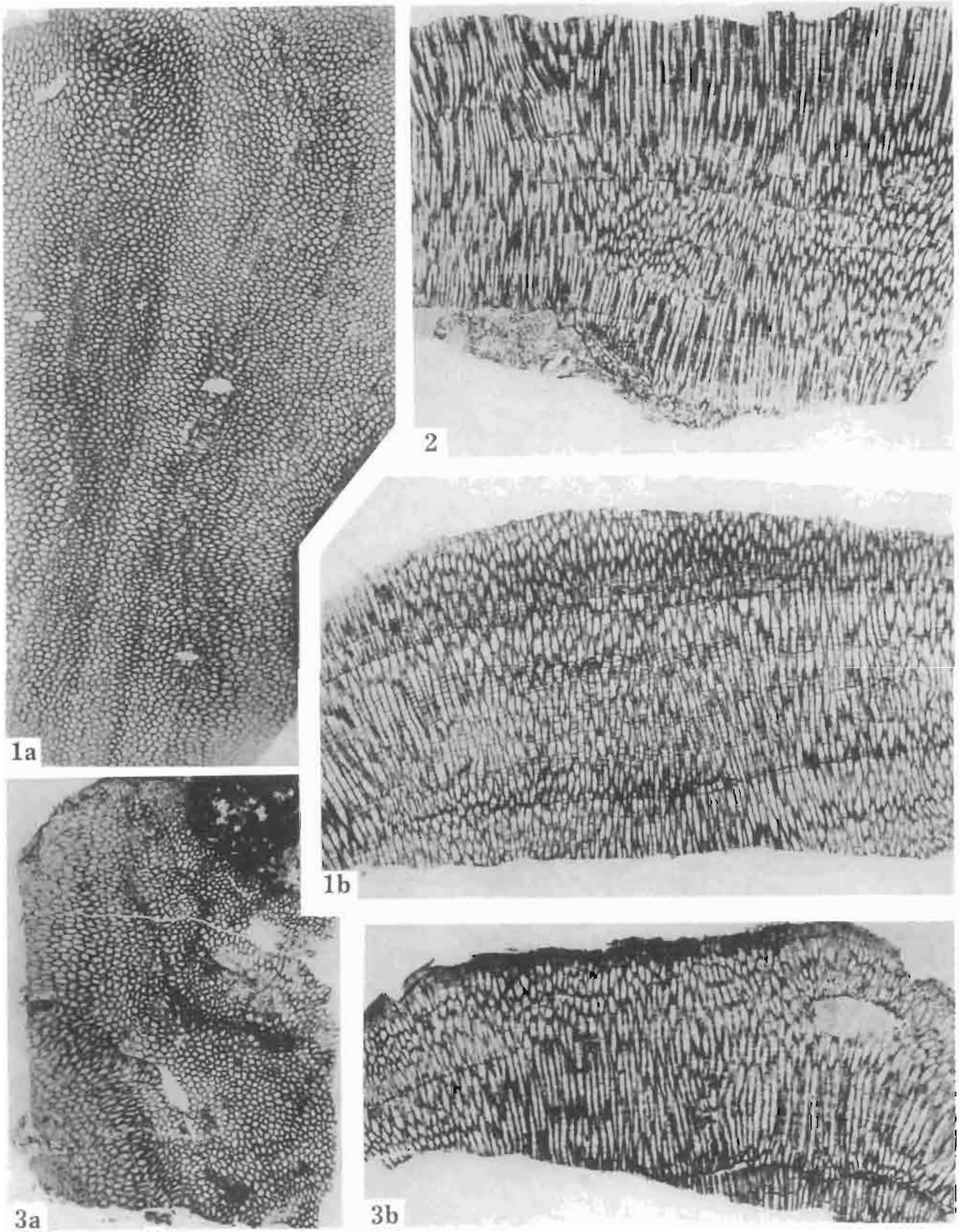
Chaetetella (Chaetetiporella) rotaiformis sp. n. 106

Fig. 1. (a) Transversal section, × 5; (b) longitudinal section, × 5; holotype (ZPAL T IX/390).
Fig. 2. Longitudinal section, × 5; (ZPAL T IX/391).

Chaetetella repens SOKOLOV 103

Fig. 3. (a) Transversal section, × 5; (b) longitudinal section, × 5; (ZPAL T IX/377).
Gałęzice (railroad cut on the Ostrówka Hill, Holy Cross Mts., U. Visean, D_2


1a
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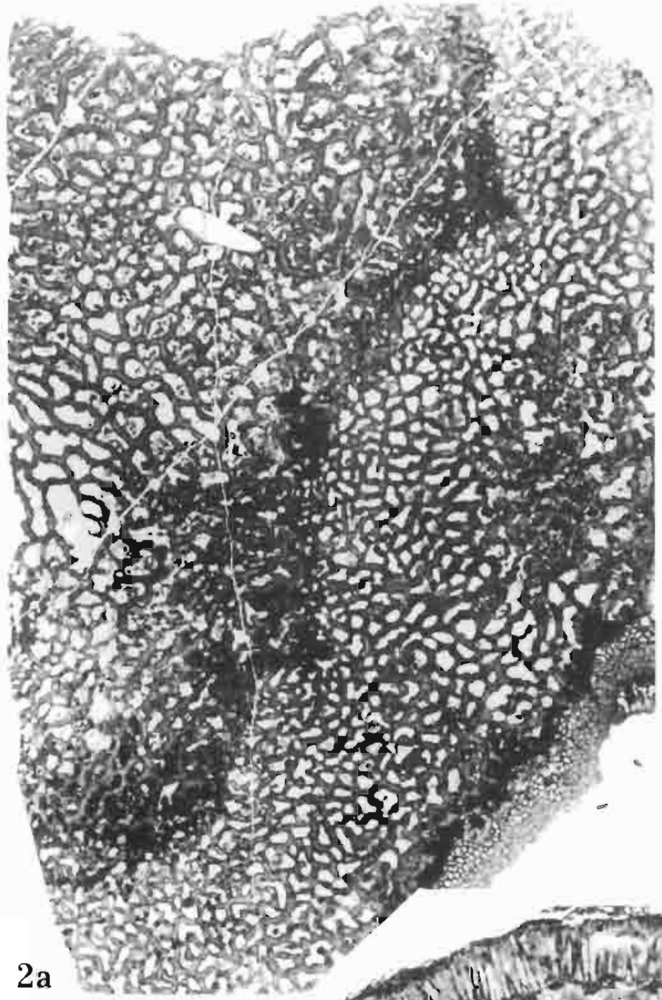
3a
3b

A. NOWIŃSKI: TABULATA AND CHAETETIDA OF POLAND

PLATE XXVII

Fig. 1. Transversal section, × 5; (ZPAL T IX/388).

Fig. 2. (a) Transversal section, × 5; (b) longitudinal section, × 5; (ZPAL T IX/394).
Gałęzice (railroad cut on the Ostrówka Hill), Holy Cross Mts., U. Visean, D_2



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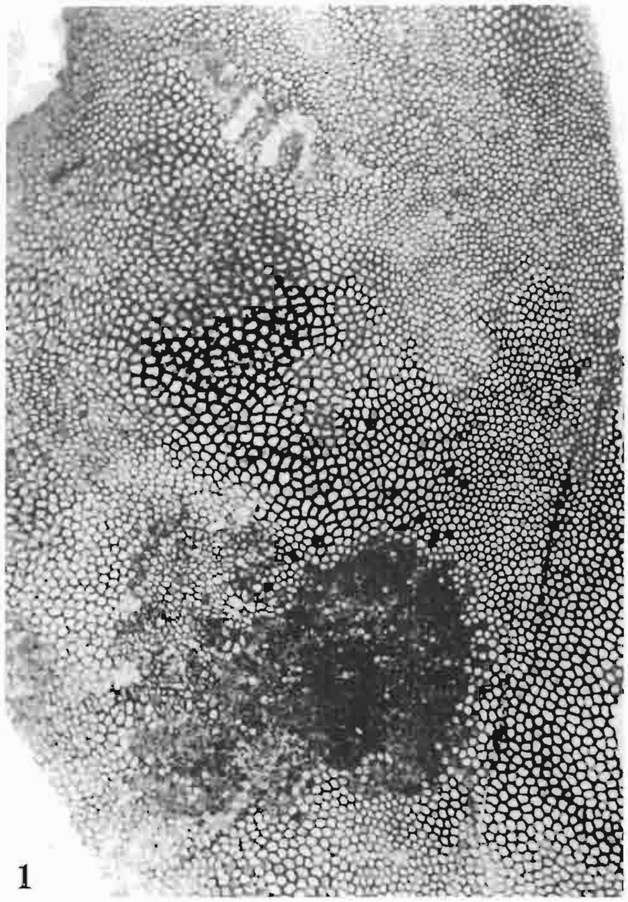

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