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NGUYEN DUC KHOA

CARBONIFEROUS RUGOSA AND HETEROCORALLIA FROM BOREHOLES IN THE LUBLIN REGION (POLAND)

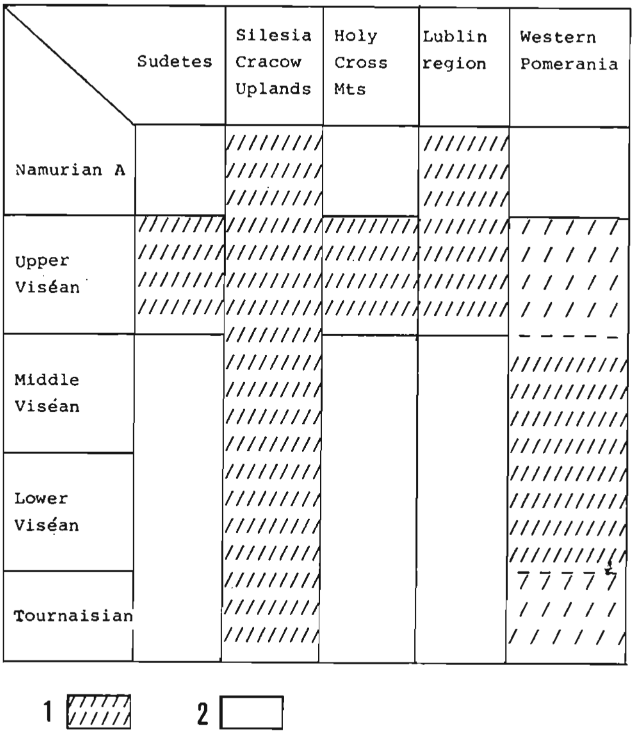
Abstract. — Fourty two species referred to 21 genera and 2 subgenera are described; one genus and 5 species are new: *Diphyphyllum rarevesiculosum* sp.n., *Lithostrotion* (*Siphonodendron*) *dobrolyubovae* sp.n., *L.* (*S.*) *rossicum strzelcense* subsp.n., *L.* (*S.*) *rossicum parvum* subsp.n., *Lublinophyllum fedorowskii* gen. et sp.n. Genera *Orionastraea* and *Turbinatocaninia* are for the first time recorded in Poland. Heterophyllidae with 5 septa and pentagonal cross-section are recorded. Blastogeny has been studied in 13 species and subspecies. Axial increase has been studied in detail in *Lithostrotion* (*Siphonodendron*) *dobrolyubovae* sp.n. Taxonomic division of Rugosa based on blastogeny, is demonstrated to be questionable in some cases. Fusion of corallites has been observed in colonies of *Lithostrotion* and *Lonsdaleia* colonies. Existence of holotheca in *Orionastraea* aff. *magna* Kato & Mitchell has been proved.

INTRODUCTION

Carboniferous Rugosa and Heterocorallia in Poland are known from the outcorps and boreholes in Sudetes, Silesia-Cracow Upland, Holy Cross Mts, Lublin region and Western Pomerania (Kunth 1869; Schindewolf 1941, 1942, 1952; Fedorowski 1968, 1970, 1971, 1975). Their stratigraphic and geographic distribution is shown in Table 1.

In the Lublin region the Carboniferous system is represented by Viséan, Namurian, and Westfalian deposits. History of geological investigations in this region as well as descriptive palaeontology, lithology, and tectonics are presented in the studies by Bojkowski (1966*a*,*b*), Cebulak & Porzycki (1966), Porzycki (1976), and Żelichowski (1972*c*) among others. Some boreholes investigated in this paper have already been described by Miłaczewski and Żelichowski (1976: Strzelce IG 1 and 2) and Żelichowski (1961: Tyszowce IG 1; 1968: Kaplonosy IG 1; 1972*a*: Lublin IG 1). Rugosa occur in the Upper Viséan and Namurian deposits, while Heterocorallia are restricted to the former ones. Fedorowski (1968) investigated same corals derived from four boreholes situated in the region (fig. 1). That fauna consists of 10 species assigned to the following genera: *Bradyphyllum*, *Claviphyllum*, *Cyathaxonia*, *Dibunophyllum*, *Hapsiphyllum*, *Lithostrotion*,

Table 1



1 coral bearing deposits, *2* deposits without corals or lacking.

Trachylasma, *Antiphyllum* (=*Pentaphyllum*), and *Caninophyllum* (=?*Bothrophyllum*).

The Rugosa and Heterocorallia investigated in the present paper are derived from twenty one boreholes, made by the Geological Institute in Warsaw and situated in the Lublin region up to the state border (fig. 1). The collection described is housed in the Museum of the Geological Institute in Warsaw, abbreviated as IG. In general, the material is not numerous and poorly preserved. Some species are represented by single or few specimens.

Acknowledgments

Sincere thanks are due to the authorities of the Geological Institute in Warsaw and to Dr. A. Żelichowski from the same Institute for making the core material available to me for study.

The present paper has been completed during my stay in Poland, as a post-graduate student of the Faculty of Geology, University of Warsaw

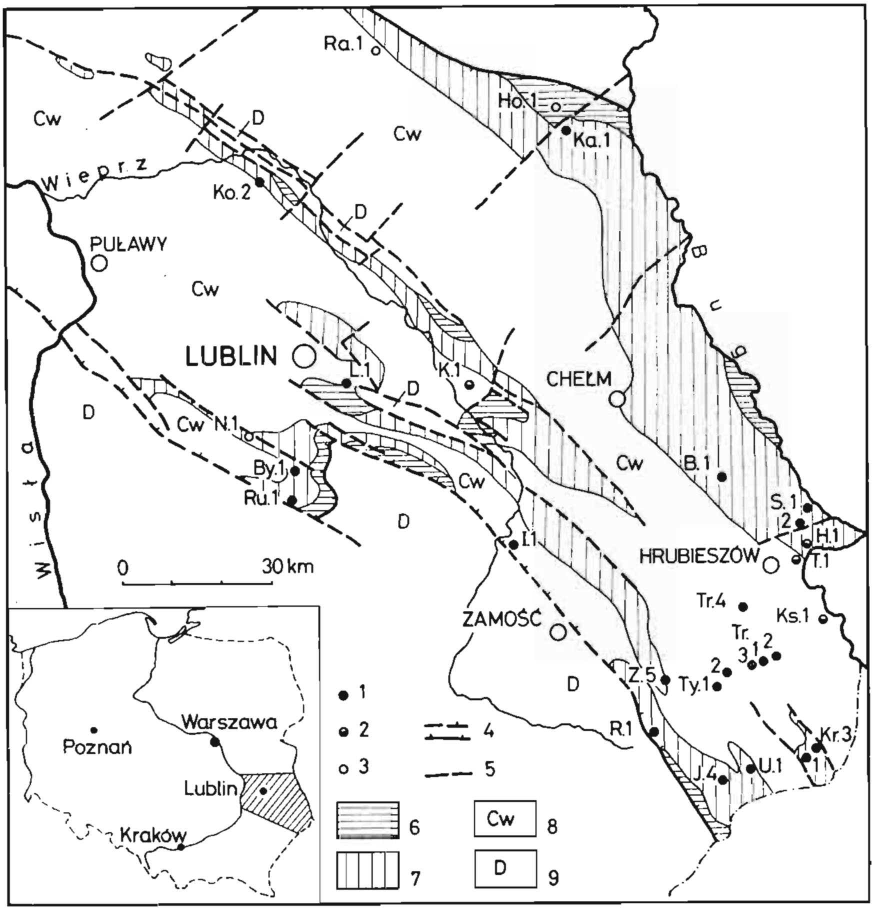


Fig. 1. Geological map of Permian subcrops (after A. Żelichowski 1973, simplified) and location of boreholes: *B.1* Białopole IG 1; *By.1* Bychawa IG 1; *H.1* Husynne IG 1; *Ho.1* Holeszów IG 1; *I.1* Izbica IG 1; *J.4* Jarczów IG 1; *K.1* Krasnystaw IG 1; *Ka.1* Kaplonosy IG 1; *Ko.2* Kock IG 2; *Kr.1, 2* Koczmin IG 1, IG 2; *Ks.1* Kosmów IG 1; *L.1* Lublin IG 1; *N.1* Niedrzwica IG 1; *R.1* Rachanie IG 1; *Ra.1* Radzyń IG 1; *Ru.1* Rudnik IG 1; *S.1, 2* Strzelce IG 1, IG 2; *T.1* Teptiuków IG 1; *Tr.1, 2, 3, 4* Terebin IG 1, IG 2, IG 3, IG 4; *Ty. 1, 2* Tyszowce IG 1, IG 2; *U.1* Ulchówek IG 1; *Z.5* Zubowice IG 5. *1* boreholes with coral-bearing core material studied by the present author, *2* boreholes with coral -bearing core material studied by Fedorowski (1968), *3* other boreholes referred in the text, *4* extent of the Carboniferous, *5* faults, *6* Upper Viséan, *8* Namurian, *9* Devonian.

in 1975—1977. The entire project was conduced under guidance of Dr. J. Fedorowski, formerly of the Palaeozoological Institute of the Polish Academy of Sciences, Poznań Branch, and now of the Adam Mickiewicz University in Poznań. My appreciation of his professional assistance and personal interest is profound. I have also benefited from informal conversation and discussions with many people, prime among them being: Prof. Maria Różkowska (Poznań), Dr. Ewa Roniewicz (Institute of Paleobiology, Polish Academy of Sciences, Warsaw) and to Dr. Antoni Żelichowski (Geological Institute, Warsaw). I am also grateful to Prof. Adam Urbanek (Institute of Geology, Warsaw University), and Dr. Magdalena Borsuk-Białynicka (Institute of Paleobiology, Polish Academy of Sciences, Warsaw) for their thoughtful care during my post-graduate studies. Mr A. Pietura is acknowledged for help in taking the photos.

In the text the following abbreviations are used:

av — average dimensions
c-c — distance between axes of calices
d.ax — diameter of axial structure
d.c — diameter of corallite
d.col — diameter of columella
e w — external wall
ext — extremal dimensions
l.s — length of septa
l.smj — length of major septa
l.smn — length of minor septa
max — maximum dimensions
n.lam — number of septal lamellae
n.c. — number of corallites in colony
n.colis — number of corallites with dissepiments present
n.s — number of septa
n. t — number of tabulae
n.vdis — number of verticils of dissepiments
s — septum
vdis — verticil of dissepiments
w.dism — width of dissepimentarium
w.tm — width of tabularium
C — cardinal septum
K — counter septum

All dimensions are in milimeters.
In text-figures bar 10 mm long, otherwise stated.

STRATIGRAPHIC SIGNIFICANCE OF THE INVESTIGATED CORALS

In the Lublin region the Carboniferous is most completely developed in the southwestern part, whereas the thickness of all the members of Carboniferous is reduced northeastwards. It also varies in a very wide range (fig. 2). For example, in the borehole Holeszów IG 1 the thickness of Upper Viséan deposits does not exceeds 10 m, while in the borehole Niedrzwica IG 1 it is over 250 m (up to 450 m according to Dr. A. Żelichowski's personal communication). Occurrence of Tournaisian and Lower to Middle Viséan deposits in this area is disputable (e.g. Żakowa *in*: Osika 1970). The

Table 2

Distribution of the described species in the Carboniferous of Poland

Species \ Distribution	Kaplonosy IG 1	Strzelce IG 1	Strzelce IG 2	Husynne	Teptiuków	Kosmów	Białopole IG 1	Terebin IG 4	Terebin IG 2	Terebin IG 1	Terebin IG 3	Tyszowce IG 2	Tyszowce IG 1	Korczmin IG 3	Korczmin IG 1	Ulhówek IG 1	Jarczów IG 4	Rachanie IG 1	Zubowice IG 5	Izbica IG 1	Rudnik IG 1	Bychawa IG 1	Krasnystaw	Lublin IG 1	Kock IG 2	Holy Cross Mts	Silesia-Cracow Uplands	Sudetes
Arachnolasma biseptatum Fedorowski										+		+														+		
A. cylindricum YÜ															+											+		
Aulophyllum fungites (Fleming)											+	+	+	+			+			+		+		+		+		+
Bothrophyllum juddi (Thomson)													?															
B. pater (Ivanovsky)	+												+		+													
Bothrophyllum sp.															+											?		
Caninia cornucopiae brockleyensis (Thomson)													?													+		?
Clisiophyllum delicatum (Smyth)	+										+		+		+			+			+	+				+		
Cyathaxonia cornu Michelin				+		+										+										+		
Dibunophyllum bipartitum (McCoy)	+								+	+	+	+	+	+	+		+				+	+	+	+		+	+	+
D. lonsdaleoides Vassiljuk																									✱			
D. percrassum Gorsky															-									-		+	+	
D. pseudoturbinatum Stuckenberg															-											+		
Dibunophyllum sp.1																					+	+						
Dibunophyllum sp.2									+																			
Diphyphyllum ingens Hill													-					-										
D. lateseptatum McCoy																					+	+				+		
D. rarevesiculosum sp. n.		+											+															
D. simplex (Thomson)	+						+				+		+		+									+				
Koninckophyllum interruptum (Thomson & Nich.)													+													+		+
K. meathopense (Garwood)																					+					+		
Lithostrotion (Lithostrotion) portlocki (Bronn)															-													
L. (Siphonodendron) affine (Fleming)													+															+
L. (S.) dobrolyubovae sp. n.										+					+									+				
L. (S.) junceum (Fleming)	+				+					+	+	+	+	+	+			+			+	+	+	+		+	+	+
L. (S.) martini M.Edwards & Haime	+		-	-	-					-	-	-	-									-		-		+	?	+
L. (S.) rossicum parvum subsp. n.		+																										
L. (S.) rossicum rossicum Stuckenberg													+		+					+	+	+		+				
L. (S.) rossicum strzelcense subsp. n.		+	+					+		+	+		+		+	+	+		+	+	+	+						+
L. (S.) volkovae Dobrolyubova	+							+							+							+						
Lonsdaleia floriformis floriformis (Martin)	+																									-		
Lublinophyllum fedorowskii sp. n.			+																									
Mirka prima (Fedorowski)													+													+		
Neokoninckophyllum trifossulum Fedorowski													+													+		
Neokoninckophyllum sp.													?															
Nervophyllum primitivum Fedorowski													+													+		
Nervophyllum sp.													+															
Orionastraea ensiter (M.Edwards & Haime)													-															
O. kurakovensis Dobrolyubova									✱						✱													
O. magna Kato & Mitchel																								✱				
Palaeosmilia murchisoni M.Edwards & Haime													+									+					+	+
Siphonophyllia siblyi Semenoff											-																	
Spirophyllum sanctaecrucense lublinese subsp. n.													+		+													
Spirophyllum sp.																						+						
Turbinatocaninia tyszowcensis sp. n.													✱+															
Heterophyllia angulata Duncan									+		+					+					+							+
H. grandis McCoy											?		+			+												+
H. parva Schindewolf										+	+		+			+												+
Hexaphyllia marginata (Fleming)	+																							+				
H. mirabilis (Duncan)	+										+				+						+	+		+				+
Hexaphyllia sp.															+									+				
Heterophyllidae gen. indet.	+										+		+		+						+	+		+		+		

- cf ✱ aff

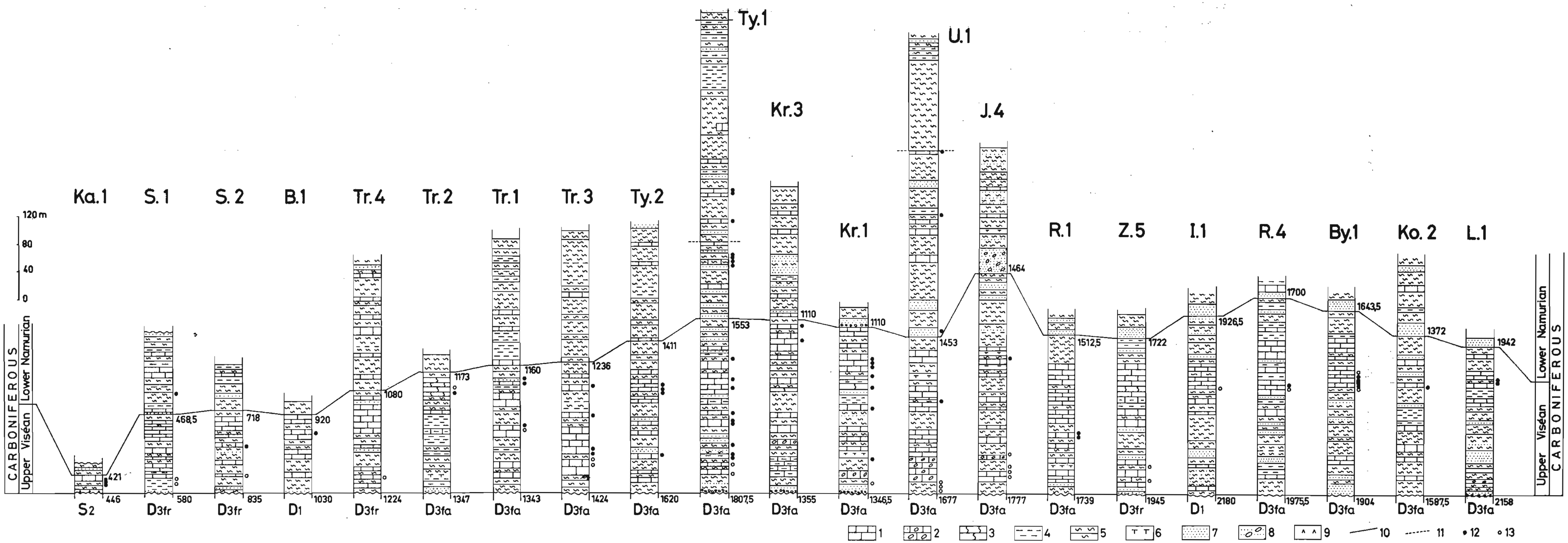


Fig. 2. Lithological-stratigraphic columns of the Upper Viséan and Lower Namurian A deposits penetrated by boreholes in the Lublin region: *1* limestone, *2* nodular limestone, *3* limestone with cherty concentrations *4* claystone, *5* siltstone, *6* marls, *7* sandstone, *8* conglomerate, *9* tuffite, *10* boundary between the Upper Viséan and Namurian after A. Żelichowski (1972) and unpublished reports of the Geological Institute, *11* boundary between the Upper Viséan and Lower Namurian as indicated by the corals studied, *12* range of *Lithostrotion (S.) rossicum strzelcense* subsp.n., D_1 Lower Devonian, D_3fa Famennian, D_3fr Frasnian, S_2 Upper Silurian. Numbers represent depth of the top and base of the Upper Viséan in meters. Abbreviations as given in fig. 1.

Viséan/Namurian boundary has been variously interpreted (Table 3). The present author suggests here to use the corals to determine the Viséan/ Namurian boundary.

Table 3

Bojkowski, Cebulak, Jachowicz Magier, Porzycki (1966)				Żelichowski (1967, 1968)			
Carboniferous	Westfalian	D + C	Silstone series	Pilica series	D	Westfalian	Carboniferous
				Magnuszew series	C		
		A + B		Żyrzyn series	A + B		
			Sandstone-siltstone series	Karczmiska series			
	Namurian	B + C		Bystrzyca series	B + C	Namurian	
			Siltstone series with limestones	Komarowo series			
		A		Korczmin series	A		
	Viséan	Middle + Upper	Limestone-claystone series	Huczwa series	Middle + Upper	Viséan	
				Kłodnica series			
	Turnaisian		Mottled series	Hulcza beds	Upper	Fammenian	Devonian
			Dolomitic series				

In the Lublin region the most common representatives of Rugosa and Heterocorallia are: *Lithostrotion* (*Siphonodendron*) *dobrolyubovae* sp.n., *L.* (*S.*) *junceum*, *L.* (*S.*) cf. *martini*, *L.* (*S.*) *rossicum rossicum*, *L.* (*S.*) *rossicum strzelcense* subsp.n., *Diphyphyllum simplex*, *Aulophyllum fungites*, *Clisiophyllum delicatum*, *Dibunophyllum bipartitum*, *Heterophyllia angulata*, *H. parva*, *Hexaphyllia mirabilis*. The *Orionastraea* species being relatively uncommon are important stratigraphically as they occur exclusively in the uppermost Viséan. The distribution of investigated fauna is shown in Table 4.

Diphyphyllum simplex, *L.* (*S.*) *volkovae* and *Heterophyllia parva* occur throughout the stratigraphic range of the section shown in figure 2. *Diphyphyllum simplex* has also been reported from the Lower Carboniferous deposits of Great Britain and Moscow Basin. *L.* (*S.*) *volkovae* has been recorded from the Lower Carboniferous deposits of Moscow Basin and from the Upper Viséan beds of Kazakhstan. *Heterophyllia parva* occurs in the Upper Viséan deposits of Sudetes.

Table 4

Species \ Distribution	Ka. 1	S. 1	S. 2	B. 1	Tr. 4	Tr. 2	Tr. 1	Tr. 3	Ty. 2	Ty. 1	Kr. 3	Kr. 1	U. 1	J. 4	R. 1	Z. 5	I. 1	Ru. 1	By. 1	L. 1
Aulophyllum fungites								*	+	ˇ	*			+			+		+	*
Clisiophyllum delicatum	+							-		+ˇ					+			+	+	
Dibunophyllum bipartitum	+					*	+	+	+	+	+	ˇ		+				+	+	*
Diphyphyllum simplex	+			+				-		ˇ		ˇ								*
Lithostrotion (S.) dobrolyubovae							+					+								*
L. (S.) junceum	+ˇ						+	+	+	-	*	+			+			+	+	*
L. (S.) cf. martini	+		+				+	-	+	+ˇ									+	*
L. (S.) rossicum rossicum										ˇ		ˇ	ˇ				+	+	+	*
L. (S.) rossicum strzelcense		-	-		-		··	-		-		-	-	-		-	+	+	+	
L. (S.) volkovae	+				-							··ˇ							+	
Orionastraea sp. sp.						*				ˇ		ˇ								*
Heterophyllia angulata								-	+	··			+					+		
H. parva							+	-					ˇ							*
Hexaphyllia mirabilis	+							+-				+						+	+	*

- 1 ·· 2 + 3 * 4 ˇ 5

Distribution of the most common species and subspecies of Rugosa and Heterocorallia in the boreholes in Lublin region. *1* lowermost part of the profile; *2—4* middle part of the profile (*2* lower, *3* middle, and *4* upper portions of this part); *5* uppermost part of the profile.

Clisiophyllum delicatum, *L.* (*S.*) cf. *martini*, and *Heterophyllia angulata* occur mainly in the middle parts of the investigated sections. *Clisiophyllum delicatum delicatum* and *C. delicatum nanum* related in morphology to the Lublin representatives of *C. delicatum*, have been reported from the Viséan deposits of Great Britain and from the Upper Viséan beds of Holy Cross Mts and Sudetes. *Heterophyllia angulata* occurs in the Upper Viséan of Sudetes and Scotland.

In most boreholes *Lithostrotion* (*S.*) *rossicum strzelcense* subsp.n. occurs in the lowermost part of the Upper Viséan. It is but a single representative of Rugosa in the lowermost pierced Carboniferous beds in the boreholes: Ulhówek IG 1 (depth of 1658.4 — 1673 m), Zubowice IG 5 (1901 — 1921.7 m), or Jarczów IG 4 (1719 — 1741 m). In other boreholes it may occurs above or along with *Arachnolasma cylindricum*, *L.* (*S.*) *junceum*, *L.* (*S.*) *volkovae*, *Diphyphyllum rarevesiculosum* sp.n. and *Lublinophyllum fedorowskii* sp.n. The lowermost Carboniferous part of the profile of the borehole Terebin IG 3 makes quite another case. *L.* (*S.*) *rossicum strzelcense* subsp.n. occurs here together with 6 other species that have been found in other borehole in a higher stratigraphical position. In the boreholes Bychawa IG 1, Izbica IG 1, and Rudnik IG 1, *L.* (*S.*) *rossicum strzelcense* occurs in the middle part of the profile. However, in these particular boreholes it occurs with *L.* (*S.*) *rossicum rossicum*, while in other boreholes the latter subspecies have been found in somewhat higher beds. *L.* (*S.*) *rossi-*

cum strzelcense subsp.n. has been described as *L. junceum* from the Upper Viséan of Sudetes (Fedorowski, 1967) and from Lower Carboniferous of Czechoslovakia (Zukalova, 1961).

Lithostrotion (*S.*) *junceum*, *Dibunophyllum bipartitum*, and *Hexaphyllia mirabilis* always occur in the middle parts of the Upper Viséan in the profiles discussed. The first two species have been recorded in the Upper Viséan deposits of the Western and Central Europe. In Urals, Kazakhstan, and Donets Basin they have been reported from the Upper Viséan and Lower Namurian deposits.

Aulophyllum fungites and *L.* (*S.*) *dobrolyubovae* sp.n. in the Lublin region occur higher in the profile than any of the species mentioned above. In Great Britain and USSR (Donets Basin, the Urals) *Aulophyllum fungites* has been recorded from the Viséan and Lower Namurian deposits, whereas in France, Belgium, and Poland (Sudetes and Holy Cross Mts) it has been found in the Upper Viséan deposits.

L. (*S.*) *rossicum rossicum* and the genus *Orionastraea* occur still higher in the profile. The former has been reported from the Upper Viséan - Lower Namurian deposits of Donets Basin, and Lower Carboniferous sediments of Moscow Basin. *Orionastraea* is known from the Lower Carboniferous deposits of Russian platform, England, and Scotland, and also from the Upper Carboniferous deposits of the Urals, Timan, Novaya Zemlya, and Spitzbergen.

As indicated by the above analysis of the stratigraphic distribution of the most common species, the species of Rugosa and Heterocorallia considered in other areas as the Upper Viséan or Lower Namurian, are mixed in the Lublin area. Most of the investigated species occur in part of the profile which Żelichowski (fig. 2) recognized as the Viséan. It seems that they may constitute an assemblage typical of the Upper Viséan deposits in the Lublin region. The lowermost Rugosa zone is marked by the occurrence of *Lithostrotion* (*S.*) *rossicum strzelcense* subsp.n. and absence of *L.* (*S.*) *rossicum rossicum*, while the last subspecies in assistance of *Orionastraea* species occurs mostly in the upper beds of the Upper Viséan in this area.

The coral fauna from the Tyszowce IG 1 core is the richest described. It can be grouped in 4 assemblages (Table 5). The assemblage 1 is typical of the lowermost part of the Upper Viséan deposits existed in the Lublin region. The assemblage 2 (mainly colonial corals) and the assemblage 3 (dominantly solitary forms) are both of the late Viséan age. The assemblage 4 consists of species not existing in other parts of profile and also in other boreholes. The genera *Turbinatocaninia* and *Neokoninckophyllum* occurring also in the lower part of the profile, are here represented by different species. The assemblage is dominated by ?*Caninia cornucopiae brockleyensis* and ?*Bothrophyllum juddi*. Other species are represented by only a few specimens. In spite of the occurrence of *Mirka prima* and *Neokonincko-*

Table 5

Corals and goniatites in the borehole Tyszowce IG 1

Depth	Rugosa and Heterocorallia	Goniatites	Coral assemblages
1375.0—1376.0	*Turbinatocaninia tyszowcensis*, *Mirka prima*, ?*Bothrophyllum juddi*		4
1378.8	*Neokoninckophyllum trifossulum*		
1380.0—1380.5	?*Caninia cornucopiae brockleyensis*, ?*Bothrophyllum juddi*		
1418.0		*Cravenoceras* sp.	
1419.2—1420.0	?*Caninia* sp.		
1448.0—1442.7		*Cravenoceras* sp. *Dimorphoceras* sp.	
1476.0	*Neokoninckophyllum* sp., *L.* (*S.*) cf. *martini*		3
1477.0	*Palaeosmilia murchisoni*		
1478.5—1479.5	*Orionastraea* cf. *ensifer*		
1480.0—1481.0	*Clisiophyllum delicatum*		
1536.4—1539.0		*Anthracoceras paucilobum*, *Sudeticeras ostraviensis*, *Cravenoceras* sp.	
1575.6—1577.5		*Sudeticeras crenistriatum*	
1616.3—1617.3	*Aulophyllum fungites*		
1642.0—1755.1	*Clisiophyllum delicatum*, *Dibunophyllum bipartitum*, *Diphyphyllum rarevesiculosum*, *D. simplex*, *D.* cf. *ingens*, *Koninckophyllum interruptum*, *L.* (*S.*) *affine*, *L.* (*S.*) *junceum*, *L.* (*S.*) *rossicum rossicum*, *L.* (*S.*) cf. *martini*, *Nervophyllum primitivum*, *Turbinatocaninia* aff. *tyszowcensis*, *Heterophyllia angulata*, *H. grandis*, *Hexaphyllia* sp., Heterophyllidae gen. indet.		2
1763.9—1764.9	*L.* (*S.*) *rossicum strzelcense*		1
1779.6—1780.1	*L.* (*S.*) *junceum*		

Table 6

Corals in the borehole Ulhówek IG 1

Depth	Rugosa and Heterocorallia	Coral assemblages
1188.0—1189.0	*L. (S.) rossicum rossicum, Heterophyllia grandis, H. parva*	3
1279.0—1281.0	*Cyathaxonia cornu, Cyathaxonia* sp.	2
1281.0—1282.0	*Cyathaxonia cornu, Heterophyllia angulata*	
1282.0—1283.0	*Cyathaxonia* sp.	
1445.0—1446.0	*Heterophyllia angulata*	
1545.0—1546.0	*Cyathaxonia cornu, Heterophyllia angulata*	
1648.4—1673.0	*L. (S.) rossicum strzelcense*	1

phyllum trifossulum previously reported from the Upper Viséan of the Holy Cross Mts (Fedorowski 1971), this part of the profile is considered to represent the Lower Namurian; according to Żelichowski (1972*b*: 589; fig. 2) it contains several specimens of *Cravenoceras* sp., while the brachiopods *Gigantoproductus giganteus* and *G. latissimus* are already lacking.

In the borehole Ulhówek IG 1 the Rugosa and Heterocorallia fauna is rather peculiar; it consists of small-sized specimens. It can be grouped into 3 assemblages (Table 6). In the lowermost part of the profile (assemblage 1) only *Lithostrotion* (*S.*) *rossicum strzelcense* subsp.n. occurs (see also page 306). Heterophyllidae and *Cyathaxonia* have been recorded in higher beds of the profile (assemblage 2). According to Weyer (1967), the Heterocorallia occur exclusively in the Viséan deposits. This assumption and the data given above on *L.* (*S.*) *rossicum rossicum* (assemblage 3) allow to infer that in the borehole Ulhówek IG 1 the investigated part of the profile with Rugosa and Heterocorallia is of the late Viséan age.

The occurrence of Rugosa and Heterocorallia in the boreholes Tyszowce IG 1 and Ulhówek IG 1 may allow for more precise determination of the Viséan/Namurian boundary in this area. In the borehole Tyszowce IG 1 this stratigraphic boundary based on the poorly preserved goniatites: *Anthracoceras paucilobum*, *Sudeticeras ostraviensis*, and *Cravenoceras* sp. has been traced at the depth of 1553 m (fig. 2), (see Żelichowski 1972*b*: 589; fig. 2; pl. 1: 5—6). The present author holds that this boundary should be placed some 100 m higher (i.e., at at least at the depth 1420 — 1476 m) because typically Upper Viséan Rugosa and Heterocorallia occur in the higher portions of the core. This opinion is also supported by the appearance of *Gigantoproductus giganteus* and *G.* ex gr. *latissimus* above the mentioned goniatite zone (Żelichowski *op. cit.*: fig. 2). This brachiopod assemblage has been recorded in the beds regarded as Viséan in the borehole Tyszowce IG 1 (Żelichowski *l.c.*) and in some other ones in the

Lublin area (Bojkowski 1966*a*, table 4). In the borehole Ulhówek IG 1 the depth of 1453 m can also be hardly accepted as representing the Viséan/Namurian boundary, as it was suggested by Żelichowski (*l.c*). The coral assemblage recorded in this borehole allows to infer that the boundary occurs considerably higher in the profile, probably above the level of 1189 meters. The boundary may be extrapolated to the adjacent boreholes but on basis of a purely lithological correlation.

In the Lublin region the distinctive assemblages of Rugosa and Heterocorallia can be determined with respect to stratigraphy, as follows:

Upper Viséan: *Lithostrotion* (*Siphonodendron*) *dobrolyubovae* sp. n., *L.* (*S.*) *junceum*, *L.* (*S.*) *rossicum rossicum*, *L.* (*S.*) *rossicum strzelcense* subsp. n., *L.* (*S.*) *volkovae*, *L.* (*S.*) cf. *martini*, *Diphyphyllum simplex*, *Aulophyllum fungites*, *Clisiophyllum delicatum*, *Dibunophyllum bipartitum*, *Heterophyllia angulata*, *H. parva*, and *Hexaphyllia mirabilis*. Moreover, the assemblage contains also *Cyathaxonia cornu*, *Paleosmilia murchisoni*, *Nervophyllum primitivum*, *Koninckophyllum interruptum*, *Diphyphyllum lateseptatum*, *D. rarevesiculosum* sp.n., *Arachnolasma biseptatum*, and *A. cylindricum*.

Lower Namurian: ?*Bothrophyllum juddi*, ?*Caninia cornucopiae brockleyensis*, *Mirka prima*, *Neokoninckophyllum trifossulum*, *Lithostrotion* (*S.*) *rossicum parvum* subsp.n., and *Turbinatocaninia tyszowcensis* sp.n.

DISTRIBUTION AND CHARACTERISTICS OF THE ASSEMBLAGES OF RUGOSA AND HETEROCORALLIA

Paleoecology and paleogeography of Poland during the Viséan and Namurian time was presented by Bojkowski & Dembowski (1973, 1974), Fedorowski (1975*b*), and others. The most important Carboniferous marine transgression took place in Poland in the Late Viséan. At that time the sea was delimited by the following continental blocks: East-European platform at the North-East, and Sudetes, Pra-Carpathians and San Land [1] at the South. The Lublin basin was situated between the East-European platform and the San Land; this was an inlet linking the seas of Western Europe together with the Donets Basin and also with Moscow and Ural Basins. According to Fedorowski (1971: 20—22), among the Carboniferous Rugosa of Poland the cosmopolitan species and genera are dominant, while the eastern- and western-european taxa are almost equally numerous. Nevertheless, this author regards the Upper Viséan Rugosa of Poland as resembling most closely the British coral assemblages of that age. In the Eastern Europe contemporaneous assemblages resembling the Polish ones have been recorded in the Donets Basin and the Urals.

Several cosmopolitan species and subspecies of the genera *Arachno-*

[1] the term introduced by Żakowa *in*: Osika 1970: 284.

lasma, Aulophyllum, Cyathaxonia, Dibunophyllum, Diphyphyllum, Lithostrotion, Lonsdaleia, Orionastraea, Palaeosmilia and others, occurred in the Lublin basin. Species of the genera *Lublinophyllum, Nervophyllum, Spirophyllum, Turbinatocaninia*, and some species of the genus *Lithostrotion* (*L.* (*S.*) *dobrolyubovae* sp.n., *L.* (*S.*) *rossicum*) have insofar been recorded only in Poland and the European part of the USSR.

Despite the small sample size the Lublin fauna can be compared to the faunas of the Holy Cross Mts and Sudetes. Among the Rugosa, 53% of the species an subspecies occur also in the adjacent region of the Holy Cross Mts. The generic composition of Lublin fauna is almost the some as in the Holy Cross Mts (only *Bifossularia* has not insofar been reported from the Lublin area). In the Holy Cross basin the coral fauna is dominated by solitary forms, namely, by several genera of the family Aulophyllidae, and the genus *Spirophyllum* of the family Amygdalophyllidae. In contrast, in the Lublin basin colonial forms are more common. The Upper Viséan coral fauna and lithology of the Sudetes basin resemble very closely those of the Lublin area (J. Fedorowski — personal communication). However, in the Lublin basin marine conditions persist and the coral fauna develops also during the early Namurian time, whreas in the Holy Cross Mts and Sudetes the youngest corals occur in the *Goniatites crenistria* Zone. The detailed analysis of the Carboniferous fauna of Rugosa and Heterocorallia of the Lublin region allows the statements as follows:

a) The corals occur in the largest numbers in the south-eastern part of the Lublin region (fig. 1). The other coral-bearing localities are sparse and their coral fauna is often poor. The poorest fauna occurs at Białopole (B1). Specimens from Zubowice (Z5) are often considerably flattened. The sedimentation rate was probably high herein, at least the beginning of the Late Viséan; diagenesis was late relative to accumulation. Therefore, the coral skeletons have been crushed by the pressure of rapidly accumulating sediment.

Fasciculate colonial forms occur in almost all boreholes, except for Terebin IG 2 where only one massive colony was found. Fasciculate colonies constitute the entire coral fauna of the boreholes Białopole IG 1, Strzelce IG 1—2, Zubowice IG 5, and Teptiuków IG 1.

Percent contributions of particular ecological types (defined after Hill 1938—1941) to the whole investigated material are as follows:

Rugosa	
reef-coral fauna	
— fasciculate forms	45%
— massive forms	3%
solitary forms	
Cythaxonia Fauna	3%
Caninia-Clisiophyllum Fauna	29.5%
Heterocorallia	19.5%

b) In the area penetrated by the borehole Ulhówek IG 1 and Kosmów IG 1 the ecological conditions were probably different from those in other regions. This is evidenced by the species composition being strongly dominated by solitary forms of the "*Cythaxonia* Fauna". The sea floor had to be muddy, and water depth fairly large.

c) The northern area in the vicinity of Kaplonosy appear also to be ecologically distinct. In the borehole Kaplonosy IG 1 thickness of the Viséan deposists does not exceed 25 m but the fauna is very rich. In a bed 10 m thick (depth of 428.6 — 438.6) 10 species or subspecies of Rugosa have been recorded. The ecological conditions were exceptionally suitable for coral development. The biotope represented a nearshore zone with a slow sedimentation.

d) The Heterophyllidae are often found together with fasciculate colonies or at least in places where these dominated.

The above remarks indicate that ecological conditions, significant for the coral life were fairly variable in the Upper Viséan of Lublin basin. This variability is stressed by a zonation visible in the occurrence of Rugosa and Heterocorallia in the investigated area.

BLASTOGENY

Blastogeny of the Carboniferous Rugosa has been investigated by Smith (1916), Smith & Ryder (1926), Dobrolyubova (1958), and Jull (1965, 1967). The present author has studied the blastogeny of 13 species or subspecies, of which 11 are attributed to the family Lithostrotionidae. All the investigated species increase laterally, except for *Lithostrotion* (*S.*) *dobrolyubovae* sp.n. where an axial increase occurs. Peripheral increase regarded by Fedorowski & Jull (1976) as being frequently only a corallite rejuvenescence, has not been observed in the specimens from Lublin region.

The analysis and comparisons among taxa have been carried according to the following criteria: a) inheritance of parent septa; b) occurrence of aseptal stage; c) location of initial offset within parent calice; d) formation type of partition or dividing wall; e) ability of parent corallite to insert neo-septa at the new wall. In some cases these blastogenetic criteria allow to distinguish two morphologically similar species from each other; e.g. *Lithostrotion* (*S.*) *junceum* and *Diphyphyllum simplex*, or *D. simplex* and *D. rarevesiculosum* sp.n.

Main blastogenetic characters of the investigated species or subspecies are presented below:

1. Lateral increase in fasciculate colonies

Lithostrotion (*Siphonodendron*) *junceum*: The offset increases sidewards from the very beginning of the process. It inherites a part of the parent-corallite external wall and goes through a long aseptal stage. The cardinal septum often appears earlier than any other protoseptum. In the cardinal quadrants (at the old wall) the insertion of septa is rapid. The partition originates from septal pinnacles formed of peripheral parts of parent major and minor septa. The offset produces its connecting channels already at the hystero-brephic stages.

Diphyphyllum simplex: The offsetting differs from that in *L.* (*S.*) *junceum* in the occurrence of but a short aseptal stage or lack of it. The counter septum appears at the first protoseptum; the others septa appear successively in the cardinal and counter quadrants.

Diphyphyllum rarevesiculosum sp.n.: The process of offsetting resembles that in *D. simplex*. At the early-neanic stages the counter septum may be long.

Lithostrotion (*S.*) *rossicum strzelcense* subsp.n.: The offset does not go through an aseptal stage; it produces only a part of the neo-septa, while the others are inherited from the parent corallite. The insertion of septa is simultaneous with the formation of partition; similary like in *L.* (*S.*) *junceum* is rapid in the cardinal quadrants (at the old wall). The columella is biseptal. The parent corallite continues to develop atavo-septa at the new wall.

Lithostrotion (*S.*) *rossicum rossicum* and *L.* (*S.*) *volkovae*: The type of increase is similar in both these species. There are no typical septal pinnacles: in the sector of increase the minor septa of the parent become elongated and attached to the major septa, forming contratingent septa. One of these septa remains uninterrupted and is transformed into the axial septum forming the columella at a very early blastogenetic stage. The offset inherites all the parent septa in the sector of increase. The insertion of the major septa goes simultaneously with the formation of partition. The minor septa and dissepiments develop at first in the cardinal quadrants. The similarity of increase in both these species maybe due to the similar number of verticils of dissepiments.

Lithostrotion (*S.*) cf. *martini*: The process of offsetting resembles that in *L.* (*S.*) *volkovae*. The sector of increase covers, however, more septa (10) and proturberance does not occur at the early stages. The cardinal septum develops from an inherited septum, while the counter septum appears as the first septum at the new wall (partition). In contrast to Jull (1965:215—218; fig. 5), the present author has not found any additional neo-septa at the old wall in the sector of increase.

Lithostrotion (*S.*) *affine*: The formation of septal pinnacles goes simultaneously with the insertion of additional neo-septa (just as it does in *L.* cf. *martini* investigated by Jull, *l.c.*). The minor septa and dissepiments appear at first at the external wall. The columella develops at the late blastogenetic stages.

Lublinophyllum fedorowskii sp.n.: The process of offsetting resembles that in *L.* (*S.*) *rossicum rossicum*; however, a protuberance does not develop at the beginning of blastogeny; whereas the additional septa appear for a while and disappear later on. The offset separates itself from the parent corallite by means of epitheca only after the formation of dissepimentarium.

2. Lateral increase in massive colonies

Lithostrotion (*Lithostrotion*) cf. *portlocki*: The sector of increase occurs in the central part of dissepimentarium, far away from the parent-corallite external wall. The offset calice develops as a result of a disruption of the parent neo-and atavo-septa. The offset inherites some septa and dissepiments from the parent corallite. The septal aparatus is formed very rapidly. The columella is biseptal. The partition-type wall develops at very early blastogenetic stage.

Lonsdaleia floriformis floriformis: The sector of increase occurs usually in the parent-corallite corner. The cardinal septum appears as the first septum; whereas the counter septum appears but at the end of the hystero-brephic stage or even later. The partition originates form lonsdaleoid dissepiments.

3. Axial increase

In the investigated material an axial increase has been found only in *Lithostrotion* (*S.*) *dobrolyubovae* sp.n.-3 offsets develop in the course of increase; however, only 2 of them develop usually into normal individuals. The offset wall is of septal origin. It originates from fused septal lamellae.

4. „Simplified" increase

Apart from the normal lateral increase, a simplified process does also occur in *Lithostrotion* (*S.*) *junceum* and *L.* (*S.*) *rossicum strzelcense* subsp.n. The difference between these two increase types is in formation of the partition. In the simplified increase (*L.* (*S.*) *junceum*) the partition develops from two septa (septal partition) rather than from the septal pinnacles; whereas in simplified lateral increase of *L.* (*S.*) *rossicum strzelcense* the partition is of dissepimental origin.

Many workers (e.g. Spassky 1965, Spassky & Kravtsov 1974, Fedorowski 1965, Fedorowski & Jull 1976) regards offsetting as a character important for taxonomy. This opinion has not been fully confirmed by the present study.

Jull (1965) distinguished in *Lithostrotion* (*Siphonodendron*) 3 types of lateral increase, related to the width of dissepimentarium: *Siphonoden-*

dron with dissepiments lacking, *Siphonodendron* with narrow dissepimentarium, and *Siphonodendron* with wide dissepimentarium. This classification that has probably been intended for a use in taxonomy of *Lithostrotion* (*Siphonodendron*), is not supported by the present study. For example, discontinuous of parent-corallite septa from the wall in the sector of increase, typical for *Siphonodendron* with narrow dissepimentarium (in *Lithostrotion arundineum* — Jull 1965: fig. 2), has not been found in *L.* (*S.*) *volkovae* or *L.* (*S.*) *rossicum* exhibiting dissepimentarium of a similar width. Insertion of additional septa at the beginning of increase in *Lithostrotion* with wide dissepimentarium (in *Lithostrotion* cf. *martini* — Jull, *l.c.*) has not been observed in *L.* (*S.*) cf. *martini* investigated herein. Jull (*op. cit.*: 211—212) compared to the increase in *L.* (*S.*) *junceum* to that in *Sudetia lateseptata* Różkowska, 1960, and recognized the former species as being possibly of another origin than other species of *Siphonodendron*. The present author has found, however, *L.* (*S.*) *junceum* to increase just like *Diphyphyllum simplex* or *D. rarevesiculosum* sp.n.; moreover, the blastogeny of *L.* (*S.*) *rossicum strzelcense* subsp.n. appears to be intermediate between those occurring in *L.* (*S.*) *junceum* and *L.* (*S.*) *volkovae*. Thus, the increase in *L.* (*S.*) *junceum* does not exhibit any distinctive features when compared to *Siphonodendron* or related genera.

The present author has also observed a few distinct types of increase to occur in a single species or subspecies, e.g., in *L.* (*S.*) *junceum*, *L.* (*S.*) *rossicum strzelcense, or Lonsdaleia floriformis floriformis*. Three types of increase occur in the subgenus *Siphonodendron*, namely: lateral increase (most common), axial increase (in *L.* (*S.*) *dobrolyubovae* sp.n.), and peripheral increase (in *Lithostrotion* sp., Jull 1965; 222—224). With respect to the latter type, Fedorowski (1970: 603) claimed that either *Lithostrotion* sp. (*sensu* Jull) might be attributed to *Spirophyllum* Fedorowski, or type of increase cannot be used as a diagnostic character. The present author holds that *Spirophyllum geminum* Fedorowski differs clearly from *Lithostrotion* sp. (*sensu* Jull) not as much in the axial structure, as in the structure of dissepimentarium with its herringbone, lateral-cystose and pseudoherringbone dissepiments.

Variable development of offset skeletal elements may also support the view that blastogeny might be not very usseful in taxonomy. For example, the partition develops in *L.* (*S.*) *junceum* either from septal pinnacles or directly from septa; while in *L.* (*S.*) *rossicum strzelcense* it may develop from dissepiments. In a single specimen of *Lonsdaleia floriformis floriformis* some distinct ways of partition formation are recorded; the insertion of protosepta in an offset may also be variable in this subspecies.

In summary, it may be concluded that: 1° blastogeny can usually allow to distinguish species; 2° various types of increase can often be found in a single species; 3° a similar type of increase may occur in species belonging to different families; and 4° blastogeny has a rather restricted taxonomic value. Therefore the concept of Spassky & Kravtsov (1974) who claimed that types of increase may be used as the family-rank characters, is to be discorded.

BIOLOGICAL STATUS OF CORAL COLONIES

Fedorowski (1965) and other claim that massive colonies can be regarded as biological units. According to Fedorowski *(op. cit.*: 141) the corallites belonging to such a colony are not separated from one another by means of epitheca, and their soft parts were fused thus, forming the common body of a colony. The colony surrounded by holotheca that was formed by an uninterrupted ectoderm of polyps at the colony periphery. Similar opinions have also been formulated by Coates & Oliver (1973) and Fedorowski & Jull (1976) who claimed that common ectodermal tissues occurred in some cerioid colonies of Rugosa. In contrast, Schouppé & Oekentrop (1974) and others regard a colony in Tabulata or Rugosa as a set of individuals linked only at the period of increase, thus being not a biological unit; as the colony develops, the corallites become more and more individualized. Hence, any true holotheca cannot be formed, according to these authors.

The results of studies on some Rugosa from the Lublin area induced the present author to discuss this problem.

A common wall 0.5 — 1.5 mm thick has been found in a specimen assigned to *Orionastraea* aff. *magna* Kato & Mitchell (pl. 9: 2*a*,*b*; pl. 10: 1*c*). The wall is preserved at the entire lower surface of the colony which suggests that it had to be formed by the ectoderms of all the polyps occurring at the colony periphery. No break has been found within the wall. So it may be considered as a colony common wall, i.e., holotheca.

A fusion of soft parts in some colonies is also supported by disappearance of the common septotheca of adjacent corallites (pl. 24:1 *a*-*f*), observed in a cerioid colony of *Lonsdaleia floriformis floriformis*. The common fold of ectoderm forming that septotheca has probably been smoothed down and replaced by a large marginal vesicle. In the same colony a fusion of two offsets has also been observed (pl. 24:1 *a*-*h*; fig. 3*a*-*h*). These offsets (marked by the letters A and B in figure) developed in two adjacent corallites in the neighbourhood of the mentioned disappearing wall. As the offsets increased, the distance between them diminished (pl. 24:1*f*; fig. 3*f*). At the place of the contact, the offsets looses at first their septa and then also the external walls (fig. 3*h*) becoming completely fused (pl. 24:1*g*-*h*; fig. 3*g*-*h*). In *Lonsdaleia floriformis floriformis* the wall disappearance (the wall is of partition type) and fusion of two (or more) polypes is possible since massive colonies represent biological units; every individual possesses the same genotype inherited from protopolyp, and the whole colony represents probably a supraindividual, that is a set of intergrated individuals with their soft tissues fused.

Stasińska (1967: 16; fig. 5) described the formation of a new branch of the chain in *Halysites junior*; this process takes form of attaching the protocorallite of a new colony to an alive colony. However, this author has not found complete integration of corallite tubes (calices), as the present

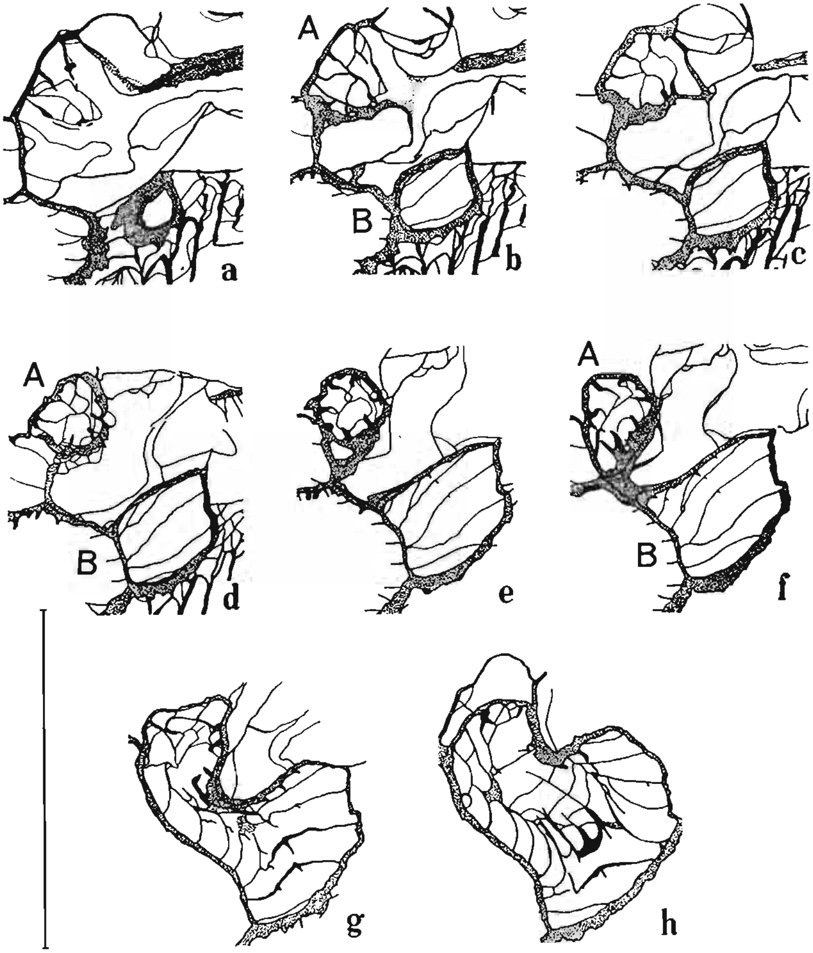


Fig. 3. *Lonsdaleia floriformis floriformis* (Martin): successive stages of blastogeny (*a-f*) and fusion (*g, h*) of two individuals (*A, B*); IG-1403.II.153, borehole Kaplonosy IG 1, depth 434.0—434.5 m.

author did; Stasińska (*l.c.*) has observed only the fusing corallite walls. A similar phenomenon of young corallites fusion has, however, been found by Roniewicz (1966: 172; pl. 6: 1*d-f*) in a plocoid colony of *Pseudocoenia longiseptata* Roniewicz.

The present author has also observed a fusion of two corallites in a fasciculate colony of *Lithostrotion* (*Siphonodendron*) *junceum* (figs. 7,8).

The development and relation of the corallites marked by the letters A and E in figure 7, seems to be especially interesting. The distances between corallites A and B, and A and D remain almost the same whereas the distance between corallites A and E decreases from 1 mm (fig. 7*a*) to a complete fusion (fig. 7*e*). The polyp A which was "active" in this process separated itself from its parent polyp (fig. 7*b*-*e*) and developed its skeleton towards the corallite E. When both corallites attach one to the other, the walls in between disappear (fig. 7*e*-*g*). Finally the polyps and their skeletons become entirely integrated. A reconstruction of this phenomenon is presented in figure 8. The present author supposes that such a possibility of corallite fusion in fasciculate colony can be explained just as in the case of *Lonsdaleia floriformis floriformis*, that is by a genetic identity of all the corallites within a colony.

DESCRIPTIONS

Order **Rugosa** Milne-Edwards et Haime, 1850
Suborder **Streptelasmatina** Wedekind, 1927
Family **Cyathaxoniidae** Milne-Edwards et Haime, 1850
Genus *Cyathaxonia* Michelin, 1847

Diagnosis. — See Hill 1938—1941: 194.

Remarks. — According to Carruthers (1913), the synonymy of the type species, *Cyathaxonia cornu* Michelin, includes the Vaughan's species, *C. rushiana*, the two forms being different but in corallite size and some details of columella structure. The criteria of division of the genus *Cyathaxonia* into species are variable among authors. Fomitshev (1953) and Bikova (1974) distinguised several species and subspecies (forma, varietas) within the genus *Cyathaxonia*. Bikova (*l.c.*: 30-35; pl: 6: 3-17) regards as specific such characters as septal thickening, dilatation of axial ends of major septa, or shortening of cardinal septum. In contrast, de Groot (1963: 26) regards most morphological characters (e.g. size of columella, presence of carinae, corallite size and shape, thickening of epitheca, or axial dilatation of septa) as taxonomically insignificant. According to this author, the most important specific criterion is the septal ratio (n/d). The present author is of the same opinion as de Groot (*l.c.*). As shown in figure 4, on the basis of their septal ratios all the species of *Cyathaxonia* can be placed in three groups: A — *Cyathaxonia rushiana* group including *C. tenuiseptata* Fomitshev, *C. lomonosovi* Fomitshev, *C. angularis* Fomitshev, *C. corisensis* de Groot, *C. stereolasmoidea* Bikova, *C. klininae* Bikova, and *C. angulariformis* Bikova; *B* — *Cyathaxonia cornu* group including *C. archangelskyi* Fomitshev, *C. kapustini* Fomitshev, and *C. cornu orientalis* Dobrolyubova; C — *Cyathaxonia* aff. *cornu* (*sensu* Różkowska 1969: 52-55) group including solely the Famennian specimens from the Holy Cross Mts. This may indicate that "*Cyathaxonia* aff. *cornu*" from the Famennian of Poland represents a new species. The American specimens of *Cyathaxonia arcuata* Weller (Conkin 1954: 214-217, fig. 1) do not make part of any of these groups.

The groups A, B, C represent probably true biological species of the genus *Cyathaxonia*. However, the present author cannot prove this since he has been unable to restudy the hitherto known species of *Cyathaxonia*.

Cyathaxonia cornu Michelin, 1847
(*pl.* 1: 1, 2, 3*a*—*b*, 4—6; fig. 4)

1847. *Cyathaxonia cornu* Michelin: 258; pl. 59: 9*a*—*b*.
1913. *Cyathaxonia cornu* Michelin; Carruthers: 53; pl. 3: 4—7.
1953. *Cyathaxonia archangelskyi* Fomitshev: 60; pl. 1: 6*a*—*v*, 7*a*—*v*, 8, 9.
1953. *Cyathaxonia kapustini* Fomitshev: 57; pl. 1: 1, 2.
1968. *Cyathaxonia cornu* Michelin; Fedorowski: 210; pl. 1: 4*a*—*d* (*cum synon.*).

Material. — 45 mostly incomplete specimens; 9 thin sections and approximately 200 peels.

Dimensions:

Specimens No.IG—1403.II	d.c (av)	n smj	septal dilation barring	septal dilation including
1	1.2	10		
2-4	2.58	14		0.66
5—8, 9A, 10	3.64	16—18	0.89	1.51

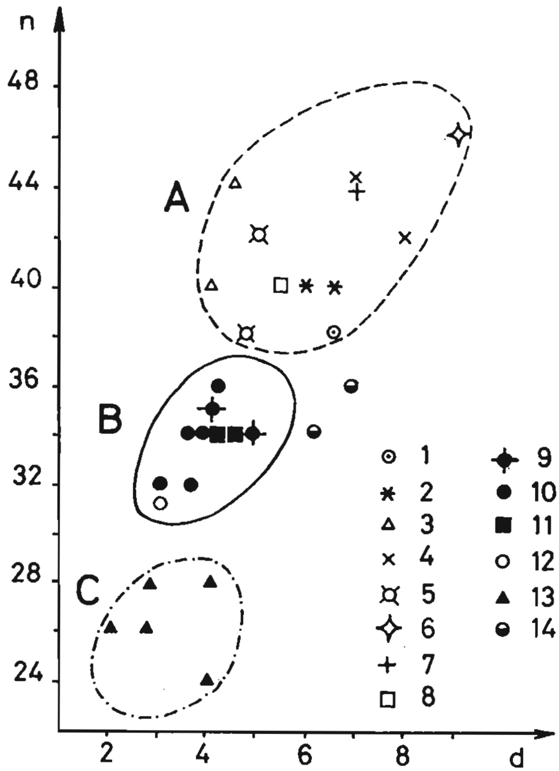


Fig. 4. Ratio of number of septa to the corallite diameter (n:d) in species of the genus *Cyathaxonia*: *1 C. angularis* Fomitchev; *2 C. angulariformis* Bikova; *3 C. corisensis* de Groot; *4 C. kleninae* Bikova; *5 C. lomonosovi* Fomitchev; *6 C. rushiana* Vaughan; *7 C. stereolasmoidea* Bikova; *8 C. tenuiseptata* Fomitchev; *9 C. archangelskyi* Fomitchev; *10 C. cornu* Michelin (specimens from Lublin region); *11 C. cornu orientalis* Dobrolyubova; *12 C. kapustini* Fomitchev; *13 C.* aff. *cornu* Michelin (specimens from the Famennian of the Holy Cross Mts); *14 C. arcuata* Weller. *A* n:d variation field for species of the *Cyathaxonia ruschiana* group, *D* for *C.* aff. *cornu* group.

Remarks. — *Cyathaxonia cornu* was adequately decribed by Carruthers (1913), Grabau (1922), and others. Among the specimens from the Lublin area the following morphological variability has been found:

Major septa (pl. 1: 2) range in thickness from 0.8 to 2.5 mm and their axial ends are variously dilated. In some cases they are attached laterally forming a wall (phyllotheca) around the columella (pl. 1: 1, 2, 4); in other cases they reach the collumella, remaining separate (pl. 1: 3*a*). The cardinal septum is often thinner and shorter than the other ones. Below the calice the septa are shorter and separate from the columella (pl. 1: 3*a*, *b*). Minor septa attain usually 1/3 to 2/3 the length of major septa (pl. 1: 2, 4). Sometimes they are longer and join the major septa at the columellar margin (pl. 1: 2, 5, 6). They are either equally or less thickened than the major septa (pl. 1: 5, 6). The columella occupies usually 1/4 (sometimes 1/3) of the total diameter. In a single specimen (pl. 1: 4) it merely reaches 1/7 of the diameter. Together with phyllotheca, the columella takes 1/4 to 2/3 (most commonly 1/3) of the total diameter. The external wall (septotheca) is 0.2 — 0.3 mm thick.

Occurrence. — Poland: Upper Viséan (Holy Cross Mts and Lublin region). USSR: Lower Carboniferous (the Urals, Moscow Basin, Donets Basin); ?Lower Permian (Western Urals). Western Europe: Tournaisian and Viséan (Belgium, France, Ireland). Africa: Tournaisian (Western Sahara).

Family **Lithostrotionidae** d'Orbigny, 1851
Genus *Lithostrotion* Fleming, 1828

Diagnosis. — See Hill 1956: F 282.

Remarks. — Dr. J. R. Nudds, University of Durham (*in litt.*), regards the type species, *Lithostrotion striatum*, as a junior synonym of *Madrepora vorticalis* Parkinson, 1808. However, Kato (1971: 2) found that the holotypes of both these species are lost, and he suggested to retain the name *Lithostrotion striatum* Fleming for the type species of the genus *Lithostrotion*.

There is no unanimity as to what colony form is typical of the genus *Lithostrotion*. The type species is a cerioid coral. Milne-Edwards and Haime (1852) assigned to this genus both cerioid and fasciculate forms. The same opinion is followed by Hill (1938-1941), Ivanovsky (1965), Bikova (1966), and others. Some other authors, e.g. Chi (1931) and Minato (1955), follow McCoy (1849), in giving the generic name *Siphonodendron* to the fasciculate forms. The present author agrees with Jull (1974) that the fasciculate and cerioid forms should be regarded as two distinct subgenera. Jull (*l.c.*) adopts the view that these subgenera differ not only in the colony form but also in the way of lateral increase.

Lithostrotion (*Lithostrotion*) Fleming, 1828

Diagnosis. — See Jull 1974: 62.

Lithostrotion (*Lithostrotion*) cf. *portlocki* (Bronn, 1848)
(pl. 3: 4; fig. 5*a*—*g*)

Material. — One small fragment of a colony (in cross section its dimensions are 10 × 35 mm); 24 peels.

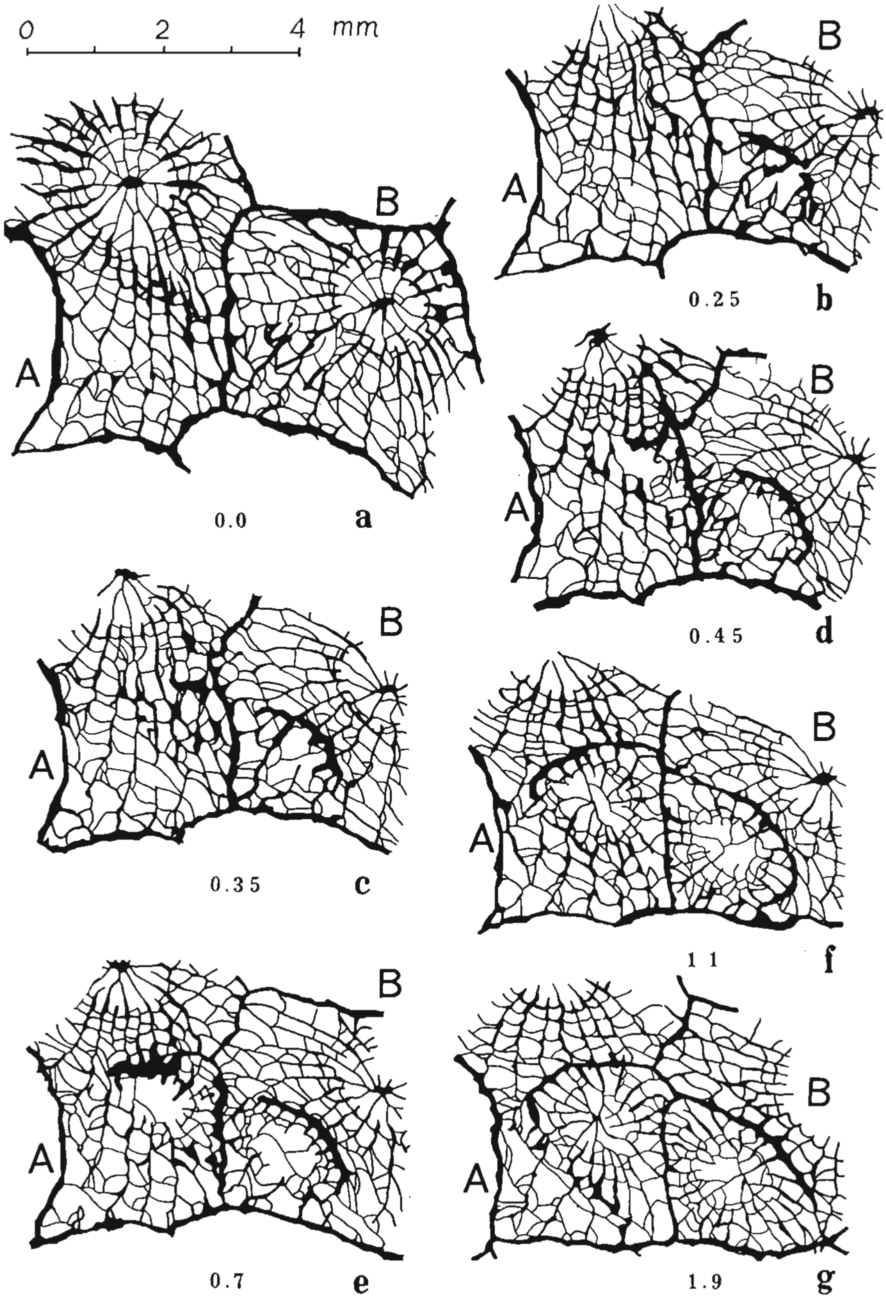


Fig. 5. *Lithostrotion* (*Lithostrotion*) cf. *portlocki* M. Edwards & Haime: *a-g* successive stages of blastogeny of two corallites (*A*, *B*); IG-1403.II.12A, borehole Koczmin IG 1, depth 1223.1—1224.1 m.

Dimensions:

Specimens No.IG-1403.II.	d.c (av)	w.dism (av)	w.tm	n. smj	n. vdis
12 A/y	3.71	1.46	1.62	10—13	2—7
12 A/t	4.1	1.73	1.51	11—12	3—7

Description. — The colony is massive. Major septa are long and rather undulate. Near the internal wall they dilate slightly. They often reach the columella. Some of them are carinate. Those major septa that do not reach the columella, join the adjacent septa. Minor septa, too, are slightly undulate and carinate. They cross the internal wall and attain at least 2/3 the length of major septa. Near the calice the columella disappears and the major septa can hardly be differentiated from the minor ones. Both the cardinal and counter septa attach to the columella usually lense-like in cross section. The dissepimentarium of variable width consists normally of 3 to 5 verticils of concentric dissepiments. Sometimes pseudoherringbone and lateral-cyctose dissepiments occur. The tabularium width increases simultaneously with the increase of corallite diameter, while the width of dissepimentarium is variable.

Blastogeny. — The lateral increase occurs within the dissepimentarium. In the sector of increase 2 or 3 couples of septa dilate. Among them new, short offset septa appear (corallite A, fig. 5*a*, *b*; corallite B, fig. 5*a*). In the central part of the sector of increase both the neo-septa and the atavo-septa of a parent corallite are disrupted, resulting in formation of the offset calice (corallite A, fig. *c-e*; corallite B, fig. 5*b-e*). The wall of partition type appears very early in the blastogeny (fig. 5*b*, *c*) close to the external wall of the parent corallite (corallite A) or in its centre (corallite B). A disruption of next 2—3 septa in the sector of increase allows further development of the partition, owing to which the offset calice enlarges. This process of increase takes place away from the external wall of the parent corallite, in the central part of its dissepimentarium. The external part of dissepimentarium and the septa therein become inherited by the daughter corallite almost without any changes (corallite A) or with some minor ones (corallite B).

The septal apparatus of an offset is formed very rapidly. The inherited parent septa become the offset major septa and among them new minor septa appear (fig. 5*d-g*). The present author was not able to state either septal insertion or the position of the cardinal septum. The early stages of columella formation (fig. 5*f*, *g*) indicate that it is biseptal, and the cardinal/counter septa plane is perpendicular to the parent corallite.

Jull (1965: 218—220, fig. 6; 1*a-m*) investigated the blastogeny on the specimen closely related to *L.* (*L.*) *portlocki*. However his observation differ from those made by the present author. In Polish material some septa and dissepiments are inherited by the offset, and the partition is formed very early. These differences may result from something more than a mere difference in position of the sector of increase within the dissepimentarium (in the Jull's specimen the sector of increase occurs very close to the external wall); they may indicate that the specimens involved belong to different species.

Remarks. — In corallite size, number of septa, and especially dissepimentarium structure and width, the investigated specimen resembles very closely *L. laminacolumellata* Dobrolyubova (1958: 171—174, pl. 27: 1, fig. 32). The similarity of the latter species to *L.* (*L.*) *portlocki* was already stressed by Dobrolyubova (*l.c.*).

Occurrence. — Poland: Upper Viséan (Lublin region).

Lithostrotion (*Siphonodendron*) McCoy, 1849

Diagnosis. — See Jull 1974: 64.

Lithostrotion (*Siphonodendron*) *junceum* (Fleming, 1828)
(pl. 2: 1*a*, *b*, 2, 3; fig. 6*a-r*; fig. 7*a-i*; fig. 8)

1828. *Caryophyllia juncea* Fleming: 508.
1973. *Lithostrotion* (*Siphonodendron*) *junceum* (Fleming, 1828); Fedorowski *in*: Fedorowski & Gorianov: 54; pl. 11: 4,5 (*cum synon.*).

Material. — 41 colony fragments; 22 thin sections and 82 peels.
Diagnosis. — See Hill 1938—1941: 172.
Dimensions:

Specimen	d.c		n.smj	d.col
No.IG-1403.II.	ext	av		av
22B	1.3—1.6	1.43	14—15	0.28 × 0.43
15	2.1—3.1	2.35	16	0.25 × 0.48
17	2.6—3.1	2.99	16—17	0.31 × 0.46

Individual variability. — As indicated by previous investigations (e.g. Perna 1923, Dobrolyubova 1958), high individual variability is typical of the species. Very high inter-colony and slight intra-colony variabilities in corallite size have also been found (see above). The number of septa is less variable among the colonies.

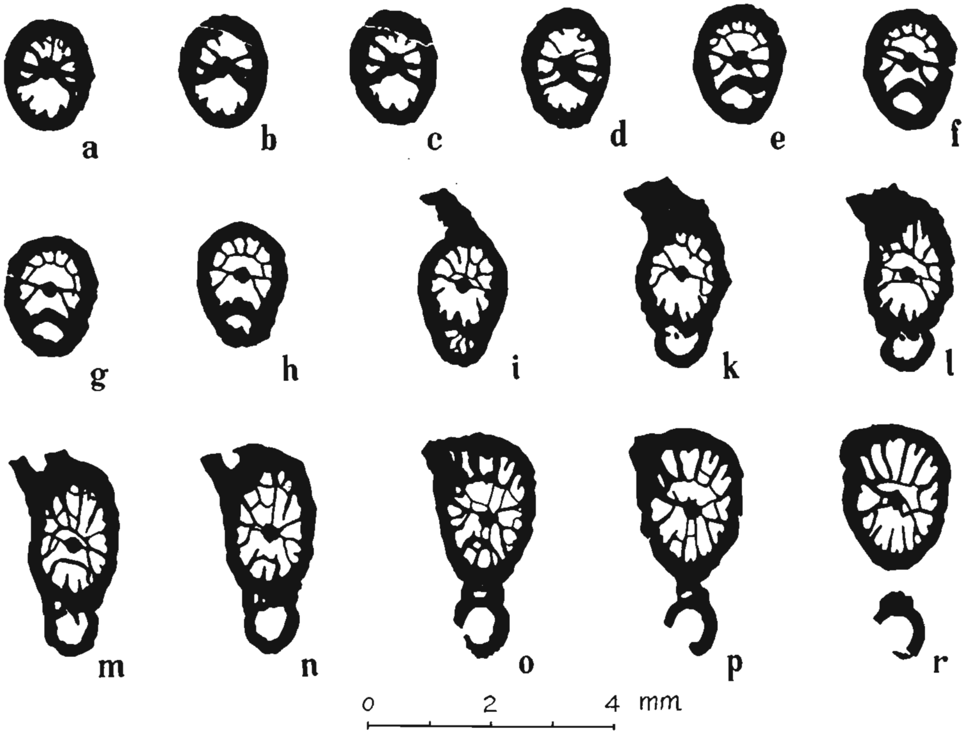


Fig. 6. *Lithostrotion* (*Siphonodendron*) *junceum* (Fleming): *a-r* successive stages of blastogeny (simplified increase); IG-1403.II.20, borehole Lublin IG 1, depth 1997.5—1998.5 m.

Both inter-colony and intra-colony variabilities in columella shape are shown in the sections (pl. 2: 2). In some corallites the columella is disrupted. This feature varies among the colonies. In some colonies the cardinal and counter septa join the columella (pl. 2: 1*a*, *b*): in the others the columella is usually free (pl. 2: 2). In a few colonies axial ends of two septa adjacent to the cardinal septum (more seldom to the counter septum) are attached to it. In these specimens most minor septa are short; only two septa adjacent to the counter septum are distinctly elongate (pl. 2: 1*a*, *b*). The major and minor septa are also variable in length among individuals

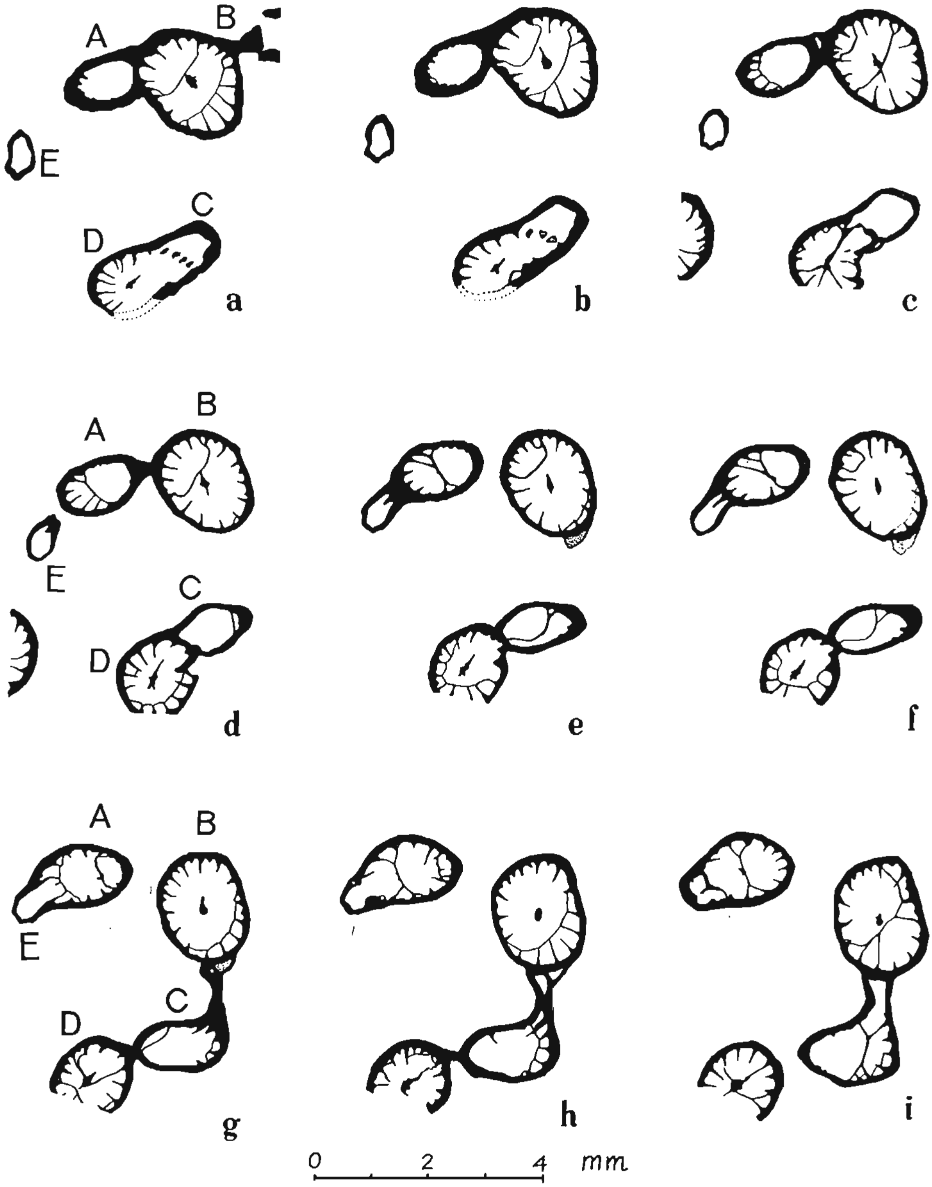


Fig. 7. *Lithostrotion* (*Siphonodendron*) *junceum* (Fleming): *a-i* successive stages of blastogeny of corallites *A-B* and *C-D*, and fusion of corallites *E-A*; IG-1403.II.20, borehole Lublin IG 1, depth 1997.5—1998.5 m.

within the colony. The external wall exhibits an intra-colony variability in thickness (pl. 2: 2). The wall is thick mostly in young individuals (pl. 2: 3).

Blastogeny. — Blastogeny in *Lithostrotion* (*S.*) *junceum* has been investigated in detail and illustrated by Jull (1965: 208—212, fig. 1: 1*a*-*m*, 2—5). In the present study two examples of the increase in this species are analysed which are somewhat different from those studied by Jull.

In one case (fig. 6*a*-*r*) two of the twelve major septa dilate to form a wall crossing the columella and dividing the corallite into two parts (fig. 6*a*-*c*). One of these parts contains 7 normal septa; the other one forms the offset calice and contains 3 much shorter septa (fig. 6*d*). Thus, at the beginning the separating wall consists of septa. Nevertheless, it is not of the partition type as it is in the specimens described by Jull (*l.c.*); in contrast, it is a septal wall as in *Stauria*. The inherited septa

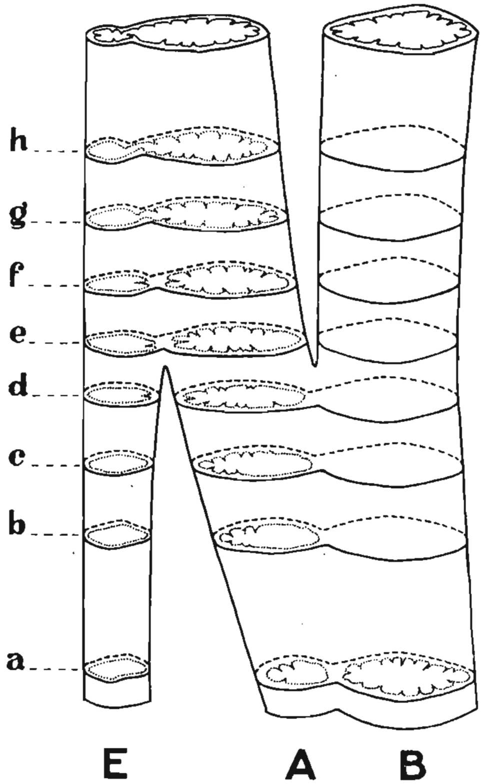


Fig. 8. Schematic reconstruction of a process of corallite fusion in *Lithostrotion* (*Siphonodendron*) *junceum* based upon specimen IG-1403.II.20 (see fig. 7, columella omitted); explanations see fig. 7.

disappear gradually and the offset comes into a long aseptal stage (fig. 6*k*-*r*). The parent forms neo-septa on the new wall fairly early (fig. 6*h*-1). The young individual does not attain maturity and dies early (fig. 6*o*-*r*). This may indicate that an increase of this type represents an abortive variety of asexual reproduction, in fact, it was found in a single corallite.

Apart from the above described process, a simultaneous lateral increase of a few individuals can also be seen (fig. 7*a*-*i*). In general, the blastogeny resembles that described by Jull (*l.c.*). However, the following phenomena are to be stressed:

1. Formation of the connecting tubulae (fig. 7*e-g*). Even before a complete separation from its parent corallite, the young corallite C tends to grow towards the adjacent corallite B. The latter exhibits a similar tropism towards the corallite C. This results in formation of a connecting tubula that opens to the cavity of one of the corallites. A similar phenomenon was also observed by Dobrolyubowa (1958) who interpreted it as an increase on the connecting tubulae. This opinion was already criticized by Jull (1965: 224).

2. Fusion of two corallites. This process has been described on the page 317—318.

Remarks. — Dobrolyubova (1958: 139—151, pl. 18—20) distinguished 3 subspecies of *Lithostrotion junceum* being different from one another in development of columella and septa, type of tabulae, corallite diameter, and number of septa. The above-described, very high individual variability indicates that these characters should be regarded as reflecting an intra-specific or even intra-colony variability.

Occurrence. — Poland: Upper Viséan (Sudetes, Holy Cross Mts, and Lublin region). The species has been reported from the Upper Viséan of Eurasia.

Lithostrotion (*Siphonodendron*) *rossicum* Stuckenberg, 1904 emend.

Emended diagnosis. — *Siphonodendron* with 2.5 — 7 mm in corallite diameter, and (14—26) × 2 septa; 1 to 3 verticils of dissepiments, often incomplete; in some sections dissepimentarium is lacking; offsetting without aseptal stage.

Remarks. — Dobrolyubova (1958: 151—153) designated Stuckenberg's specimen (1904: pl. 8: 3*a-f*) for the holotype and gave the diagnosis of the species. The descriptions by Stuckenberg (*l.c.*) and Dobrolyubova (*l.c.*) do not differ from that of *Lithostrotion pauciradiale* as given by Hill (1938—1940: 169). However, the illustrations given by these authors indicate that an important difference, the lack or weak development of dissepimentarium in Russian specimens does occur. The present author considers this feature as the most important characteristics of *Lithostrotion* (*Siphonodendron*) *rossicum*, making it different from related species.

The type of blastogeny and presence of dissepiments make *L.* (*S.*) *rossicum* different from *L.* (*S.*) *junceum*. In structure of its dissepimentarium *L.* (*S.*) *rossicum* resembles *L.* (*S*). *succintus* Armstrong (1970: 20; fig. 27); however, these species differ in structure of septa and tabularium. In corallite size and number of septa the investigated species resembles *L.* (*S.*) *volkovae* Dobrolyubova (1958: 153—155; pl. 22: 1—3) but in contrast to the latter species, in its corallites there are fragments lacking of dissepiments.

Within the investigated species the present author has recognized three subspecies: *L.* (*S.*) *rossicum rossicum* Stuckenberg, *L.* (*S.*) *rossicum strzelcense* subsp.n., and *L.* (*S.*) *rossicum parvum* subsp.n.

Lithostrotion (*Siphonodendron*) *rossicum rossicum* Stuckenberg, 1904
(pl. 5: 2; fig. 9*a-c*; fig. 10*a-f*)

1904. *Lithostrotion rossicum* Stuckenberg: 36; pl. 8: 3*a-f*.
1958. *Lithostrotion rossicum* Stuckenberg; Dobrolyubova: 151; pl. 21 (? *non* fig. 5); fig. 26, 27.
?1960. *Lithostrotion rossicum* Stuckenber; Vassiljuk: 81; pl. 20: 1—1*d*.
1967. *Lithostrotion ?rossicum* Stuckenberg; Ivanovsky: 75; pl. 18: 3.

Material. — 11 colony fragments; 5 thin sections and 43 peels.

Diagnosis. — *Siphonodendron rossicum* with 4—7 mm in corallite diameter and (22—26) × 2 septa; at most 3 verticils of dissepiments.

Dimensions:

Specimen No.IG.1403.II.	d.c	n.smj	n.vdis
24	5.3	24	1—2
25	3.7	21	0—2
27	5.1	22	0—2
	6.2	26	0.2

Individual variability. — The range of variability is narrow, just as it is in the Russian specimens (Dobrolyubova 1958). This is especially true when considering the length of major septa and width of dissepimentarium. The major septa sometimes reach the columella. The dissepimentarium consists of 0 to 2 (seldom 3) dissepimental verticils which only exceptionally are complete. Both these characters may also very within one corallite.

Blastogeny. — In the sector of increase covering 8 septa of both orders, both the external wall and septa dilate. The minor septa attain the length of the major ones (fig. 10*a*). The dissepiments gradually disappear. Most dilated septa are disrupted

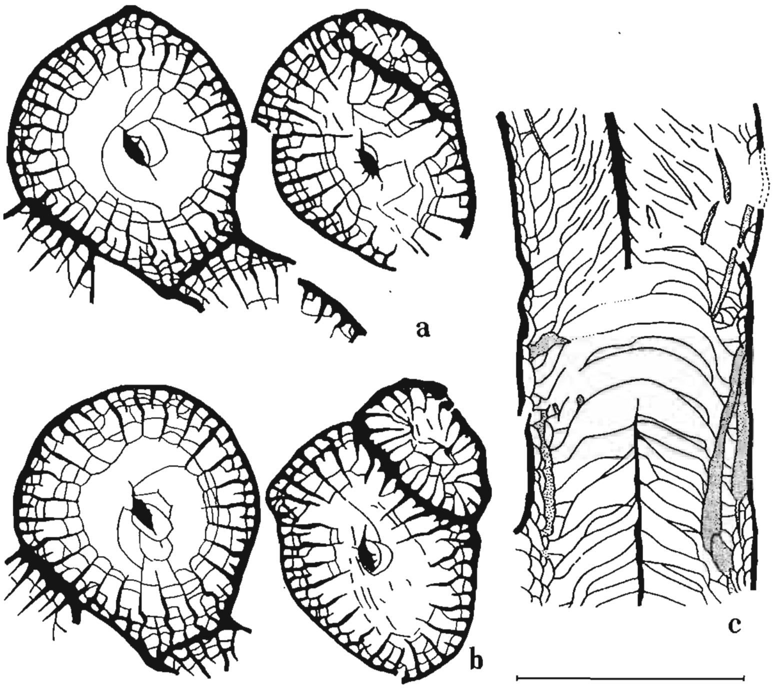


Fig. 9. *Lithostrotion* (*Siphonodendron*) *rossicum rossicum* Stuckenberg: *a*, *b* successive cross sections, *c* longitudinal section; IG-1403.II.24, borehole Tyszowce IG 1, depth 1642.4—1643.4 m.

in the area of new calice formation. Their marginal parts are inherited by the offset and transformed into its major septa, while the axial parts are retained by the parent corallite. Only one of the original parent major septa remains in the offset. Its middle part gives the origin to columella (fig. 10*b*-*f*). It seems that this septum plays a role similar to that played in ontogeny by the axial septum, i.e. the interconnected cardinal (external part) and counter septa. The neo-septa appear at first near the external wall (fig. 10*b*, *c*) and thereafter, near the new wall separating the offset from its parent (fig. 10*d*-*f*). Originally, this new wall is formed as a partition at one

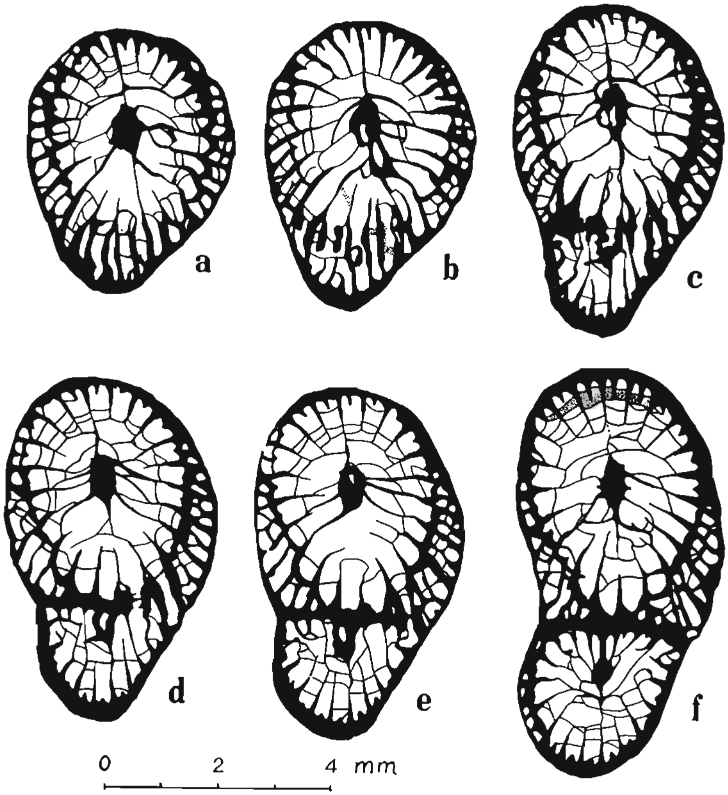


Fig. 10. *Lithostrotion* (*Siphonodendron*) *rossicum rossicum* Stuckenberg: *a-f* successive stages of blastogeny: *a*, *b* hystero-brephic stages, *c* hysteroneanic stage, *d*, *e* neanic stages, *f* late neanic stage; IG-1403.II.26A, borehole Lublin IG 1, depth 1997.5—1998.5 m.

side of the sector of increase; later on it extends across the sector (fig. 10*c-f*). The minor septa and dissepiments appear at first near the external wall. The blastogeny presented herein is entirely different from that described by Dobrolyubova (1958: 152) for *Lithostrotion* (*Siphonodendron*) *rossicum rossicum*; in fact, Dobrolyubova (*l.c.*) assumed that the separating wall originated from a dilatation of the parent internal wall, and the columella of the offset was formed at an advanced stage of its development; this statement however was not based on an analysis of serial sections.

Remarks. — The specimens of Stuckenberg (1904), and Dobrolyubova (1958) have somewhat smaller dimensions and number of septa than those from Poland.

Occurrence. — Poland: Upper Viséan (Lublin region). USSR: Upper Viséan and Namurian (Moscow Basin, Northern Urals, Kazakhstan); Lower Viséan (Donets Basin).

Lithostrotion (*Siphonodendron*) *rossicum strzelcense* subsp.n.
(pl. 2: 4; pl. 3: 1*a*, *b*, 2*a*, *b*, 3; fig. 11*a*, *b*; fig. 12*a-g*; fig. 13*a-e*)

1961. *Lithostrotion junceum* (Fleming); Zukalova: 332; pl. 4: 4—6.
1967. *Lithostrotion junceum* (Fleming); Fedorowski: 21; fig. 3.

Holotype: specimen number IG-1403.II.28; pl. 4: 1*a-c*; fig. 11*b*; fig. 13*a-c*.

Type horizon: Upper Viséan.

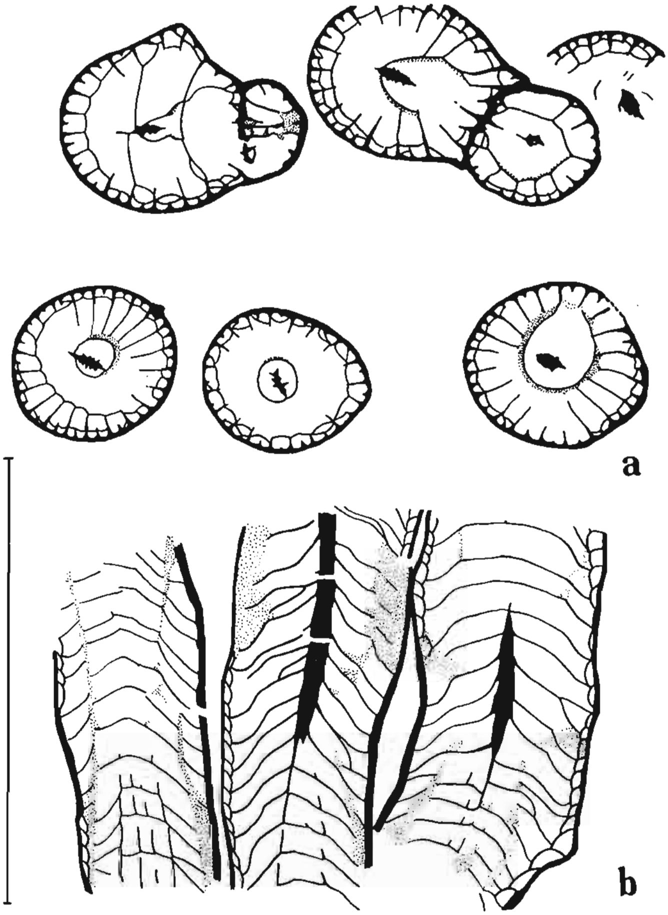
Type locality: Strzelce IG 1, depth of 561.0 m.
Derivation of the name: after the type locality.

Material. — 27 colony fragments; 18 thin sections and 78 peels.

Diagnosis. — *Lithostrotion* (*Siphonodendron*) *rossicum* with (16—24) × 2 short septa at the diameter of 3—4 mm; usually 1 incomplete verticil of dissepiments.

Dimensions:

Specimen	d.c		n.smj	n.t/10 mm
No.IG-1403.II.	ext	av		
34	2,2—3.4	3	16—18	
33	2.1—3.6	3.07	18—20	10—12
28	3.5—4.2	3.61	16	17—21
29	3.3—4.2	3.61	20—22	14—16
30	3.3—5	3.77	17—19	15
32	3.3—4.7	3.92	20	
35	3.5—5	4	20—22	
31	4 —4.7	4.36	23—24	15



a

b

Fig. 11. *Lithostrotion* (*Siphonodendron*) *rossicum strzelcense* subsp.n.: *a* colony fragment in cross section, IG-1403.II.29 borehole Strzelce IG 2, depth 810.0—811.0 m; *b* longitudinal section, holotype, IG-1403.II.28, borehole Strzelce IG 1, depth 561.0 m.

Description. — Major septa are usually short, radial, slightly dilated peripherally. They may elongate above the tabulae but they reach the columella only rarely. Two septa of the columella plane (the cardinal and counter septa) may attach to it. The minor septa are usually very short, cuneiform, often visible only in the wall microstructure. In some sections with well developed dissepimentarium, they may reach the internal wall. The columella is lense-like, dentate in outline, build up by an axial lamella and some septal lamellae attached to it. The dissepiments are rudimentary. In most cross sections there is an incomplete verticil of dissepiments (fig. 11*a*, *b*). Cross sections lacking dissepiments at all or with a complete verticil occur rarely. The occurrence of dissepiments is fairly strongly dependent upon the development of minor septa; namely, dissepiments do never develop where the minor

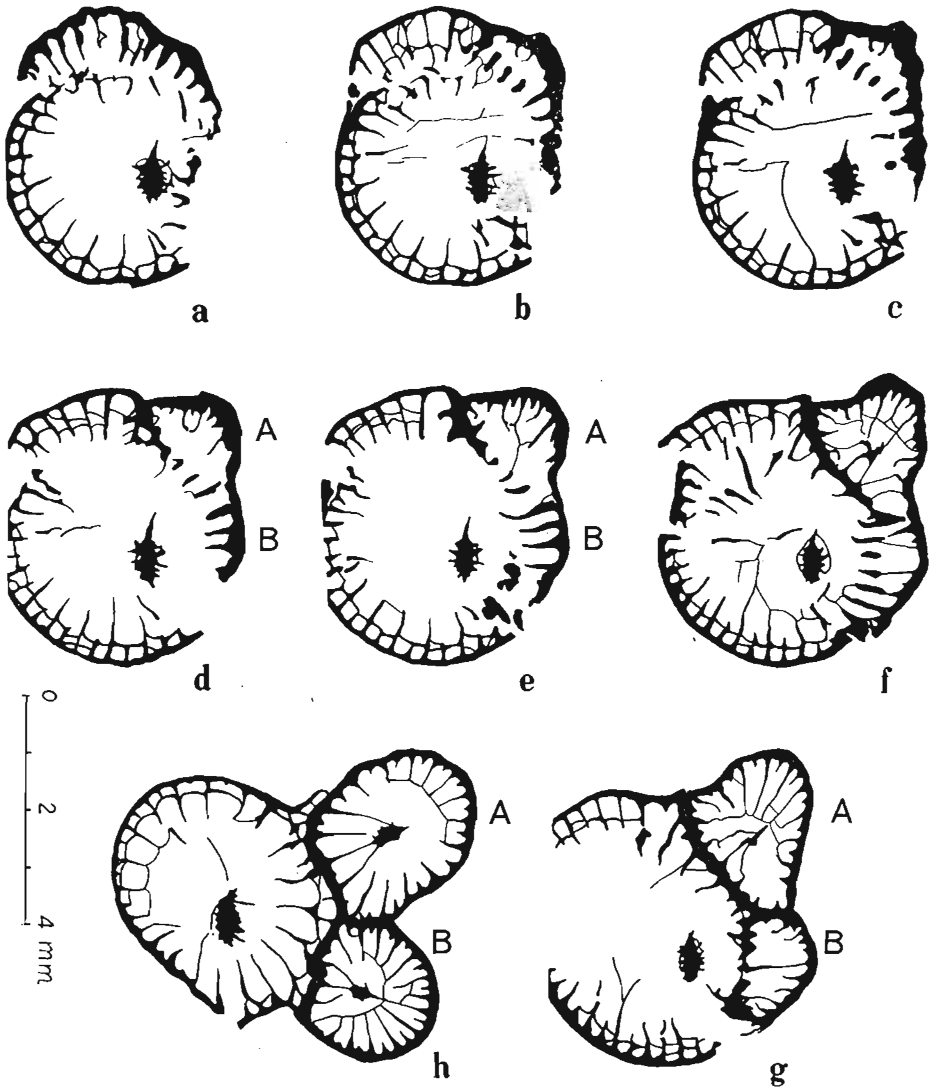


Fig. 12. *Lithostrotion* (*Siphonodendron*) *rossicum strzelcense* subsp.n.: *a-g* successive stages of blastogeny of corallites *A* and *B*; IG-1403.II.30B, borehole Ulhówek IG 1, depth 1672.3—1673.3 m.

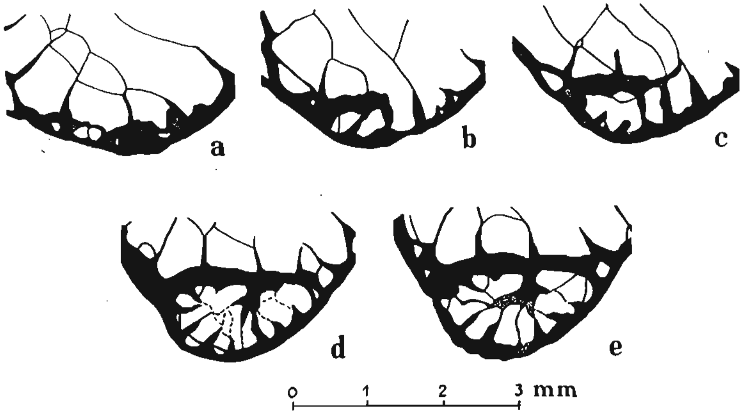


Fig. 13. *Lithostrotion* (*Siphonodendron*) *rossicum strzelcense* subsp.n.: *a-e* successive stages of blastogeny: *a* initial hystero-brephic stage, *b*, *c* hystero-brephic stage, *d*, *e* neanic stage; IG-1403.II.28, holotype, borehole Strzelce IG 1, depth 561.0 m.

septa are absent, and only sporadically occur where they are short. With respect to the occurrence of dissepiments the frequency distribution of corallites of 8 investigated colonies (IG-1403.II.28 — 35) is as follows:

corallites lacking dissepiments	20.5%
corallites with more than one half a verticil	27.5%
corallites with less than one half a verticil	43.0%
corallites with a complete verticil	9.0%

In a longitudinal section, the dissepiments appear and disappear at various stages of corallite development (pl. 3: 1*a*, *b*); in some corallites they occur only sporadically (pl. 3: 2*a*, *b*). The tabulae are usually complete, tent-shaped, often peripherally concave; most commonly they are from 12 to 18 per 10 mm. The peripheral tabellae occur rarely, and the axial ones only sporadically (fig. 11*b*). The internal wall is slightly dilated. Thickness of the external wall seems to be correlated with the occurrence of dissepiments. Where the dissepiments do occur the wall is 0.05—0.1 mm thick; its thickness is 0.1—0.22 mm where dissepiments are lacking (pl. 3: 1*b*, 2*b*; fig. 11*b*).

Individual variability. — Inter-colony variability concerns corallite distribution and size, and the length of major septa. Very short septa occur in the specimen IG-1403.II.30 (pl. 3: 3). In that specimen the septa exceptionally join the columella. Very high ontogenetic, intra- and inter-colony variability is exhibited by the dissepimentarium development. In some colonies the dissepiments occur sporadically resulting in a close similarity of these colonies to *Lithostrotion* (*Siphonodendron*) *junceum*, in others most corallites possess at least half a verticil of dissepiments what makes them very similar to the *Lithostrotion* (*Siphonodenderon*) *pauciradiale*. Colonies of intermediate type also occur.

Blastogeny. — In the sector of increase the external wall and 5—6 septa of both orders dilate (fig. 12*a-f*, offset A), and the minor septa elongate to attain the length of major septa. In the further development the septa become interrupted in their middle parts (fig. 12*b*, *c*, offset A), and thereafter, their internal parts form the septal pinnacles. Gradually, these pinnacles fuse laterally to form the common wall (partition). The wall may originate either at the one side of the sector of increase (fig. 12*d*, *c*, offset A) or at the both sides of it (fig. 12*g*, offset B). The offset starts to develop neo-septa of both orders close to the external wall even before formation of the partition. At the beginning the cardinal septum is short and thick; it is set at the external wall. Later on it elongates rapidly to join the counter septum forming the columella.

Apart from the above-described process of offsetting, a simplified offsetting was also observed in the holotype (fig. 13*a*-*c*). In the sector of increase covering originally one major and one minor septum, the dissepimentarium dilates; it is transformed into a wall separating the inception of offset calice from the parent calice (fig. 13*a*). The wall expands towards an adjacent major septum of the parent. The young indiviual inherits the continuous but shortened septa of its parent (fig 13*b*, *c*) and produces the neo-septa at the new wall (fig. 13*d*, *e*). In no one corallite the offset comes through an aseptal stage, typical of *L.* (*S.*) *junceum*, although, from the beginning of its development the sector of increase forms a protuberance.

Remarks. — From the nominative subspecies the new subspecies differs mostly in the rudimentary development of dissepiments which only exceptionally form two verticils; furthermore, the septa (especially the minor ones) are shorter. From *L.* (*S.*) *rossicum parvum* subsp. n. it can be distinguished by its larger size, more numerous and shorter septa, and weak development of a dissepimentarium. Because of the rudimentary dissepimentarium the specimens described by Zukalova (1961; pl. 4: 4—6) and Fedorowski (1967: 21; fig. 3) as *Lithostrotion junceum* are here assigned to *L.* (*S.*) *rossicum strzelcence* subsp.n.

Occurrence. — Poland: Upper Viséan (Sudetes and Lublin region). Czechoslovakia: Lower Carboniferous.

Lithostrotion (*Siphonodendron*) *rossicum parvum* subsp. n.

(pl. 4: *1a*-*d*; fig. 14*a*, *b*)

Holotype: specimen number IG-1403.II.36; pl. 4: 1*a*-*d*; fig. 14*a*, *b*.

Type horizon: Lower Namurian.

Type locality: Strzelce IG 1, depth of 437 m.

Derivation of the name: Lat. *parvus* — small; from small size of the corallites.

Material. — One colony fragment; 2 thin sections and 8 peels.

Diagnosis. —*Lithostrotion* (*Siphonodendron*) *rossicum* with 2 - 3.5 mm in diameter and (15—16) × 2 long septa; at most 2 verticils of dissepiments.

Dimensions:

Specimen	d.c		n.smj	vdis
No.IG-1403.II	ext	av		
36e	2.4—2.7	2.56	15—16	0—2
36a	2.2—3.1	2.61	15—16	0—2
36c	2.6—2.9	2.71	14—15	1—2
36b		3.3	15	1—2

Description. — Corallites 2.7 mm in average diameter may form chains. Major septa are thin, slightly dilated at the bases. Where dissepiments are lacking they are thicker. Minor septa are short. Usually they reach the internal wall but they seldom cross it becoming much shorter where dissepiments are lacking. In cross section the columella is lense-like, often attached to the cardinal and counter septa, rarely to one of them. The dissepimentarium consists usually of 1—2 verticils of small dissepiments; however, it often covers corallite perimeter only partly. The tabulae are domed, from 20 to 22 per 10 mm. Several peripheral tabellae occur.

Blastogeny. — Blastogeny has not been investigated in detail. In the sector of increase the septa of both orders dilate, and the internal wall disappears (pl. 4: 1c). Even at the hystero-neanic stage the offset is entirely enclosed in the calice of

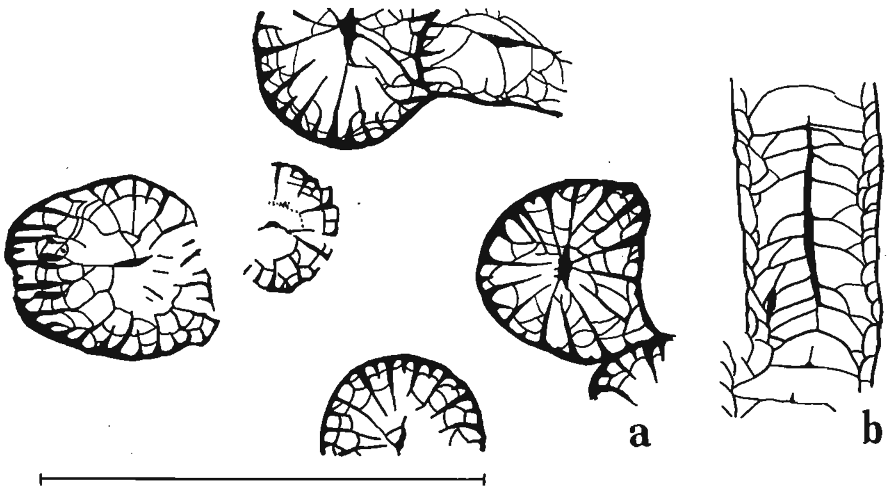


Fig. 14. *Lithostrotion* (*Siphonodendron*) *rossicum parvum* subsp.n.: *a* colony fragment in cross section, *b* longitudinal section of a corallite; IG-1403.II.36, holotype, borehole Strzelce IG 1, depth 437.0 m.

parent corallite which does not form any protuberance (pl. 4: 1*b*). The wall of a dividing-wall type (?) appears at a one side of the sector of increase and expands gradually to the other side.

Remarks. — From the nominative subspecies the discussed subspecies differs in its much smaller corallite diameter, and its longer but less numerous septa. From *L.* (*S.*) *rossicum strzelcense* subsp.n. it differs also in the occurrence of 2 verticils of dissepiments.

Occurrence. — Poland: Lower Namurian (Lublin region).

Lithostrotion (*Siphonodendron*) *volkovae* Dobrolyubova, 1958

(pl. 5: 3, 4; fig. 15*a-e*)

1958. *Lithostrotion volkovae* Dobrolyubova: 153; pl. 22: 1, 2; fig. 28.
1966. *Lithostrotion volkovae* Dobrolyubowa; Bikova: 134; pl. 21: 6, 7.

Material. — 15 poorly preserved colony fragments; 3 thin sections and 53 peels.

Diagnosis. — See Dobrolyubova 1958: 153—154.

Dimensions:

Specimen	d.c		n.smj	n.vdis
No.IG.1403.II.	ext	av		
38	3.3—3.8	3.40	19	1—2
40	2.9—4.3	3.76	20—22	1—2
39	4.1—4.8	4.45	20	1—2
42	4.5—5.	4.88	21—22	1—2
37	5.5.—5.8	5.67	23	1—2

Blastogeny. — The sector of increase consisting of 7 dilated septa of both orders forms a protuberance. Minor septa are contratingent (fig. 15*a*). The internal parts of septa dilate and separate from the peripheral parts forming septal pinnacles with the parent septa settled thereon. In the common parent/offset area the integrated septal pinnacles form a partition (fig. 15*b*, *c*). Only one of the parent septa remains continuous in the offset. This septum corresponds to the axial septum occurring in ontogeny. Its axial part dilates to form columella, while the internal one has a share in the partition (fig. 15*b*, *c*). Peripheral parts of the parent septa are inherited by the offset.

Remarks. — In their size and number of septa the Lublin specimens resemble those known from the USSR. However, they exhibit less verticils of dissepiments, a fairly constant number of septa, and a higher variability in corallite diameter. The

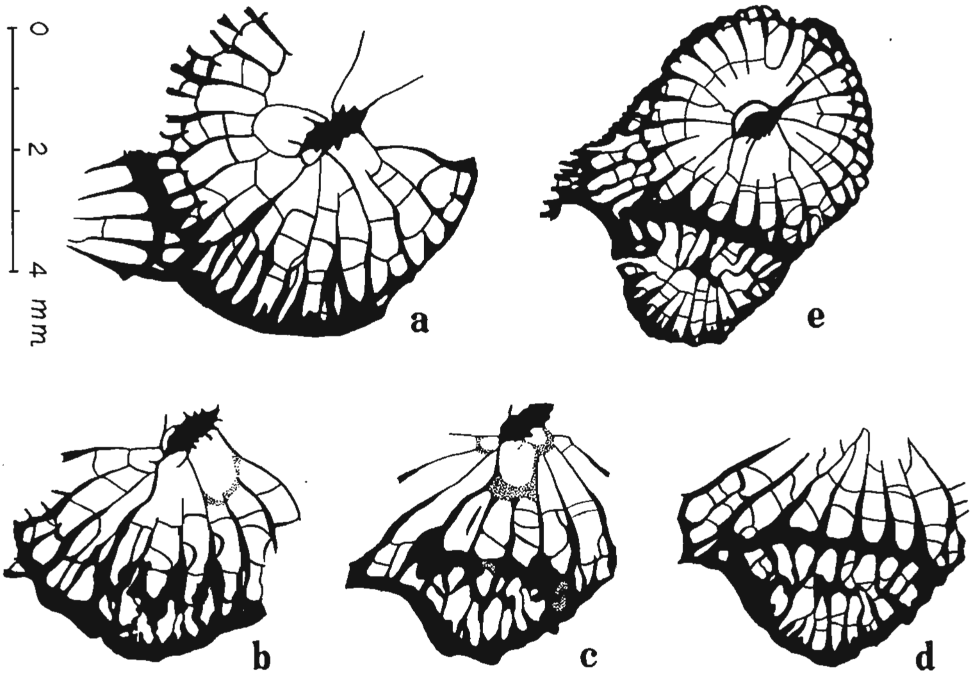


Fig. 15. *Lithostrotion* (*Siphonodendron*) *volkovae* Dobrolyubova: *a-e* successive stages of blastogeny: *a* initial stage, *b*, *c* hystero-neanic stage, *d* neanic stage, *e* late neanic stage; IG-1403.II.37, borehole Bychawa IG 1, depth 1743.7—1744.7 m.

characters making the discussed species different from *L.* (*S.*) *rossicum* have already been considered above.

Occurrence. — Poland: Upper Viséan (Sudetes and Lublin region). USSR: Lower Carboniferous (Russian Platform); Viséan-Namurian (Eastern Kazakhstan).

Lithostrotion (*Siphonodendron*) cf. *martini* Milne-Edwards & Haime, 1851

(pl. 4: 2*a*, *b*; pl. 5: 1 *a*, *b*; fig. 16*a*-1)

Material. — 13 poorly preserved colony fragments; 9 thin sections and 68 peels.

Dimensions:

Specimen No.IG-1403.II.	d.c ext	d.c av	n.smj	n.vdis
49	5.2—6.5	5.46	21—25	1—3
50	5.7—6.0	5.8	23—24	1—4
44	4.7—6.3	5.52	23—25	1—3
48	5.3—6.3	5.95	22—24	2—3
45	6.4—7.6	6.66	26—27	2

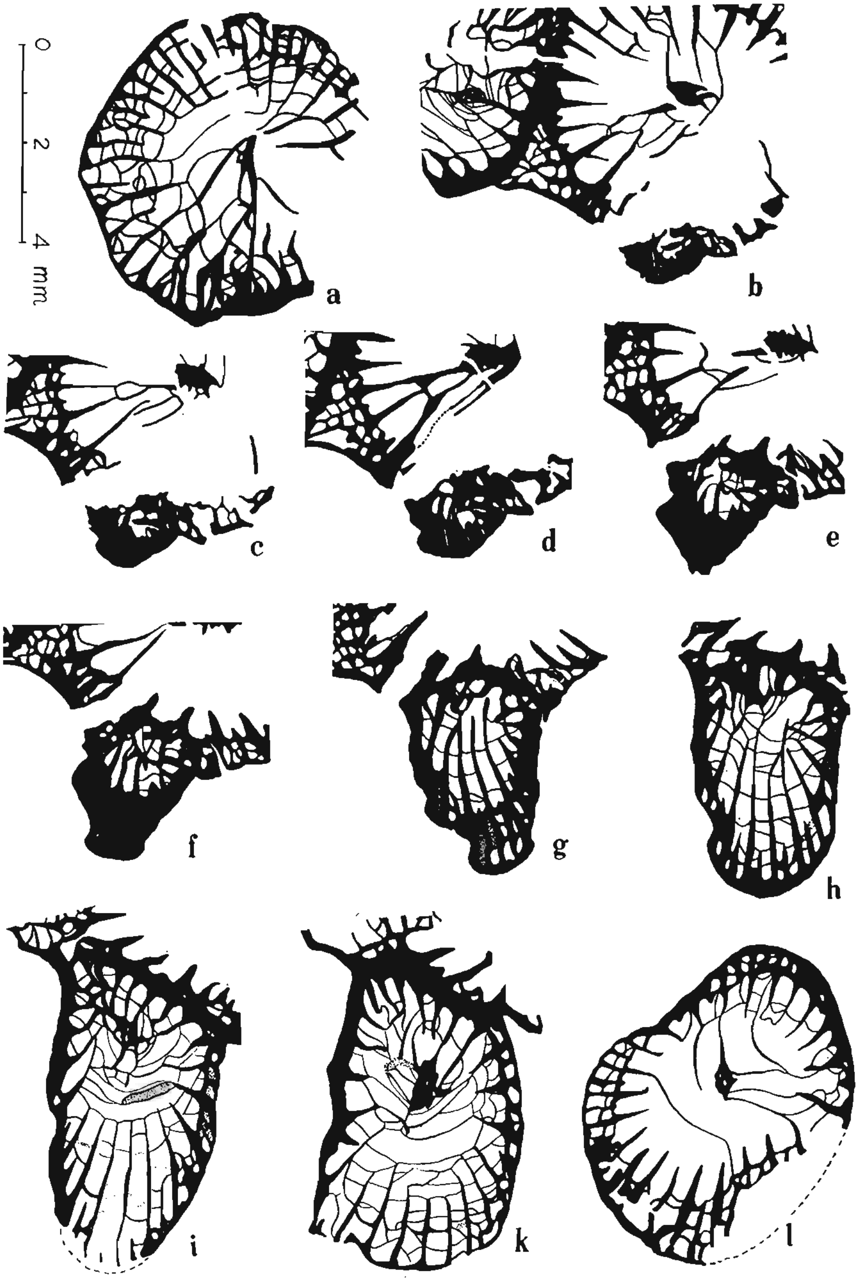


Fig. 16. *Lithostrotion* (*Siphonodendron*) cf. *martini* M. Edwards et Haime: *a-l* successive stages of blastogeny: *a-c* hystero-brephic stage, *d*, *e* hystero-neanic stage, *f-i* neanic stage, *k* late neanic stage, *l* early ephebic stage; IG-1403.II.46, borehole Bychawa IG 1, depth 1743.7—1744.7 m.

Description. — Major septa are long, but only a few of them reach a columella. They are dilated to a various extent within the tabularium. Minor septa attain 1/3—1/2 the length of major septa and usually cross the internal wall; they are thinner than the major ones. In a few instances the minor septa end within the dissepimentarium. The cardinal and counter septa may attach to the lense-like columella. The dissepimentarium consists of 1—4 (most commonly 1—3) verticilis of dissepiments varying in size, and it reaches approximately 1/3 the coralite radius in width. The number of verticils may vary even in the individual (pl. 4: 2*b*). Tabulae from 7 to 15 per 5 mm. They are raised up near the columella, being either S-shaped (pl. 4: 2*b*) or vertically declined at the internal wall and resting on those lying beneath. Several horizontal tabellae occur between the internal wall and axial tabulae. The internal wall is dilated, often thickner than the external wall.

Blastogeny. — In the sector of increase the external parts of septa of both orders distinctly dilate to form septal swellings, while the internal wall disappears. The external portions of parent septa are inherited by the young individual. Most of them shorten or even disappear (fig. 16*b*) a single one (probably the cardinal septum) remaining long. The septal pinnacles are formed in the area common for the parent and offset, and one of the peripheral, dilated septa shares in formation of the partition (fig. 16*b*, *c*). Later on (fig. 16*d-f*) this septum joins the septal pinnacles which results in an expansion of the partition formed at the level of the parent internal wall. At one side of the partition the parent neo-septa and at the other a single offset septum appear (fig. 16*d-f*). This particular offset septum is probably the counter septum (fig. 16*d*). The columella is formed fairly late (fig. 16*h*); it originates from the joined cardinal and counter septa but it is more closely related to that one occurring near the partition (fig. 16*i-l*). The first minor septa and dissepiments appear near the old external wall.

Remarks. — Dobrolyubova (1958) assigned to *Lithostrotion caespitosum* (Martin, 1793) several morphologically variable specimens. However, the name *L. caespitosum* cannot be accepted for anyone of these specimens since due to the decision of ICZN all the names introduced by Martin in 1793 and 1809 should be abanoned. The present author assigned some of the specimens of Dobrolyubova (*l.c.*, pl. 23: 1—5; pl. 33: 2) to *Lithostrotion* (*Siphonodendron*) *dobrolyubovae* sp. n.: all the other (*l.c.*, pl. 22: 3*a*, *b*) are assigned here to *L.* (*S.*) cf. *martini* because they seem to be most similar to that species.

The present author agrees with Dobrolyubova (*l.c.*) and Fedorowski (1968: 214) that "*Lithostrotion* (*S.*) *caespitosum*" cannot be included into the synonymy of *Diphyphyllum furcatum* Thomson, 1887, as it was suggested by Hill (1938–1941: 185—186).

Occurrence. — Poland: Upper Viséan (Lublin region).

Lithostrotion (*Siphonodendron*) *affine* (Fleming, 1828)

(pl. 4: 3*a-d*: fig. 17*a-d*)

1938—1941. *Lithostrotion proliferum* (Thomson & Nicholson); Hill: 174, pl. 9: 11—14 (*cum synon*).

1958. *Lithostrotion proliferum* (Thomson & Nicholson); Dobrolyubova: 158; pl. 24.

1966. *Lithostrotion profiferum* (Thomson & Nicholson); Dobrolyubova, Kabakovitsh: 160; pl. 31: 2—5.

1971. *Siphonodendron affine* (Fleming); Kato: 5; pl. 1.

Material. — One colony fragment; 24 peels.

Diagnosis. — See Hill 1938—1941: 175.

Dimensions (in the order of developmental stages: i, f, c — offset; v, p — pre--offseting individual):

Specimen No.IG-1403.II.	d.c	n.smj	l(av) smj	l(av) smn	n.vdis
51v	8.55	27	2.55	1.23	2—4
p	8.55	27+1	2.88	1.17	2—5
i	4.50	24	0.9	0.46	
f	5.8	26	1.08	0.55	0—2
c	7.25	27	1.58	0.6	1—3
f	6.7	28	2.15	1.06	1—4
b	8.1	28	1.75	0.97	2—5

Blastogeny. — The lateral increase has been investigated only fragmentarily (fig. 17*a-d*). The septa of both orders and the external wall dilate; at the same time the dissepiments disappear. Later on the dilated septa are interrupted in the part corresponding to the offset calice. Their internal parts are transformed into septal pinnacles. The external, inherited parts of septa remain in the form of denticles. The further development could not be investigated.

Remarks. — Compared to the lectotype (Kato 1971: 5-6, pl. 1), the specimen from Tyszowce exhibits smaller diameter and fewer verticils of dissepiments. The length of its major septa is variable. In most sections the major septa attain one-half the radius in length; some of them almost reach the columella. Minor septa are long, occasionally crossing the internal wall. The tabular parts of septa, the internal wall and the columella are slightly thickened. There are 2—5 (mostly 3—4) verticils of

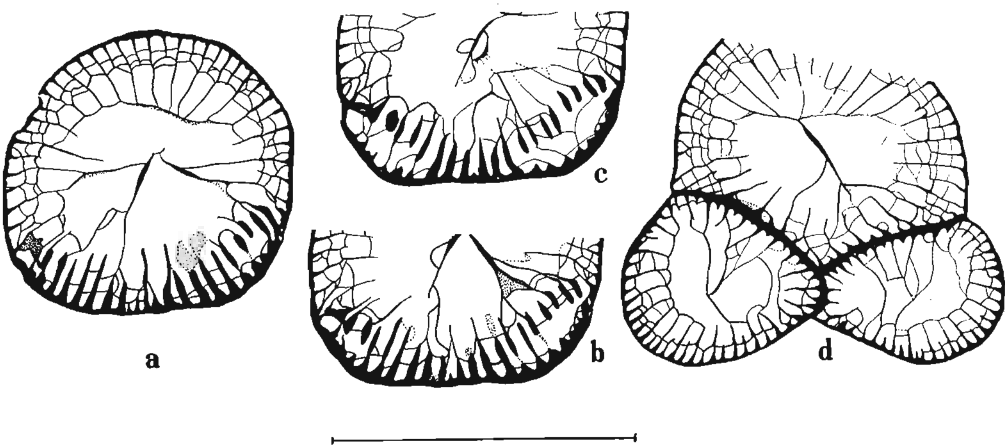


Fig. 17. *Lithostrotion* (*Siphonodendron*) *affine* (Fleming): *a-d* successive stages of blastogeny; IG-1403.II.51, borehole Tyszowce IG 1, depth 1753.2—1754.2 m.

dissepiments. Kato (1971: 6) considered the short minor septa for the most important character of *Siphonodendron affine*. However, according to the illustration of lectotype (*l.c.*, pl. 1: *a*) the minor septa in some corallites almost reach the internal wall. The specimens described by Dobrolyubova (1958: 158—160, pl. 24) as *Lithostrotion proliferum* (Thomson & Nicholson), are assigned in the present study to *L.* (*S.*) *affine* despite their long minor septa and thickened columella. The columella thickness often exhibits an individual variability within the genus *Lithostrotion*.

Occurrence. — Poland: Upper Viséan (Sudetes ? and Lublin region). Scotland, USSR (Russian Platform): Lower Carboniferous.

Lithostrotion (*Siphonodendron*) *dobrolyubovae* sp.n.
(pl. 6: 1, 2*a*, *b*, 3, 6; fig. 18*a-e*; fig. 19*a-f*; fig. 20; fig. 21: A *a-i*, B *a-d*; fig. 22*a-c*)

1958. *Lithostrotion caespitosum* (Martin); Dobrolyubova: 155, pl. 23: 1—5; pl. 33: 2; non pl. 22: 3a, b.
?1960. *Diphyphyllum lateseptatum* McCoy; Vassiljuk: pl. 23: 2.

Holotype: specimen number IG-1403.II.52; pl. 7: 2*a*, *b*; fig. 18*b*.
Type horizon: Upper Viséan.
Type locality: Korczmin IG 1, depth of 1167.2 — 1168.2 m.
Derivation of the name: in honour of the late Dr. T. A. Dobrolyubova.

Material. — 21 colony fragments; 10 thin sections and 122 peels.

Diagnosis. — *Siphonodendron* 5 — 11 mm in diameter with (20 — 36) × 2 septa distinctly dilated within the tabularium; cardinal septum (sometimes the counter septum) shortened columella thin, sometimes interrupted; 2 — 5 dissepiment verticils; tabulae steeply uprising; axial increase.

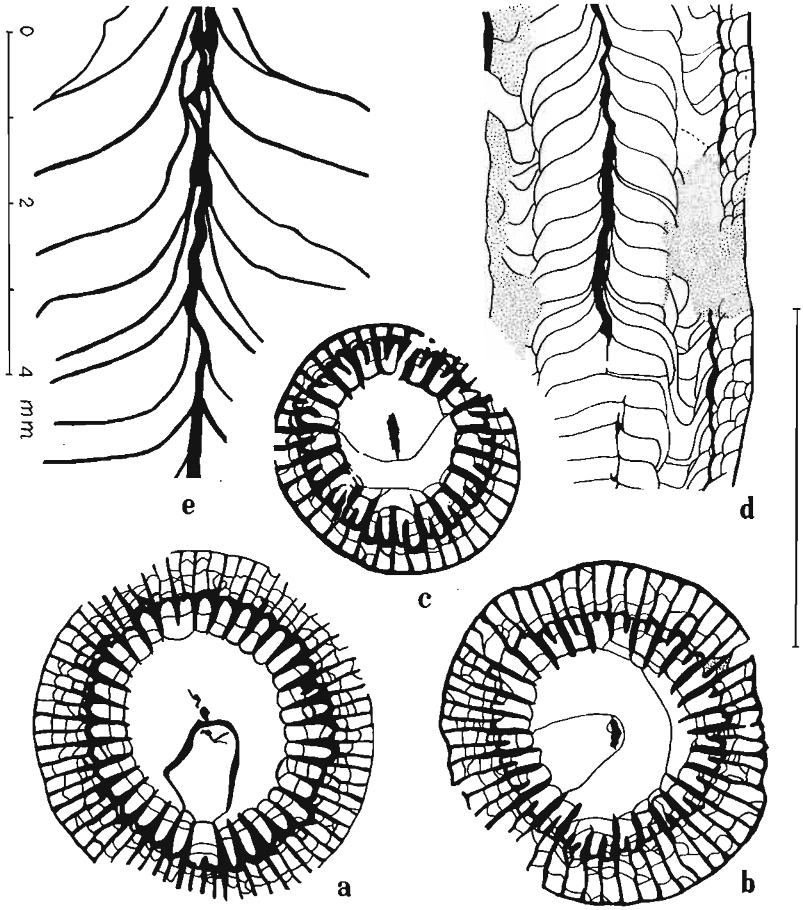


Fig. 18. *Lithostrotion* (*Siphonodendron*) *dobrolyubovae* sp.n.: *a* cross section, IG-1403. II.59; *b* cross section, holotype, IG-1403.II.52; *c-e* specimen IG-1403.II.60: *c* cross section, *d* longitudinal section, *e* longitudinal section of the axial structure. All specimens from the borehole Koczmin IG 1, depth 1167.2—1168.2 m.

Dimensions:

Specimen No.IG-1403.II.	d.c ext	d.c av	n.smj	s.vdis	nt/5 mm
57	4.9—6.7	5.68	21—23	1—4	9—10
56	4.6—7.7	5.72	21—15	2—4	
54	4.9—11.2	6.32	20—25	2—5	7—9
58	5.9—7.2	6.46	24—29		
62	6.9—8.6	7.8	24—29	1—3	5
61	5.8—10	8.25	25—34	1—4	5—7
63	7.0—10.2	8.59	28—36	2—4	6—8
55	4.4—10.8	9.8	26—27	2—4	10—12

Description. — Major septa, almost equally long, attain one-half the radius in length. They are distinctly dilated within the tabularium, especially so close to the dissepimentarium. The stereoplasmatic thickening is restricted to the internal wall (pl. 6:6; fig. 18*a*, *c*). The axial ends of major septa are often united by tabulae (fig. 18*a*). In most corallites the cardinal septum is shortened, sometimes down to half the length of the adjacent septa (pl. 6: 2*b*; fig. 18*c*). The counter septum may be also shortened (fig. 18*a*, *b*). The cardinal fossula occurs in many corallites (fig. 18*a*). The length of minor septa is variable. At the later developmental stages the minor septa hardly reach the internal wall (fig. 18*a*), whereas at the early stages they cross that wall and may attain 3/4 the length of major septa (fig. 18*b*, *c*); in the latter case, they are dilated within the tabularium. The columella is thin and elongate, someti-

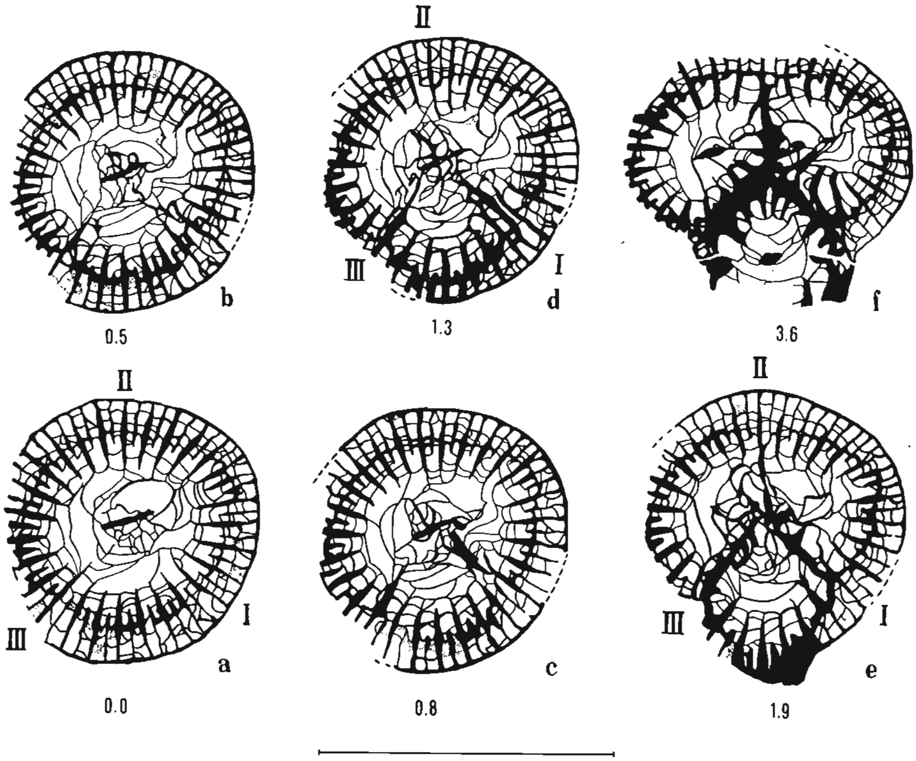


Fig. 19. *Lithostrotion* (*Siphonodendron*) *dobrolyubovae* sp.n.: *a-f* successive stages of blastogeny; different types (*I*, *II*, *III*) of partition; IG-1403.II.58A, borehole Koczmin IG 1, depth 1166.6—1167.2 m. Numbers below figures are cumulative distances of distal growth in mm.

mes rudimentary or interrupted (fig. 18*d*). In a few corallites it is lense-shaped. It is connected with the cardinal and counter septa only exceptionally. The width of dissepimentarium reaches aproximately 1/4 the corallite radius: the dissepimentarium consists of 2—5 dissepiment verticils, the largest dissepiments occurring at the periphery. The tabulae are steeply uprising towards the columella (pl. 6: 2*a*; fig. 18*d*, *e*), resembling somewhat those in the genus *Rozkowskia* (Fedorowski, 1970: 605—609; fig. 23, 24). The external part of tabularium is occupied with the concave tabellae. The internal wall is well developed.

Individual variability. — Within particular colonies the corallites vary in size

Fig. 20. *Lithostrotion* (*Siphonodendron*) *dobrolyubovae* sp.n.: axial increase with three offsets developing simultaneously; *I*, *II* walls presented in fig. 1997.5—1998.5 m.

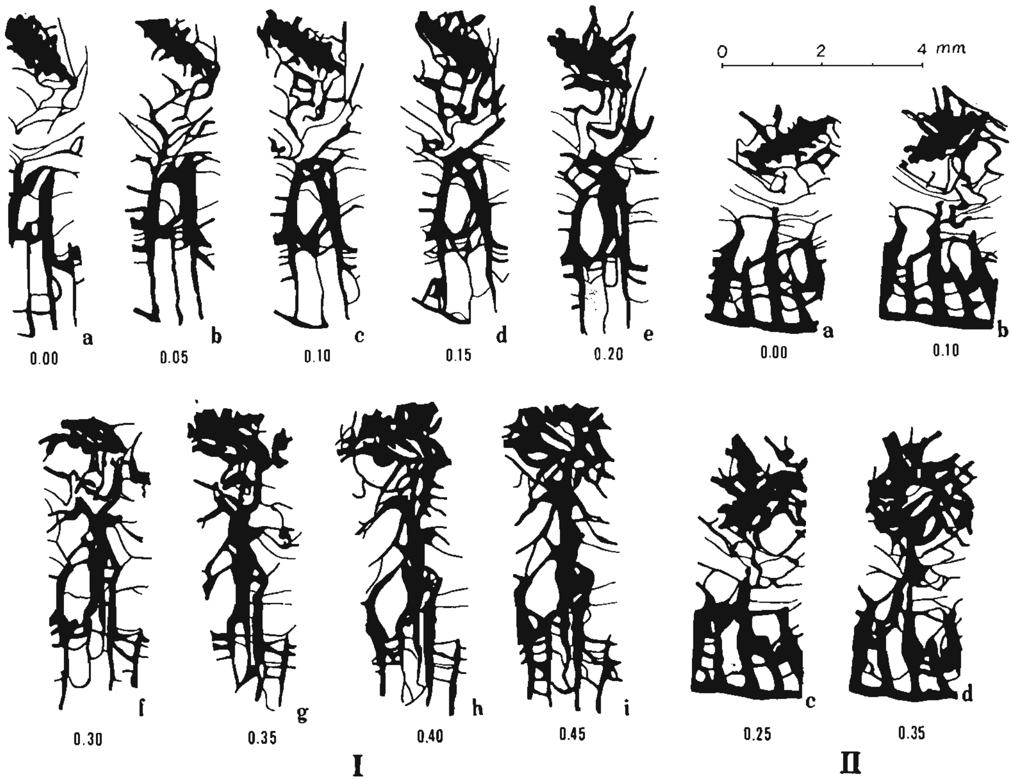


Fig. 21. *Lithostrotion* (*Siphonodendron*) *dobrolyubovae* sp.n.: *I a-i*, *II a-d* development of wall of a partition type; the same specimen as in fig. 20. Numbers below figures are cumulative distances of distal growth in mm.

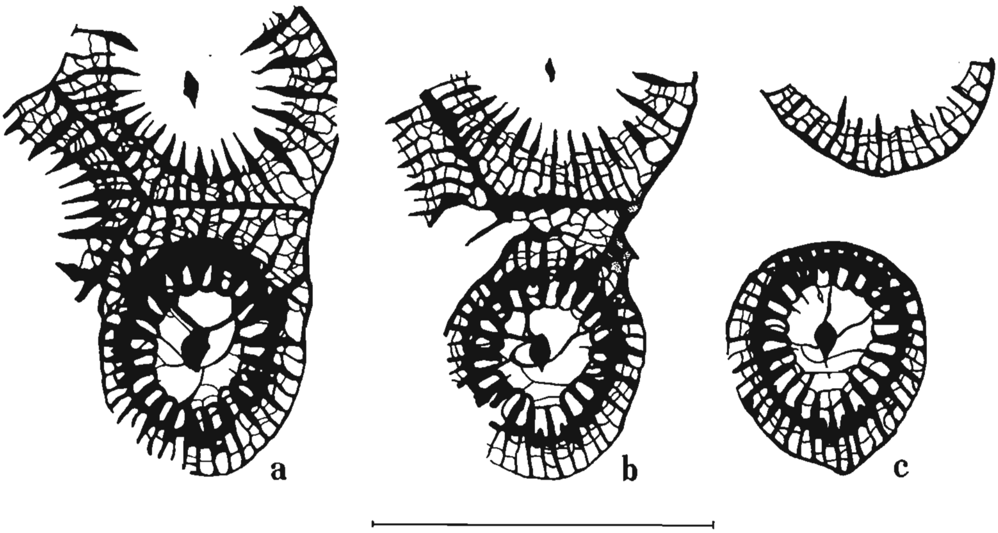


Fig. 22. *Lithostrotion* (*Siphonodendron*) *dobrolyubovae* sp.n.: *a-c* successive sections of an offsetting corallite; IG-1403.II.56, borehole Lublin IG 1, depth 1997.5—1998.5 m.

and number of septa. Morphologically all the specimens described herein are very similar to each other. They exhibit variability in the length of cardinal septum, sometimes in shortening of counter septum, and in the length of tabular parts of the minor septa (fig. 18).

Blastogeny. — An axial increase is typical of this species. It has been observed in 15 corallites belonging to 10 colonies. Three offsets always arise simultaneously from a parent corallite (figs 19,20). Walls separating the young corallites are of partition type. Three distinct ways of their formation have been observed:

1° One of the major septa dilates gradually, elongates towards the columella and reaches it to form a wall as in *Stauria* (fig. 19*a-f*, septum C); 2° One of the major septa expands axially to join a corresponding septal lamella in the columella (fig. 19*a-e*, septum B; fig. 21B *a, b*); 3° The tabular parts of 2 major septa dilate and coalesce axially (fig. 21A *a, b*). The axial part of one of these septa splits longitudinally; the separated fragment plays the role of a partition (fig. 21A *c, d*), while the other remains as a major septum in an adjacent offset. Initially, this part of the partition seems to be a continuation of a minor septum (fig. 21A *e*). Later on it thickens and expands axially and peripherally to form a complete partition (fig. 21A *f-i*). Independently of the offsetting type, the partitions always fuse at the place formerly occupied by the parent collumella. Before its complete disappearance the columella thickens and thereafter splits into irregular lamellae (fig. 19*b-e*). During the formation of partition the parent almost stops growing (fig. 20). A part of a parent external wall and some of the septa are inherited by the offset; the neo-septa are produced by the offset only close to the partition. The offset columella is monoseptal; it appears early in blastogeny, and originates from a neo-septum (fig. 19*d, e*). It may attach to an atavo-septum later on (fig. 19*f*). Rather commonly some offsets die before attaining maturity. Within such a partly dying colony a young individual abandons the external part of the common skeleton adjacent to partition, and produces a new wall by thickening and fusing the dissepiments (fig. 22*b, c*). A similar process of increase was recognized by Dobrolyubova (1958: 190, pl. 32: *1a, b*, 3, *6a, b, d, e, 7a, b*) in *Diphyphyllum fasciculatum*; it was also observed (Dobrolyubova *l.c.*, pl. 25: *1a*) in *Lithostrotion scoticum*.

Remarks. — The investigated specimens resemble very closely those described by Dobrolyubova (1958: 155—158, pl. 23; pl. 33: 2) as *Lithostrotion caespitosum* (Martin 1793). Their cardinal septum and sometimes the counter septum are shortened. They exhibit a well developed tabular cardinal fossula and a monoseptal columella. All this makes them different from all the other species of *Lithostrotion* (*Siphonodendron*). An axial increase is an important diagnostic character since it has been observed solely in this species and some closely related ones. In most species of *Lithostrotion* (*Siphonodendron*) colonies are formed by means of a lateral increase.

The specimens described by Vassiljuk (1960: 92—93, pl. 23: 2) as *Diphyphyllum lateseptatum* McCoy exhibit the well developed columella; in some of them the cardinal septum is shortened.

Occurrence. — Poland: Upper Viséan (Lublin region). USSR: Viséan (Russian Platform), Upper Viséan (Donets Basin).

Genus *Diphyphyllum* Lonsdale, 1845

Diagnosis. — See Hill 1956: F 283.

Remarks. — The holotype of the type species, *Diphyphyllum concinnum* Lonsdale, 1845, was for long regarded as lost (see Hill 1938—1941: 180). Therefore, Smith & Lang (1930: 180) revised the genus after another species *Diphyphyllum lateseptatum* McCoy, 1849. However, Dr. Wise, British Museum (Natural History), has recently found the Lonsdale's specimen; at present, he is preparing a description of this specimen (*in litt.*).

A taxonomic separatteness of the genus *Diphyphyllum* is contestable. Dr. J. R. Nudds (*in litt.*) in his revision of the British representatives of the family Lithostrotionidae has recognized within the genus *Lithostrotion* 3 groups of species: 1. *Lithostrotion* with columella, 2. forms with a weakly developed axial structure, and 3. forms with columella lacking. Thus, the latter group corresponds to the genus *Diphyphyllum.*

The present author is of the opinion that almost all species of *Diphyphyllum* can be paralleled with respective species of *Siphonodendron*; e.g. *D. simplex* can be paralleled with *L.* (*S.*) *junceum*, *D. lateseptatum* with *L.* (*S.*) *martini* etc. Dobrolyubova (1958) noticed that some corallites of *Diphyphyllum lateseptatum* are different from *Lithostrotion caespitosum* (*sensu* Dobrolyubova 1958) only in that they possess a columella. Despite these obvious similarities *Diphyphyllum* is in the present study regarded as a distinct genus; it differs from *Siphonodendron* first of all in the lack or very weak development of columella, and in the structure of tabulae.

Diphyphyllum simplex (Thomson, 1887)
(pl. 5: 5*a*, *b*; fig. 23: A*a*-*g*, B*a*-*g*)

1958. *Diphyphyllum simplex* Thomson; Dobrolyubova: 183, pl. 29, pl. 30 (*cum synon.*).

Material. — 17 colony fragments; 2 thin sections and 45 peels.

Dimensions:

Specimen No.IG-1403.II.	d.c ext	d.c av	n.smj	n.t/5mm
69	1.6—1.8	1.7	14	8
68	1.5—1.9	1.72	12—14	8—9
64a	1.5—2.2	1.88	15—16	7—12
b	1.7—2.4	2.22	14—16	6—7
e	1.9—2.6	2.28	15—16	10
d	2.0—2.6	2.31	16	

Intra-colony variability. — One colony fragment from Korczmin (IG-1403.II.65) has been studied in detail; its height is 15 cm, the diameter is 16 cm. The corallites lacking columella or with weakly developed one occur along with the corallites exhibiting well developed columella. The proportions of these corallite types are as follows:

part of colony	examined corallites	columella lacking	columella >0.1×0.35 mm	columella <0.2×0.4 mm
lower	244	117	107	1
upper	327	147	102	24

An occurence of columella is usually correlated with a better development of the minor septa (fig. 23B*a-g*) and a higher density of tabulae. The corallites without columella exhibit 6—7 tabulae per 5 mm; while those possessing a columella have 9—12 tabulae per 5 mm. The shape of tabulae is variable, but flat-topped domes (pl. 5: 5*b*) prevail.

Blastogeny. — Two specimens from the colony IG-1403.II.64 (derived from Korczmin) have been studied in detail; one of them with a distinct columella, the other one with columella lacking.

The specimen with columella present (fig. 23B*a-g*): 5 septa of both orders dilate, thereafter, the external wall of the parent thickens, in the sector of increase (fig. 23B*a-c*). The minor and major septa become equal in thickness and length. Next, they separate from the external wall, and shorten to form septal pinnacles (fig. 23B*d*). The partition is formed close to the parent wall and it gradually covers more and more septal pinnacles (fig. 23B*e-g*). The first offset septum appears even before the offset separation (fig. 23B*e, f*). Thus, no aseptal stage develops after the wall is closed; it can only be observed very early at the hystero-brephic stage (fig. 23B*d*). In this particular feature the blastogeny of *Diphyphyllum simplex* with columella present, differs from that of *L.* (*S.*) *junceum.*

The specimen with columella lacking (fig. 23A*a-g*): the process of increase resembles closely that one described above. However, the external wall is less thick, and the offset has a short aseptal stage after closing the wall (fig. 23A*g*).

In no case the offsets inherit parent septa.

Remarks. — Hill (1938—1941) included *Diphyphyllum simplex* (Thomson, 1887) to the synonymy of *Lithostrotion* (*S.*) *junceum* (Fleming). But, Dobrolyubova (1958) restored *D. simplex* as the valid name. As the matter of fact, *Diphyphyllum simplex* is very close to *L.* (*S.*) *junceum*; both species differ in nothing more than columella development. Nevertheless, the present author has decided to use the generic name *Diphyphyllum* for those colonies in which most individuals do not produce columella, because this name has still not been invalidated.

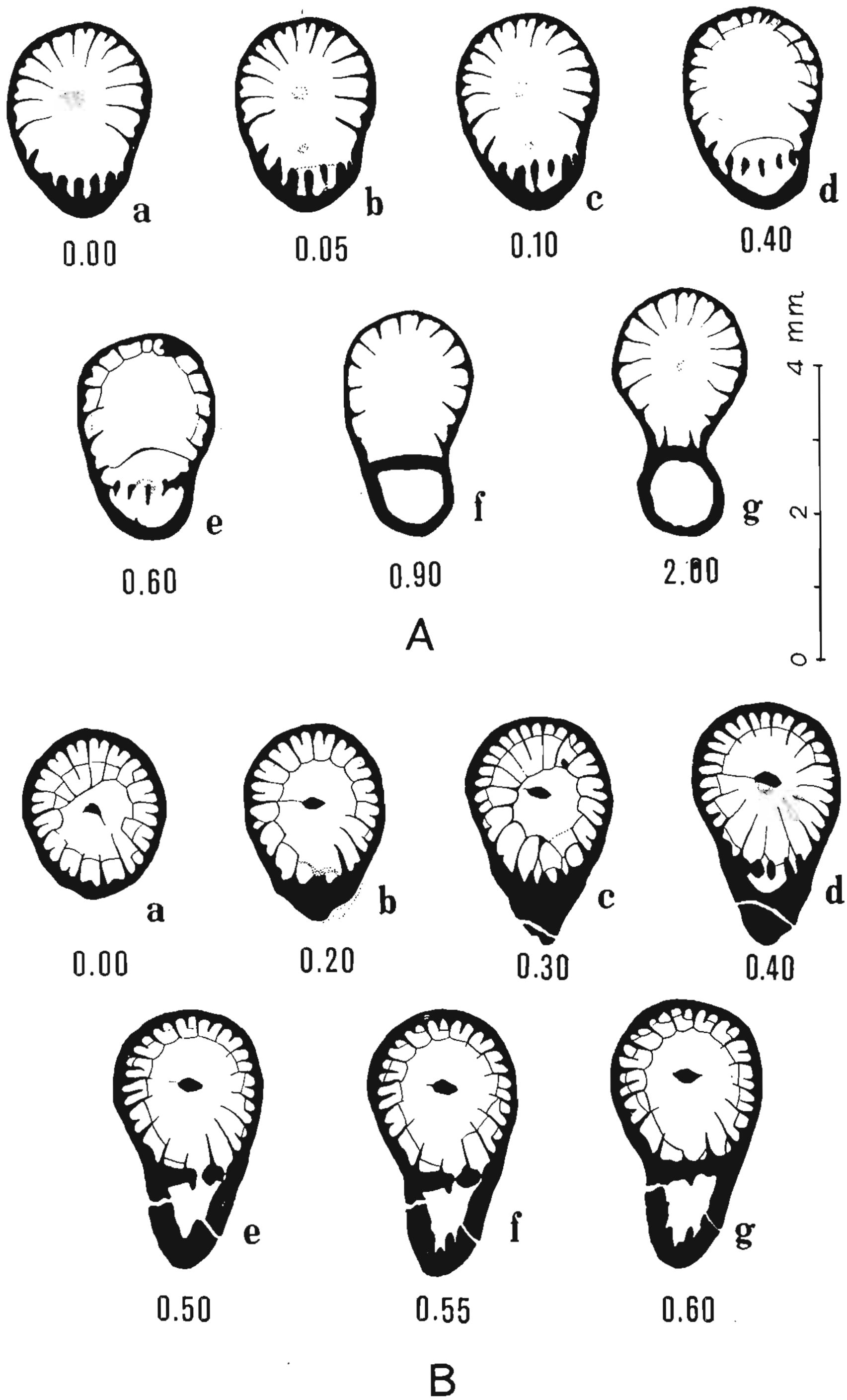
Occurrence. — Poland: Upper Viséan (Lublin region). USSR, Great Britain: Lower Carboniferous.

Diphyphyllum lateseptatum McCoy, 1849
(pl. 7: 3*a*, *b*)

1938—1941. *Diphyphyllum lateseptatum* McCoy; Hill: 184, pl. 10: 14,15 (*cum synon.*).
1958. *Diphyphyllum lateseptatum* McCoy; Dobrolyubova: 192, pl. 23: 1*a*, *b*.

Material. — A few colony fragments; 2 thin sections and 11 peels.

Diagnosis. — See Hill 1938—1941: 184.


a
0.00
b
0.05
c
0.10
d
0.40
e
0.60
f
0.90
g
2.00
4 mm
0
2
4
A
a
0.00
b
0.20
c
0.30
d
0.40
e
0.50
f
0.55
g
0.60
B

Dimensions:

Specimen No.IG-1403.II.	dc. av	n.smj	l.smj av	l.smn av	n.t/5 mm
75	3.5	20—27	0.75	0.35	
	4.23	26—27	1.3	0.7	
	6.25	27			12
	6.69	29—37	1.73	0.9	8—12

Remarks. — In corallite size, number of septa and septal length, the Lublin specimens resemble *Diphyphyllum lateseptatum* described by Hill (1938—1941; 184—185, pl. 10: 14—15).

As shown by Dobrolyubova (1958: 193) the major septa may be 5 mm long (i.e., 2/3 the radius) in the specimens from the Russian Platform. In the Lublin specimens the length of major septa never exceeds 2 mm (in average 1/3 — 1/2 the radius).

Occurrence. — Poland: Upper Viséan (Holy Cross Mts and Lublin region. Great Britain: Carboniferous, zone D2 and E1 ?; USSR: Viséan (Russian Platform).

Diphyphyllum cf. *ingens* Hill, 1940
(pl. 7: 1*a*, *b*, 2*a*, *b*)

Material. — 7 colony fragments; 6 thin section and 23 peels.

Diagnosis. — See Hill 1938—1941: 186.

Dimensions:

Specimen No.IG-1403.II.	d.c ext	d.c av	n.smj	l.smj av	l.smn av	n.vdis	n.t/5 mm
78	7.0—7.8	7.42	31—32	2.08	1.30	2—5	7—11
81	6.6—9.5	7.82	33—34	1.91	0.87	1—6	
79	5.9—10.0	8.02	26—29	2.66	1.90	5—8	

Remarks. — The Lublin specimens exhibit smaller corallite diameters, more numerous verticils of dissepiments, and longer minor septa than does the holotype (Hill 1938—1941: 186, pl. 11: 2, 3). In the latter the septal ratio (n/d) is: 20/5, 31/11, 32/12, 35/15. The discussed specimens differ from the Russian *D. ingens* in smaller corallite diameters; but they have a similar number of verticils of dissepiments. Large corallite size distinguishes the discussed species among other *Dibunophyllum* species in the Lublin region. It differs from related *D. lateseptatum* in the larger number of both septa and verticils of dissepiments, less dense tabulae, thinner septa within the tabularium, and almost unthickened internal wall.

Occurrence. — Poland: Upper Viséan (Lublin region).

Diphyphyllum rarevesiculosum sp.n.
(pl: 6: 4*a-d*, 5; fig. 24*a*, *b*; fig. 25A*a-k*, B*a-f*; fig. 26*a-f*)

Holotype: specimen number IG-1403.II.70; pl. 6: 4*a-d*; fig. 24*a*, *d*.

Type-horizon: Upper Viséan.

Type-locality: Tyszowce IG 1; depth of 1753.2—1754.2 m.

Derivation of the name: Lat. *rarus* — sparse and *vesicula* — vesicle, because of sparce occurrence of dissepiments.

Fig. 23. *Diphyphyllum simplex* (Thomson): *A a-g* successive stages of blastogeny of a specimen with columella lacking; IG-1403.II.66; *B a-g* successive stages of blastogeny of a specimen with columella present; IG-1403.II.67. All specimens from the borehole Koczmin IG 1, depth 1167.2—1168,2 m. Numbers below figures are cumulative distances of distal growth in mm.

Material. — 16 colony fragments (15 fragments comes from the borehole Tyszowce IG 1, and may represent the same colony); 3 thin sections and 47 peels.

Diagnosis. — *Diphyphyllum* with 3.5—5 mm in diameter; 17—20 short major septa sometimes lacking; dissepiments very sparse, rudimentary; columella lacking; lateral increase with an aseptal stage.

Dimensions:

Specimen No.IG-1403.II.	d.c ext	d.c av	n.smj	n.smin	l.smj	nt/5 mm	n.cdis / n.c
73	3.2—4	3.51	17—18	0—8	0.45	4—5	0.4
71a	3.2—4.1	3.76	16—20	0—8		5	0.1
u	2.3—4	3.8	18—19	0	0.32	6	0.75
70a	3.5—4.1	3.8	20	19	0.4	5	0.5
h	4.1—4.9	4.35	19	18—19	0.51	4—5	0.1
74	4.8—6.9	5.37	22—23	0	0.9		0.1

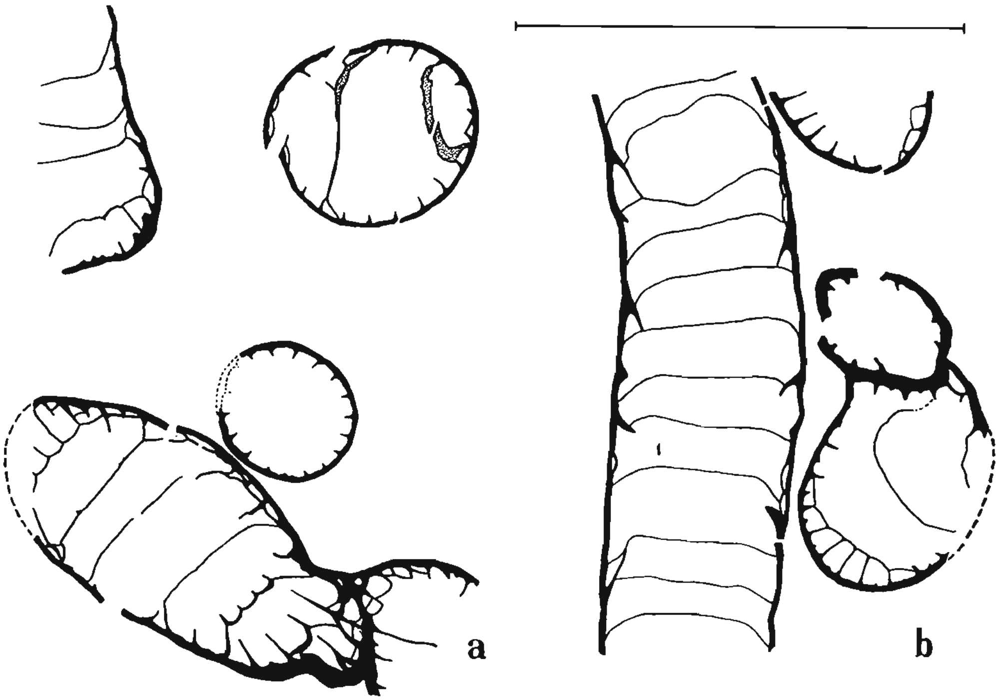


Fig. 24. *Diphyphyllum rarevesiculosum* sp.n.: *a*, *b* colony fragment in (*a*) cross and (*b*) longitudinal sections; IG-1403.II.70, holotype, borehole Tyszowce IG 1, depth 1753.2—1754.2 m.

Description. — Colony fasciculate. Major septa attain 1/8—1/3 (average 1/5) the radius in length; their triangular bases penetrate usually the external wall up to septa, often underdeveloped (see above). The cardinal and counter septa commonly half its thickness (pl. 6: 4*d*). Minor septa are very short, thinner than the major do not differ from the remaining ones; however, the counter septum may reach the axis, and the cardinal septum may also exceeds the adjacent ones (pl. 6: 4*d*). Columella is absent. Dissepiments sparse (pl. 6: 4*c*, 5; fig. 24*b*), vesicular, and fused with the external wall. As average, thickness of the external wall is 0.123 mm. The tabulae are flat-trapezoidal in shape. In the middle part they are horizontal or slightly concave, rather seldom convex; generally, they are complete.

Blastogeny. — The parent septa dilate in the zone of increase. The partition (or maybe directly the dividing wall) appears at a single side of the sector of increase. An aseptal stage is present (fig. 25A*c-f*) and young corallite does not inherit septa from the parent. These features make the investigated species very similar to *Lithostrotion* (*S.*) *junceum*. It seems that a young corallite is rather early separated from its parent (fig. 25A*d-f*). The cardinal septum appears close to the old epitheca (fig. 25A*g*). Next, the alar septa appear (fig. 25A*i*), finally, the counter, the counter-laterals and some metasepta appear almost simultaneously (fig. 25A*k*). Thus the blastogeny of the described species differs from that of *Lithostrotion* (*S.*) *junceum* in the

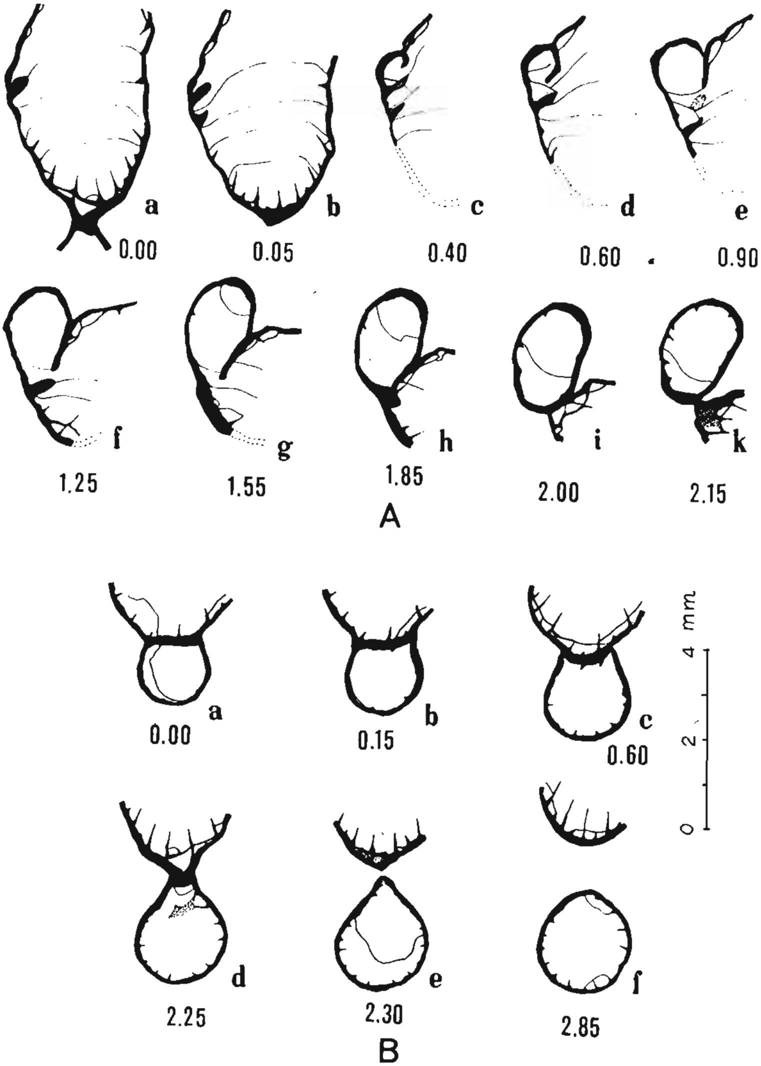


Fig. 25. *Diphyphyllum rarevesiculosum* sp.n.: *A a-k*, *B a-f* successive stages of blastogeny of corallites *A* and *B*; IG-1403.II.71, borehole Tyszowce IG 1, depth 1753.2—1754.2 m. Numbers below figures are cumulative distances of distal growth in mm.

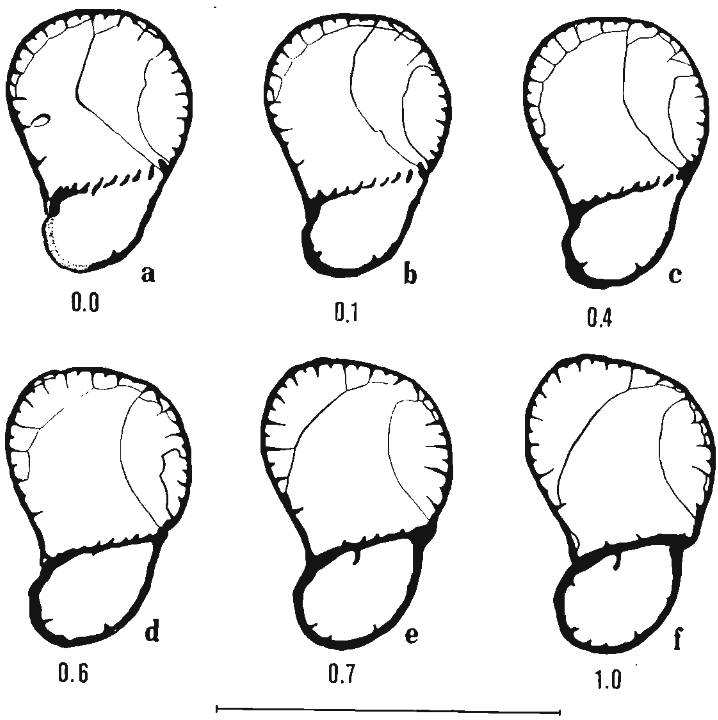


Fig. 26. *Diphyphyllum rarevesiculosum* sp.n.: *a-f* successive stages of blastogeny; IG-1403.II.72, borehole Tyszowce IG 1, depth 1753.2—1754.2 m. Numbers below figures are cumulative distances of distal growth in mm.

type of the septal insertion (cf. p. 325, fig. 6). The later blastogenetic stages are shown in figures 25B*a-f* and 26. Several septal pinnacles are formed in the common part of parent and offset, then, they fuse (fig. 26*a-c*). The offset protosepta appear even before closing the wall (fig. 25A). The counter septum is the longest (fig. 26*c-g*). The replacement of the partition by dividing wall can be clearly seen in figure 26*a-f*. The pattern of septal insertion in this specimen is the same as described above. Neither dissepiments nor columella were observed in young corallites.

Remarks. — The new species is most similar to *D. simplexforme* Degtjarev (*in* Degtjarev & Kropatcheva 1972: 87, pl. 22: 2*a*, *b*), but it exhibits less numerous and poorly developed septa, and thicker external wall. It differs from *D. simplex* in its much larger corallites more numerous septa, shorter major septa, and especially the presence of dissepiments and absence of columella.

Occurrence. — Upper Viséan (Lublin region).

Genus *Orionastraea* Smith, 1916

Diagnosis. — See Hill 1956: F 283.

Orionastraea cf. *ensifer* (Milne-Edwards & Haime, 1851)
(pl. 7: 4*a*, *b*)

Material. — One colony fragment; 1 thin section.

Description. — Colony plocoid; corallite diameter usually 4 × 5.5 mm. Septa number 26—28 at the extreme diameter 3 ×4.8 — 4.8 × 6 mm. The distance between axes of adjacent corallites is 4—6.4 mm. Major septa are long, slightly undulate; some of them reach the columella, or, in sections lacking columella, they are of the same length. Within the dissepimentarium between adjacent corallites the septa may be confluent or interrupted by dissepiments. Minor septa are long and undulate; they often attain 3/4 the length of major septa. The columella is lamellar, often attached to the cardinal and counter septa. As average, the tabularium width is 2—2.5 mm. The dissepiments are usually angulo-concentric. The internal wall is poorly developed. The external wall is discontinuous, thin and undulate.

Remarks. — The species has not been investigated in detail because of inadequate material. The corallites in the colony from Tyszowce are smaller than these of the British specimens and they exhibit much less numerous septa. Milne-Edwards & Haime (1852) found 30, and Smith (1917) up to 36 major septa in British corallites.

Occurrence. — Poland: Upper Viséan (Lublin region).

Orionastraea aff. *kurakovensis* Dobrolyubova, 1958
(pl. 8: 2; pl. 9: 1*a-c*)

Material. — One almost complete colony and one colony fragment; 3 thin sections and 15 peels.

Dimensions:

Specimen No.IG-1403.II.	n.smj	n.sm	l.smj av	w. tm
84	11	7	0.46	1.85
	12	12	0.92	2.5
	13	6	0.61	1.9
	13	13	0.75	3
	14	14	0.68	2.8
	15	15	0.96	3.2
	16	16	0.95	3.55

Description. — Colony lense-shaped; its height is 7 cm, maximum width is 14 cm (pl. 9: 1*a*). The distance between adjacent corallites is 6.3 —14 mm; as average 9.1 mm. Major septa are long (they attain 1/4 — 1/3 the tabularium in width), and dilated at the boundary separating dissepimentarium and tabularium. They may be confluent or interrupted by large dissepiments. Minor septa are of variable length; they do not exceed 1/2 the length of major septa. They may be less numerous in the lumen than the major septa (see above). The septa of both orders may be gradually constricted and then, interrupted at various places (pl. 9: 1*c*). Septal microstructure trabecular. Columella is absent. Within the tabularium there occur but tabulae and sometimes prolongated cardinal and counter septa and some metasepta. Tabulae number 15—24 per 5 mm; they are complete or incomplete, most commonly convex seldom concave or tent-shaped (pl. 9: 1*b*). The size of dissepiments is variable; 1—4 verticils of concentric dissepiments occur at tabularium boundary. No internal wall.

Remarks. — The discussed specimens have a lesser number of septa than *O. kurakovensis* Dobrolyubova (1958: 203—205, pl. 36), which has 20—21 septa. Moreover, in the investigated specimens the septa are better developed, especially within the dissepimentarium, and the cardinal and counter septa are rather commonly fused together. With respect to number of septa, our specimen resemble *O. rareseptata* Dobrolyubova (1958: 205—206, pl. 37). Some corallites, probably the young ones, exhibit short, underdeveloped septa (pl. 8: 2) which makes them similar to *O. heteroseptata* Dobrolyubova (1958: 206—207, pl. 38).

Occurrence. — Poland: Upper Viséan (Lublin region).

Orionastraea aff. *magna* Kato & Mitchell, 1970
(pl. 8: 1*a*-*c*)

Material. — One colony fragment with holotheca preserved at its lower surface; 4 thin sections and 2 peels.

Dimensions:

Specimens No.IG-1403.II.	n.smj	l.smj in tm (av)	w.tm	c-c
83d	10	0.55	1.8	4,6
	12	0.5	2.5	5.6
83a	12	0.77	2.4	7.5
	15	0.65	2.5	5.3
	15	0.71	2.2—2.7	7
83b	13	0.52		5.1

Description. — Colony is thamnasterioid, but in places aphroid; corallites sparse, skeletal elements thin. A continuous and thick holotheca covers the lower surface of the colony; it gives origin to the septa (pl. 8: 1*a*, *c*). The colony integration is significant; some septa cannot be attributed to particular corallites. Zigzag septa present. Major septa variously developed; they penetrate into the tabularium and attain approximately 1/2 its width. They may be confluent or interrupted by dissepiments. Minor septa often penetrate into the tabularium; they may attain 1/2 the length of major septa. Columella variable in thickness. It represents a prolongation of the thin counter septum (?), or it may be dilated up to 0.2—0.9 mm in cross section (pl. 8: 1*b*). The dissepiments are flat and variable in size; the largest ones cross 7—9 septa. The tabulae are dome-shaped. The boundary between tabularium and dissepimentarium is distinct (pl. 8: 1*b*).

Remarks. — In the colony form, corallite distribution, and structure of dissepiments and tabulae, the discursed specimen resembles most closely *O. magna* Kato & Mitchell (1970: 49—50, pl. 13: 1—5). However, British specimens exhibit a wider tabularium, shorter septa, and lack of a columella. With respect to these features, the investigated specimen resembles *O. phillipsi* (McCoy, 1849) as described by Dobrolyubova (1958: 201—203, pl. 34: 2a, pl. 35). It seems to be intermediate between *O. phillipsi* and *O. magna* and may represent a new species. In the columella structure some corallites resemble *O. ensifer* (Milne-Edwards & Haime) (pl. 8: 1*b*).

Occurrence. — Poland: Upper Viséan (Lublin region).

Family **Aulophyllidae** Dybowski, 1873
Genus *Aulophyllum* Milne-Edwards & Haime, 1850

Diagnosis. — See Hill 1938—1941: 82.

Aulophyllum fungites (Fleming, 1828)
(pl. 13: 1, 2*a*-*c*; fig. 27: 1*a*-*f*, 2)

1913. *Aulophyllum fungites* (Fleming); Smith: 52, pl. 5—9.
1971. *Aulophyllum fungites* (Fleming); Fedorowski: 24, pl. 1: 1—5; fig. 5*a*-*c* (*cum synon.*).
1973. *Aulophyllum fungites* (Fleming); Fedorowski *in* Fedorowski & Gorianov: 34, pl. 9: 5.
1974. *Aulophyllum fungites* (Fleming); Semenoff-Tian-Chansky: 17, pl. 5: 1—7; pl. 6: 1—5; pl. 7: 1—2, fig. 19, 20.

Material. — 14 specimens with external walls and proximal parts damaged; 9 thin sections and 66 peels.

Diagnosis. — See Hill 1938—1941: 82.

Dimensions:

Specimen No.IG-1403.II.	d.c av	n smj	d col	w dism	Remarks
85a	2.10	15			zaphrentoid stage
e	2.40	16			beginning of columella formation
g	2.57	17			”
h	2.80	18			”
i	3.45	19	0.7		”
l	4.20	21	1.3		appearance of smin, initial col
o	4.55	23	1.45		”
r	4.65	24	1.7		appearance of dis
s	5.35	25	1.75		”
t	7.55	34	2.6	0.3—0.4	
90	7.20	31	2.6		early-ephebic stage
87	8.80	33	3.0	0.5—1.1	”
89	11.40	36	4.0	0.5—0.7	”
	18.50	44	8.0	0.9—1.4	”
88	21.00	45	7.5	2.3—2.7	mid-ephebic stage

Remarks. — The specimens discussed resemble very closely those from the Holy Cross Mts, described by Fedorowski (1971: 26—27). The following slight differences have been found: 1. size and number of septa are smaller; 2. septa of cardinal quadrants dilate already at the zaphrentoid stage (fig. 27: 1*c*); 3. minor septa appear rather early, namely at the diameter of 4.2 mm, when 21 major septa are present (in the Uralian specimens (Sayutina 1973: 47—48) the minor septa never appear before the diameter of 8—9 mm is attained).

Occurrence. — Poland: Upper Viséan (Sudetes, Holy Cross Mts, Lublin region). Great Britain, France, Belgium, Turkey: Upper Visèan. Northern Africa: Viséan. USSR: Viséan-Lower Namurian.

Genus *Clisiophyllum* Dana, 1846

Diagnosis. — See Fedorowski 1971: 36.

Clisiophyllum delicatum Smyth, 1926
(pl. 10: 3*a*, *b*, 4, 5, 6*a*-*d*; fig. 28)

1926. *Clisiophyllum delicatum* Smyth: 150, pl. 4: 5*a*, *b*.
1971. *Clisiophyllum delicatum* Smyth: Fedorowski: 41.

Material. — 19 specimens, most of them poorly preserved, with proximal ends lacking and external walls damaged; 6 thin sections and 29 peels.

Diagnosis. — See Fedorowski 1971: 41.

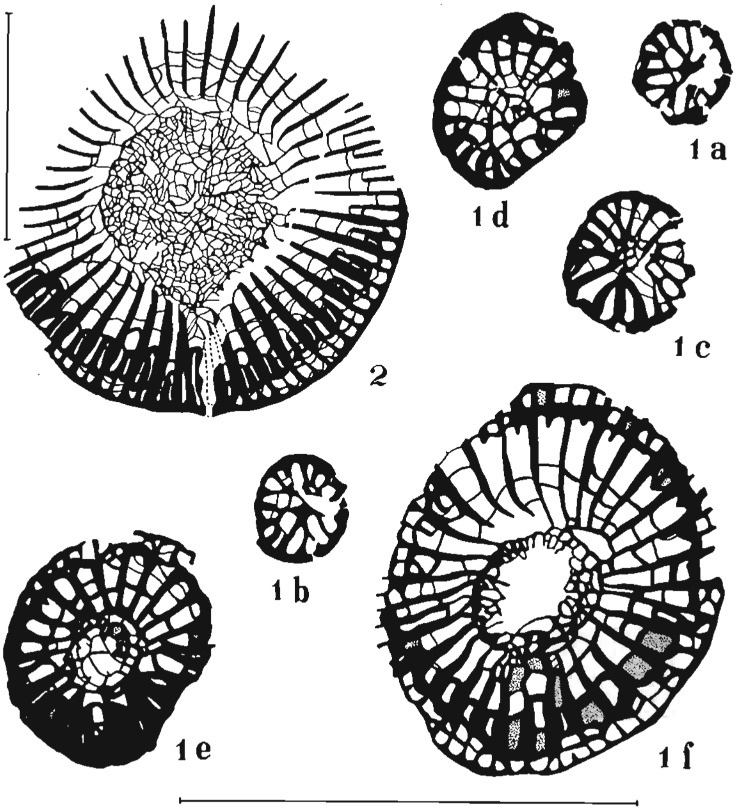


Fig. 27. *Aulophyllum fungites* (Fleming): *1/a-f* successive cross sections of a corallite: *a-d* early neanic stage, *e* neanic stage, *f* late neanic stage; IG-1403.II.85, borehole Bychawa IG 1, depth 1746.7—1747.7 m. *2* cross section of a corallite in the early ephebic stage; IG-1403.II.89, borehole Strzelce IG 2, dept 767.0—768.0 m.

Dimensions:

Specimens No.IG-1403.II.	d.c	d.col	n.smj	n.lam
97a	8.5	3.0	35	11
b	9.1	2.9	38	14
c	9.4	2.6	39	22
k	10.3	2.6	41	22
96	5.8-6.6	2.4	31	22
93	10.2	3.4	34	22
94	9.2	2.8	36	25
95	12.0	4.1	40	18

Remarks. — Fedorowski (1971: 41—49) recognized 5 subspecies within *Clisiophyllum delicatum* Smyth; namely the nominative subspecies and *C. delicatum anastomosum* Yu, *C. delicatum crassiforme* Bikova, *C. delicatum columnatum* Fedorowski, and *C. delicatum nanum* Fedorowski. None of the specimens from the here investigated area can be attributed to these subspecies. Because of poor preservation the specimens of Lublin region cannot also be examined in detail. They may be splitted into two groups. One of these groups, containing most of the specimen discussed is morphologically realated to *Clisiophyllum delicatum nanum*. The dissepimentarium width and cardinal septum length (pl. 10: 5) agree with those given in the diagnosis of *C. delicatum nanum* Fedorowski. However, the specimens discussed are larger, have more septa and a more complex axial structure. Some of these specimens (pl. 10: 3) resemble *C. delicatum delicatum* Smyth; however, they exhibit a long cardinal septum. The second group is represented by a single specimen (pl. 10: 6*a*-*d*). Its car-

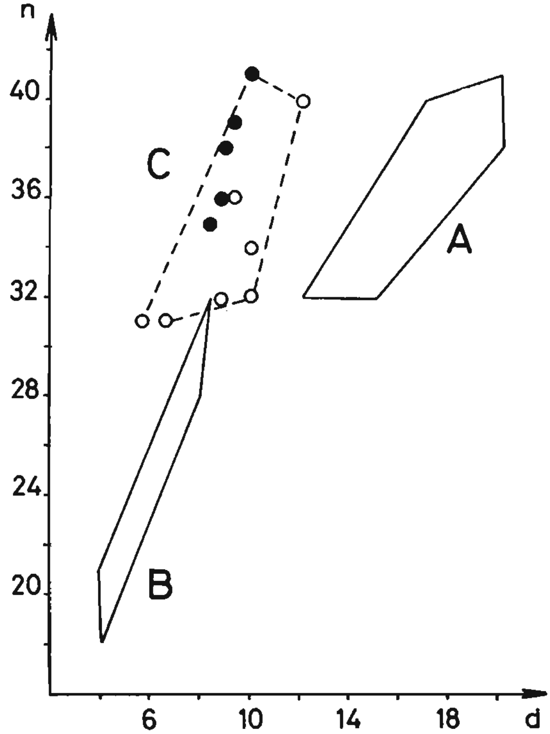


Fig. 28. Ratio of number of septa to diameter in some subspecies of *Clisiophyllum delicatum* Smyth. *A* n:d variation field for specimens of *C. delicatum delicatum* Smyth, *B* for *C. delicatum nanum* Fedorowski, *C* for *C. delicatum* described herein. *A* and *B* after Fedorowski (1971); ● specimen IG-1403.II.97, ○ other specimens.

dinal septum is long; the minor septa occur only within the external part of the dissepimentarium; the axial structure is of dibunophylloid type; the internal dissepiments are of herringbone type, while the external ones are concentric. Thus, the values of measurable characters of these two groups are intermediate between those typical of *C. delicatum delicatum* Smyth and *C. delicatum nanum* Fedorowski (fig. 28).

Occurrence. — Poland: Upper Viséan (Lublin region).

Genus *Dibunophyllum* Thomson & Nicholson, 1876

Diagnosis. — See Hill 1938—1941: 65.

Dibunophyllum bipartitum (McCoy, 1849)

(pl. 11: 2; pl. 12: 2; fig. 29: 1—5; fig. 30*a*-*d*)

1851. *Clisiophyllum konincki* Milne-Edwards & Haime: 410.
1874. *Rodophyllum craigianum* Thomson: 557.
1938—1941. *Dibunophyllum bipartitum* (McCoy); Hill. 67 (*cum synon.*).

1971. *Dibunophyllum bipartitum* (McCoy); Fedorowski: 57 (*cum synon.*).
1974. *Dibunophyllum bipartitum* (McCoy); Semenoff-Tian-Chansky: 76 (*cum synon.*).

Material. — 28 specimens; 9 thin sections and 57 peels.

Diagnosis. — See Hill 1938—1941: 67.

Dimensions:

Specimen No.IG-1403.II.	d.c (av)	n.smj	n.lam	l.smj (av)	l.smn (av)	d.col	w.dism (av)
99	13.5	39	15	3.7	1.3	6.1—7,5	1.6
102	17.0	33	10	5.4	1.7	7.0—7.0	2.7
103	19.0	37	10	6.3	0.65	6.0—6.7	3.55
98	23.6	42	8	7.4	1.2	7.4—9.6	4.25

Remarks. — When revising the Scottish specimens, Hill (1938—1941: 65—81) distinguished 3 subspecies within *Dibunophyllum bipartitum* based on the character of axial structure, i.e. *D. bipartitum bipartitum* McCoy, *D. bipartitum konincki* (Milne--Edwards & Haime), *D. bipartitum craigianum* (Thomson). The subdivision of *Dibunophyllum bipartitum* has been criticized. On the basis of biometry, Sayutina (1970;

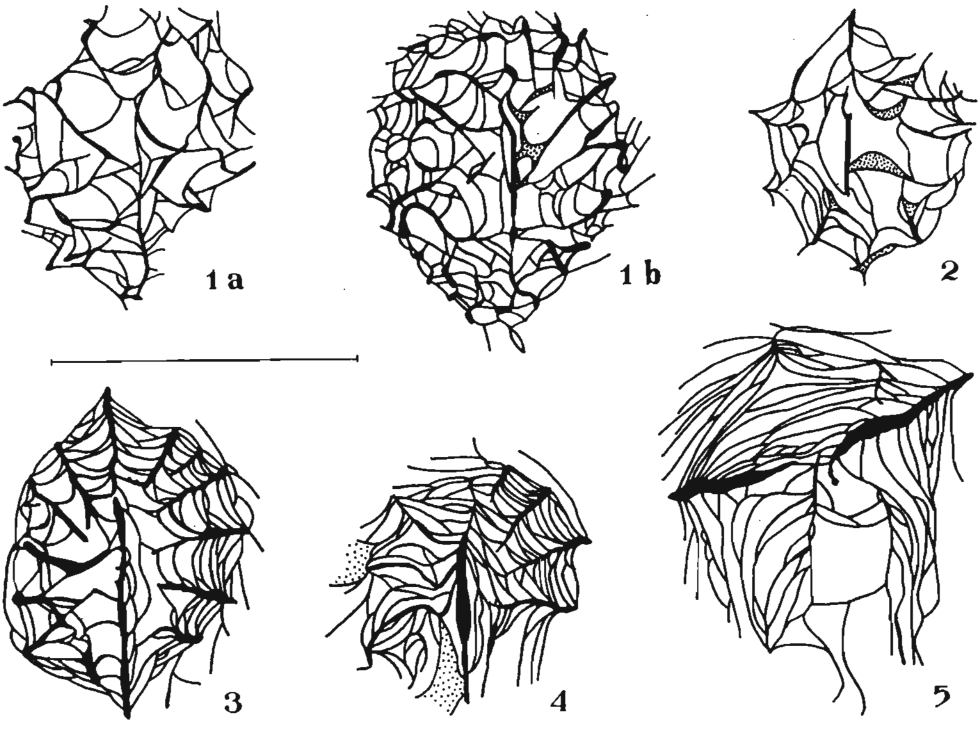


Fig. 29. Variability in development of the axial structure in *Dibunophyllum bipartitum* (Mc Coy): *1a, b* septal lamellae and axial tabellae are bent, columella is straight and long, IG-1403.II.100B (borehole Koczmin IG 1, depth 1167.2—1168.8 m; 2 septal lamellae are poorly developed, columella is shortened, IG-1403.II.98, borehole Bychawa IG 1, depth 1745.7—1746.7 m; *3* axial structure of a "bipartitum" type, IG-1403.II.101, borehole Koczmin IG 1, depth 1167.2—1168.2 m; *4* numerous axial tabellae and regular septal tabellae on one side of the columella and respectively rare and bent on the other, IG-1403.II.105, Rudnik IG 1, depth 1825.8—1826.8 m; 5 axial structure of a "craigianum" type, IG-1403.II.106, borehole Jarczów IG 4, depth 1581.0—1582.0 m.

1973) questioned validity of these subspecies. According to her (1970: 33—37), the biometrical plots indicate that *D. bipartitum bipartitum* and *D. bipartitum konincki* are synonyms, while *D. bipartitum craigianum* represents a distinct species.

Semenoff-Tian-Chansky (1974: 81) found that in some specimens from the Western Sahara the sequence of developmental stages corresponding to the 3 subspecies does not fit the phylogenetic sequence assumed by Hill (1938—1941). But, the illustrations given by this author (pl. 14: 1—3, specimen PAR 382/66) indicate that he dealt only with the stage of *D. bipartitum konincki.*

Only 3 specimens with axial structure of "*konincki*" type (fig. 30a-d) and 1 specimen with axial structure of "*craigianum*" type (pl. 12: 2; fig. 29: 5) have been found in the Lublin area. The variability displayed by the investigated specimens is as follows:

a. in most specimens the axial structure occupies approximately 1/3 of the diameter. Some specimens exhibit relatively small (approximately 2/7 of the diameter) or fairly large axial structure (more than 3/7 of the diameter);

b. thickness and length of columella change independently of developmental stage of a corallite. Constriction or even complete reduction of the columella is not always accompanied by an inflection of septal lamellae (fig. 29: 2,4);

c. septal lamellae are either numerous and regularly distributed, or only a few and disorderly distributed (fig. 29: 3,5). The straight septal lamellae are correlated with the occurrence of dense and concentric axial tabellae. Where the septal lamellae are inflated, the axial tabellae are irregularly distributed (fig. 29: 4);

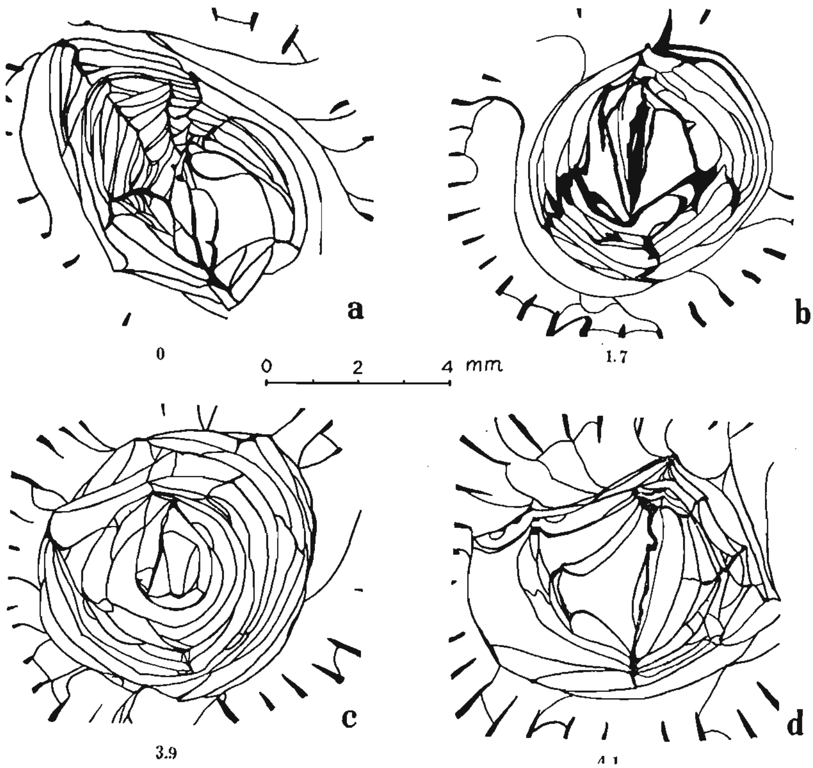


Fig. 30. *Dibunophyllum bipartitum* (McCoy): *a-d* successive cross sections of the axial structure; IG-1403.II.107, borehole Terebin IG 3, depth 1270.0—1271.0 m.

d. cross-section series of the axial structure of a single specimen is shown in fig. 30. The structure of "*konincki*" type is exhibited by the extremal sections (fig. 30*a*), while on the middle ones (fig. 30*b*, *c*) the columella and concentric axial tabellae remain, but the septal lamellae are almost completely reduced. This structure differs from all three types of axial structures that were supposed as diagnostic for the subspecies of *D. bipartitum*.

The present author is of the opinion that the subdivision of *Dibunophyllum bipartitum* into distinct subspecies is still disputable and the assignement of the investigated specimens to particular subspecies seems impossible. Moreover, the taxonomic value of *Dibunophyllum craigianum* (*sensu* Sayutina) seems to be doubtful. Specimens with the axial structure of "*craigianum*" type are relatively uncommon. Johnson (1956: 128—135) found that in the lowermost part of the middlebed of Carboniferous limestones in Northumbria, *D. bipartitum craigianum* is more common than two other subspecies.

Occurrence. — Poland: Upper Viséan (Sudetes, Holy Cross Mts, Lublin region). France, Belgium, Czechoslovakia, Northern Africa, China, Japan: Upper Viséan. Great Britain, USSR: Upper Viséan-Lower Namurian.

Dibunophyllum cf. *pseudoturbinatum* Stuckenberg, 1904
(pl. 11: *1a-e*)

Material. — 1 specimen with somewhat damaged middle part of the corallite; 20 peels.

Dimensions:

Peel No.IG-1403.II.	distance from proximal end	d	n.smn	l.smj (av)	l.smn (av)	w.dism (ext)
1001	14.00	18.0	42	5.75	1.20	0.47—0.66
h	14.55	17.4	42	5.75	1.50	0.53—0.64
f	16.00	20.0	45	7.07	1.60	0.41—0.44
d	28.00	23.6		7.50	1.93	0.43—0.6
b'	41.05	29.4	52	10.20	3.80	0.59—0.61
b	51.05	32.3	52	10.75	7.00	0.97—1.02
a	53.05	35.0	52	11.30	8.03	1.00—1.02

Remarks. — In the Koczmin specimen the ephebic stage (pl. 11: *1e*) is identical to that of *Dibunophyllum pseudoturbinatum* Stuckenberg, and especially to that of *D. pseudoturbinatum medium* Fedorowski (1971: 67—68). In the older parts of the corallite (pl. 11: 1*a-d*) the minor septa are short which makes the individual similar to *Dibunophyllum bipartitum* (McCoy). Such a development of minor septa has insofar been found neither in specimens assigned to *D. bipartitum* nor in those assigned to *D. pseudoturbinatum*. The single investigated specimen can not be regarded as an adequate material to claim that these two specific names are synonymous. On the other hand, it does not prove that *D. pseudoturbinatum* is a descendent of *D. bipartitum*, since in other specimens of the former species long minor septa occur already at the neanic stage.

Occurrence. — Poland: Upper Viséan (Lublin region).

Dibunophyllum cf. *percrassum* Gorsky, 1951
(pl. 13: 1*a-c*, 3; fig. 31: 1*a-c*)

Material. — 3 damaged specimens; 4 thin sections and 11 peels
Dimensions:

Specimen No.IG-1403.II	d.c	n.smj	d.col
111	18.0	33	5—5.5
112a	29.3	44	7—9.5
d	31.0	44	

Description. — The thickness of major septa does not change at the boundary between tabularium and dissepimentarium. Major septa are distinctly peripherally constricted (fig. 31: 1*b*, *c*). The cardinal septum is shorter and thinner, while the counter septum a little thinner than the other major septa. Minor septa are thin and, generally, very short; a few reach half a width of dissepimentarium. The cardinal fossula is shallow. At the early stages the axial structure is of *D. bipartitum bipartitum* type; there are 14—16 septal lamellae and a thin and short columella (pl.

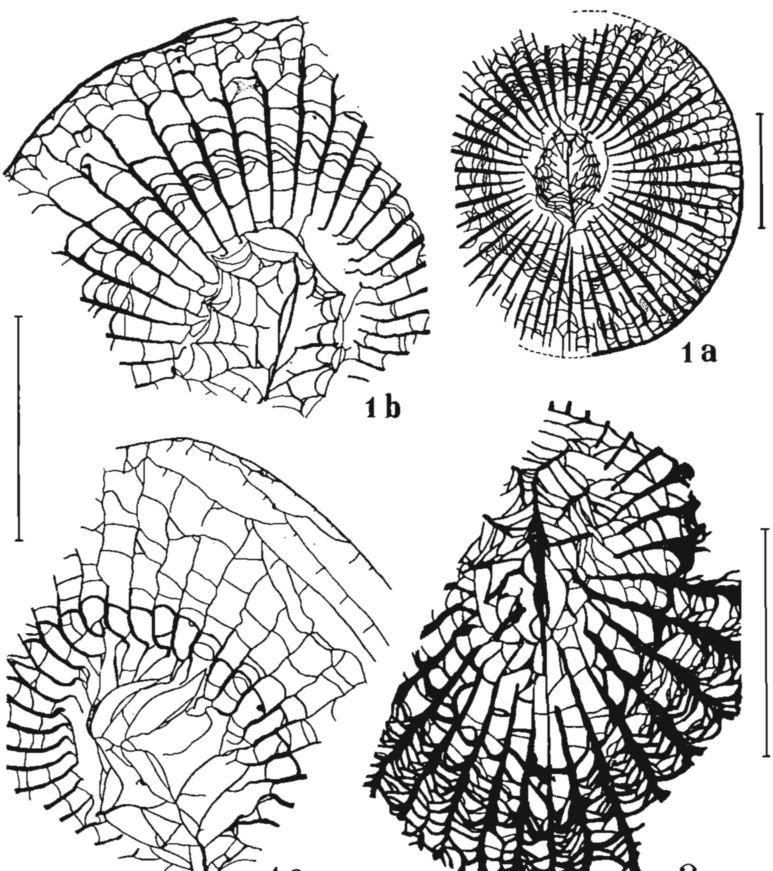


Fig. 31. 1. *Dibunophyllum* cf. *percrassum* Gorsky: *a-c* successive cross sections; IG-1403.II.112, borehole Lublin IG 1, depth 1197.3—1197.5 m. 2. *Dibunophyllum* sp. 2: cross section; IG-1403.II.110, borehole Terebin IG 2, depth 1203.9—1204.0 m.

13: *1a*; fig. 31: *1a*). At the late-ephebic stage the number of septal lamellae decreases and the columella becomes very thin (pl. 13: *1c*; fig. 31: *ac*). In the specimen IG-1403.II.112 some septa of both orders are interrupted peripherally by lonsdaleoid dissepiments. Such dissepiments are common at the late-ephebic stage, where they may disrupt more than 10 major septa (fig. 31: *1b*, *c*). In such cases short septal segments rest upon the dissepiments and external wall (fig. 31: 1*c*). As average, the dissepimentarium occupies 0.54 of corallite diameter. The internal wall becomes more distinct only at the end of developmental sequence. The external wall is thin.

Remarks. — The described specimens resemble *Dibunophyllum percrassum* Gorsky (1951) in the width and constitution of the axial structure, and the character of major septa dilatation. Lonsdaleoid dissepiments makes these specimens similar to *Dibunophyllum lonsdaleioides* Vassiljuk (1960). However, the discussed specimens differ from the latter species in the septal index and all the features making them similar to *D. percrasum.*

Occurrence. — Poland: Upper Viséan (Lublin region).

Dibunophyllum aff. *lonsdaleioides* Vassiljuk, 1960

(pl. 11: 4; fig. 32*a-h*)

Material. — 2 damaged specimens; 29 peels.

Dimensions:

Specimen No.IG-1403.II	d.c(av)	n.smj	d.ax
113k	2.6	13	
j	3.0	14	
h	3.2	15	
e	3.8	19	
c	4.0	20	
b	5.7	24	1.3—2.3
a′	12.0	29	3.2—4.0
a	12.5	31	4.0—4.0
b′	12.5	33	3,2—4.0
114	12.0	33	3.2—3.8

Description. — Most major septa reach the axial structure. Minor septa are very short; the longest ones cross 1/3 the dissepimentarium. The cardinal septum is somewhat shortened. The cardinal fossula is not developed. The axial structure is 0.28—0.29 the total diameter in width. The columella is of biseptal origin. At early developmental stages it is fused with the cardinal and counter septa; it disappears at the late-ephebic stage (fig. 32*h*). Septal lamellae 10 in number, short, thick, and irregularly distributed. Axial tabellae irregular. The dissepimentarium attains 1/3 — 1/2 the corallite diameter in width; in consists mostly of concentric and herringbone dissepiments. Lonsdaleoid dissepiments rare and confined to the periphery (fig. 32*f-h*). Internal wall thickened.

Ontogeny. — The early-neanic stages resemble those in *Dibunophyllum bipartitum* (Semenoff-Tian-Chansky 1974, fig. 27A-B). At the corallite diameter of 2.6 mm there are 13 septa; the external wall is 0.4 mm thick; some of the short septal lamellae are fused; the axial tabellae are sparse and thick. The axial structure is formed at the late-neanic stage (fig. 32*e*).

Remarks. — Lonsdaleoid dissepiments make the discussed specimens similar to *Dibunophyllum lonsdaleioides* Vassiljuk (1960: 143, pl. 35: 3-3*b*; Fedorowski 1971:

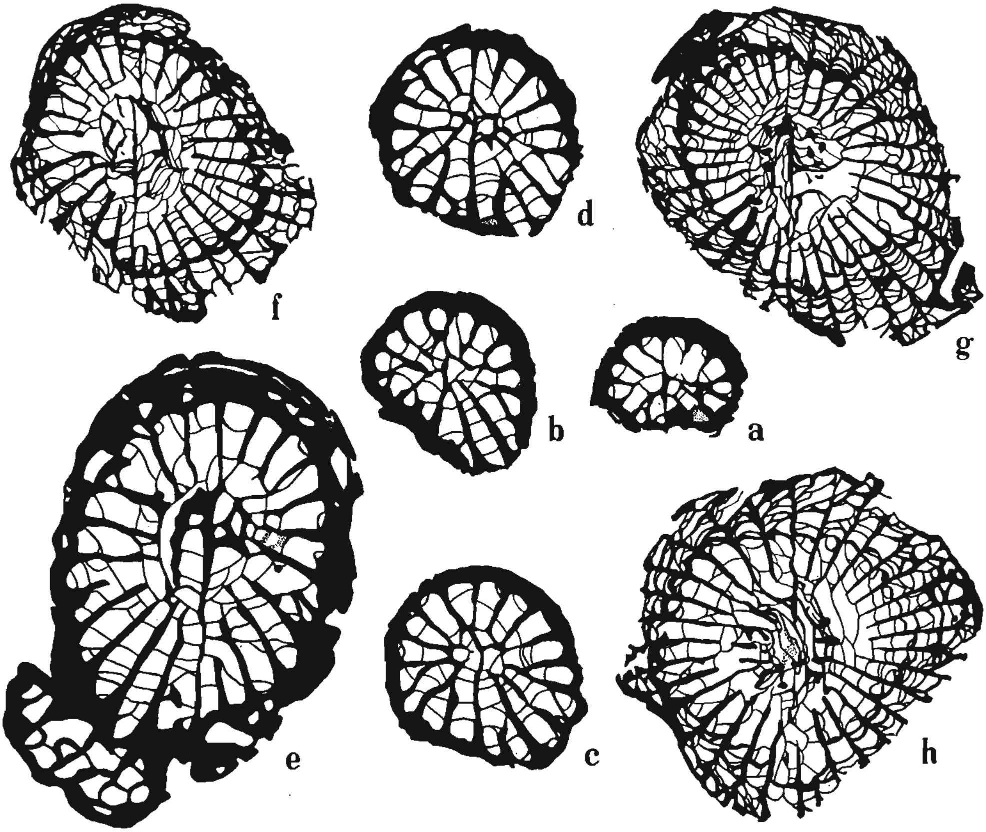


Fig. 32. *Dibunophyllum* aff. *lonsdaleioides* Vassiljuk: *a*-h successive cross sections of a corallite: *a* early neanic stage, *b*-*d* neanic stage, *e* late neanic stage, *f*, *h* ephebic stage; IG-1403.II.113, borehole Kock IG 2, depth 1446.0—1446.1 m. *a*-*e* × 8; *f*, *h* × 4.

71, fig. 26). They differ from the latter species in the small corallite diameter and especially in the size and construction of the axial structure.

Species	max d.c	max n. smj	d dism	d.ax
D. lonsdaleioides (holotype)	20	38	3.5	6.0
„ (after Fedorowski)	22	34	4.3	6.5
D. cf. *lonsdaleioides*	13	33	3.0	3.5

Occurrence. — Poland: Upper Viséan (Lublin region).

Dibunophyllum sp. 1
(pl. 11: 3*a*, *b*; pl. 12: 1*a*-*f*)

Material. — 3 specimens, the largest one 60 mm high with deep calice and damaged proximal part; 19 peels.

Dimensions:

Specimen No.IG-1403.II	d.c av	n smj	d.ax	l.smn (av)	w. dism (av)
108	6.85	25			
	7.05	27	2.0—3.2		
	7.9	28	2.1—3.3		
	15.9	40	5.8—6.7	1.45	1.25
	18.0	42	6.7—7.4	1.96	1.66
	22.5		8.0—9.2	3.05	2.85
109	12.8	36	6.0—7.2	1.45	1.1
	18.5	40	8.1	1.75	2.0

Description. — Major septa are thin within the dissepimentarium, while considerably dilated within the tabularium, especially in the cardinal quadrants (pl. 12: 1*a*, *b*). The stereoplasmatic outlays in septa are fibro-lamellar in structure. Some layers do not adhere to each other, thus, forming the structure resembling lateral--cystose dissepiments (pl. 12: 1*e*, *f*). Quite a similar type of a "leaky" stereoplasmatic structure on the septa has been observed by Fedorowski (1975: 50, pl. 8: 5*a*; fig. 5*f*) in *Siedleckia bjornoyana.* Such structure seems to be insignificant in systematics. The long minor septa reach the internal wall in the cardinal quadrants, and considerably cross it in the counter quadrants. The axial structure is of *Dibunophyllum bipartitum* type (pl. 11: 3*a*, *b*; pl. 12: 1*a*, *b*). At the late-ephebic stage it becomes similar to the structure of *D. bipartitum konincki* (pl. 12: 1c). The dissepimentarium is narrow; the dissepiments are concentric. The internall wall is well expressed.

Individual variability. — The specimen IG-1403.II.109 (pl. 11: 3*a*, *b*) exhibits a more wide axial structure (0.43 the total diameter) and much thinner septa in the cardinal quadrants (pl. 12: 1*a*-*e*).

Remarks. — *Dibunophyllum pseudoturbinatum* Stuckenberg appears as the most close morphologically species; however, *Dibunophyllum* sp.1 has a narrower dissepimentarium and thicker septa in the cardinal quadrants.

Occurrence. — Poland: Upper Viséan (Lublin region).

Dibunophyllum sp. 2
(pl. 13: 2*a*-*c*; fig. 31: 2)

Material. — 1 damaged specimen; 5 peels.

Remarks. — The septal ratio (n/d) is 35/16, 35/20. In its narrow axial structure and dilated septa within the dissepimentarium and tabularium, the investigated specimen resembles *Dibunophyllum percrassum* Gorsky. However, the complex dissepimentarium with thick and densely distributed herringbone dissepiments (fig. 31: 2) makes it different from the latter species.

Occurrence. — Poland: Upper Viséan (Lublin region).

Genus *Koninckophyllum* Thomson & Nicholson, 1876

Diagnosis. — See Hill 1938—1941: 86.

Koninckophyllum interruptum Thomson & Nicholson, 1876
(pl. 14: 5*a*-*d*)

1938—1941. *Koninckophyllum interruptum* Thomson & Nicholson; Hill: 93, pl. 4: 8—13 (*cum synon.*).

1971. *Koninckophyllum interruptum* Thomspon & Nicholson; Fedorowski: 82, pl. 18: 5—9; fig. 30A-C (*cum synon.*).

1974. *Koninckophyllum interruptum* Thomson & Nicholson; Semenoff-Tian-Chansky: 112, pl. 20: 6, 7; pl. 21: 1—6.

Material. — 2 specimens with damaged surfaces, lacking calices and proximal ends; 3 thin sections and 15 peels.

Diagnosis. — See Hill 1938—1941: 93.

Dimensions:

Specimen No.IG-1403.II	d.c (av)	n.smj	n.t/5mm
115	17.0	44	12—15
	19.8	49	
116	21.0	50	

Remarks. — The Tyszowce specimens are very small. Their septal ratio is 50/21, while that of Scottish specimens is 50/40 (Hill 1938—1941: 94), and that of previously described Polish specimens is 60/30 (Fedorowski 1971: 87). In morphology, and especially in the absence of columella at the ephebic stage, the discussed specimens resemble *K. interruptum* as illustrated by the authors of species. The most important difference are: dilated major septa in the cardinal quadrants, and cardinal septum thinner than the others (pl. 14: 5*a*).

Occurrence. — Poland: Upper Viséan (Holy Cross Mts, Sudetes, Lublin region). Great Britain: zone 3 (Upper Viséan-Lower Namurian); Scotland: Upper Viséan. Western Sahara: Lower Namurian.

Koninckophyllum meathopense (Garwood, 1913)
(pl. 14: 4*a*, *b*)

1913. *Lophophyllum meathopense* Garwood: 557, pl. 48: 2*a-e*.
1971. *Koninckophyllum meathopense* (Garwood); Fedorowski: 85, pl. 8: 1—8; fig. 31A-L (*cum synon.*).

Material. — 1 specimen; 2 thin sections and 5 peels.

Diagnosis. — See Fedorowski 1971: 85—86.

Remarks. — The Rudnik specimen is small. Its septal ratio is 32/14, while in the Fedorowski's specimens (1971: 87) it is 40/20, 53/24. The latter author (*op. cit.*) observed an exceptionally high individual variability in this species, especially in the constitution of the axial structure (first of all columella) and in the length of septa of both orders. In the investigated specimen, the columella almost fuses with the cardinal septum at the young stages. The constitution of the axial structure resembles that in *Dibunophyllum*. Similar axial structures were found in the specimens described by Garwood (1917, pl. 13: 5), and by Fedorowski (1971, pl. 8: 2, 4; fig. 31H4). The short minor septa differ the investigated specimen from previously described representatives of this species.

Occurrence. — Poland: Upper Viséan (Holy Cross Mts and Lublin region). Great Britain: Lower Carboniferous zone γ to S2.

Genus *Arachnolasma* Grabau, 1922

Diagnosis. — See Fedorowski 1971: 92.

Arachnolasma cylindricum Yü, 1933
(pl. 14: 2*a*, *b*, 3)

1971. *Arachnolasma cylindricum* Yü; Fedorowski: 94, pl. 9: 6—8; pl. 19: 10; pl. 20: 1, 2; fig. 36A-E (*cum synon.*).
1973. *Arachnolasma cylindricum* Yü; Sayutina: 95, pl. 12: 5; pl. 13: 1.

Material. — 4 damaged specimens; 2 thin sections and 2 peels.

Remarks. — When compared to the holotype (Yü 1933: 35, pl. 2: 1*a*-*c*), our specimens exhibit smaller size and less numerous septa; their septal ratio is 31/18, while it is 42/43 in the holotype, and 42—48/22—25 in the Holy Cross Mts specimens (Fedorowski 1971). Moreover, the Koczmin specimens have a thick columella and narrow dissepimentarium. Despite these difference they can be identified with the holotype and the specimens described by Fedorowski (1971) because they exhibit quite similar major septa, a long cardinal septum and very narrow axial structure with a long and lamellar columella.

Occurrence. — Poland: Upper Viséan (Holy Cross Mts, Lublin region). Carnic Alps, Japan, China: Upper Viséan. USSR: Upper Viséan-Namurian (Eastern Ural), Namurian (Donets Basin).

Arachnolasma biseptatum Fedorowski, 1971
(pl. 14: 1*a*-*c*; fig. 34: 2*a*, *b*)

1971. *Arachnolasma biseptatum* Fedorowski: 97, pl. 20: 6, 7; fig. 38A,B (*cum synon.*).

Material. — 2 damaged specimens; 1 thin section and 12 peels.

Diagnosis. — See Fedorowski 1971: 98.

Remarks. — The Lublin specimens are smaller than the holotype (Fedorowski 1971: 97, pl. 20: 7). In the successive sections of specimen IG-1403.II.120 the septal ratio is 26/13, 30/16.5, 31/17.5. and 33/18; whereas in the holotype it is 32/15 and 38/23. However, our specimens exhibit the following characters typical of this species: the cardinal septum shortened; the middle lamella elongate and attached to the cardinal septum; some major septa joined to the septal lamellae; the minor septa penetrating into the tabularium and attaining 2/3 the major septa in length; the cardinal fossula distinct. At late developmental stages the specimen IG-1403.II.120 exposes considerable changes (fig. 34: 2*b*): the columella reduces, the cardinal fossula disappears, and dissepimental parts of septa undulate so as to resemble carinae. These features may be recognized as gerontic.

Occurrence. — Poland: Upper Viséan (Holy Cross Mts and Lublin region). China: Upper Viséan. USSR: Namurian.

Genus *Neokoninckophyllum* Fomitshev, 1939

Diagnosis. — See Fedorowski 1971: 102.

Neokoninckophyllum trifossulum Fedorowski, 1971
(pl. 15: 2*a*, *b*; fig. 33)

1971. *Neokoninckophyllum trifossulum* Fedorowski: 109, pl. 10: 9; pl. 11: 6, 7; pl. 21: 8; fig. 44A-C.

Material. — 1 specimen; 4 peels.

Diagnosis. — See Fedorowski 1971: 109—110.

Remarks. — In the successive sections of investigated specimen the septal ratio is 38/22 and 48/28; whereas in the holotype (Fedorowski 1971: pl. 11: 6; fig. 44A1-d) it is 55/43—50. The septa are thin within the dissepimentarium, and considerably dilated within the tabularium. The cardinal and 2 adjacent septa are shorter than the others. The alar pseudofossulae are weakly developed. Most dissepiments are of the herringbone type. Apart from these diagnostic characters the investigated speci-

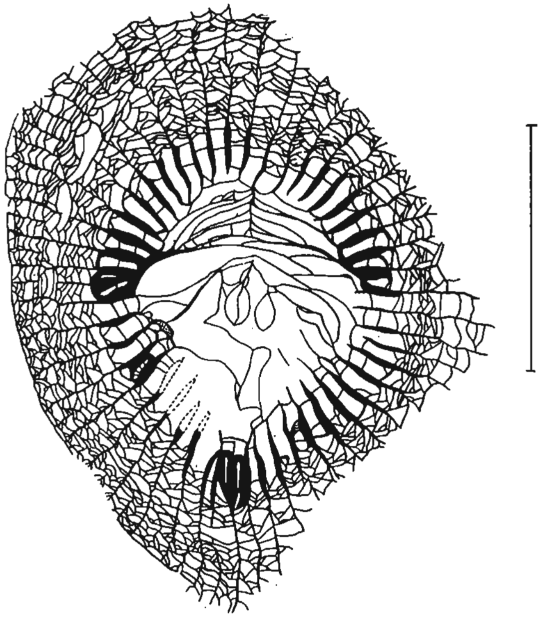


Fig. 33. *Neokoninckophyllum trifossulum* Fedorowski: cross section, IG-1403.II.123, borehole Tyszowce IG 1, depth 1378.7 m.

men exhibits also some features different from those of the holotype: in a few places the septa of both orders are interrupted by dissepiments (pl. 15: 2*b*), and the minor septa are short. These features occur also in the paratypes illustrated by Fedorowski (*l.c.*, fig. 44B1) although in the latter case they are less distinct.

Occurrence. — Poland: Upper Viséan (Holy Cross Mts); Lower Namurian (Lublin region).

Neokoninckophyllum ? sp.
(pl. 15: 1*a*, *b*)

Material. — 1 specimen; 5 peels.

Description. — The septal ratio (n/d) is 39/21 and 47/28. At the late neanic stage the major septa are long; within the tabularium they are thickened up to 0.6 mm, while within the dissepimentarium they are thin (0.1—0.15 mm). In the cardinal quadrants two last couples of septa are shortened. The minor septa almost reach the internal wall: they do not differ from the dissepimental parts of major septa. The cardinal septum joins the elongate lamellar columella. The axial structure is 1/4-1/5 the total diameter in width. It consists of several septal lamellae. The dissepimentarium is 1/3 the radius in width.

Ephebic stage: Major septa are long and thin. The cardinal septum is very short; two septa adjacent to it are also shortened. Most minor septa reach 1/2 of the dissepimentarium width, and only a few reach the internal wall. The axial structure is narrow. The dissepimentarium attains one-half the radius in width. Most dissepiments are concentric; only a few are of a herringbone or a pseudo-herrinbbone type.

Remarks. — In the investigated specimen the columella is formed by a junction of the cardinal and counter septa; that is just as in other species of *Neokoninckophyllum*. This junction can still be seen at the late neanic stage (pl. 15: 1*a*). The specimen resembles also closely the genus *Dibunophyllum* in the constitution of its axial structure consisting of several septal lamellae and axial tabellae. From all other species of *Neokoninckophyllum* it differs in the lack of lateral-cystose dissepiments. Fedorowski (1971: 109) recognized three groups of specimens of his new species, *Neokoninckophyllum multiseptatum*, with respect to the type of dissepiments. The investigated specimen may be attributed to the second group consisting of specimens with concentric dissepiments dominant. The present author claims that not only the constitution of the axial structure but also the dissepimentarium dominated by lateral-cystose and pseudo-herringbone dissepiments is diagnostic for the genus *Neokoninckophyllum*. Specimens with concentric dissepiments are probably not to be assigned to this genus.

Occurrence. — Poland: Upper Viséan (Lublin region).

Genus *Nervophyllum* Vassiljuk, 1959

Diagnosis. — See Fedorowski 1971: 114.

Nervophyllum primitivum Fedorowski, 1971
(pl. 15: 3*a*, *b*)

1971. *Nervophyllum primitivum* Fedorowski: 114, pl. 11: 1—5; pl. 22: 2; fig. 46A-D.

Material. — 1 specimen with its surface damaged; 2 peels.

Diagnosis. — See Fedorowski 1971: 115.

Remarks. — The septal ratio (n/d) is approximately 40/20, while in the holotype it is 40/22. In the axial structure some septal lamellae do not join with the major septa and most of them do not reach the columella. The dissepiments are most commonly concentric.

Occurrence. — Poland: Upper Viséan (Holy Cross Mts and Lublin region).

Nervophyllum sp.
(pl. 13: 4; pl. 22: 1*a*, *b*)

Material. — 2 damaged specimens; 7 peels.

Description. — Major septa number 25—27 at the corallite diameter of 15 mm, and approximately 34—38 at the diameter of 20—22 mm. They are dilated within the tabularium, especially in the cardinal quadrants; most commonly they attain 2/3 the radius in length, and in places they attach to the septal lamellae. Minor septa attain one half of dissepimentarium width. The axial structure occupies 1/3 of the total diameter. It consists of one axial lamella, several septal lamellae, and a few axial tabellae. Some septal lamellae do not reach the axial one. In a section just beneath the calice the axial lamella is short, discontinuous and attached to the cardinal septum. The dissepimentarium attains approximately 1/3 the radius in width. Adjacent to the external wall it consists of concentric dissepiments, whereas in its internal part it contains herringbone dissepiments. At the early stages most major septa are attached to the narrow, elongate and low-complex axial structure. The axial lamella is thin.

Occurrence. — Poland: Upper Viséan (Lublin region).

Genus *Turbinatocaninia* Dobrolyubova, 1970, emend.

Emended diagnosis. — Corallites solitary; at early developmental stages merely a columella or dibunophylloid axial structure occur; at ephebic stage the axial structure disappears; cardinal fossula well developed; cardinal septum shortened; counter septum most commonly longer than the other ones; major septa dilated in cardinal quadrants.

Remarks. — Apart from the type species, Dobrolyubova (1970: 130) assigned to the genus *Turbinatocaninia* the following species: *Rodophyllum slimonianum* Thomson, 1874 (she did not discuss the opinion of Kato & Mitchell (1961: 280—291, pl. 35, 36; fig. 9) who had designated this species as the type species of the genus *Slimoniphyllum*); *Campophyllum sinzowi* Stuckenberg, 1904; and two new species, *T. besputensis* and *T. toropovensis*. Later on, Sayutina (1973: 103) described a new species, *Turbinatocaninia dobrolyubovae*.

The present author regards *Slimoniphyllum* and *Turbinatocaninia* as distinct although closely related taxa. They belong to the same family and probably even the same subfamily Aulophyllinae Dybowski. They differ in the axial structure and the length of the counter septum. In *Turbinatocaninia* the axial structure occurs at the young developmental stages only; the counter septum often is longer than the other major septa (or at least equal to them) and attached to the axial structure, while in *Slimoniphyllum* it is always short. Moreover, in *Turbinatocaninia* the herringbone dissepiments and caninoid thickenings of septa occur.

Among the genera of this family, it is *Koninckophyllum* Thomson & Nicholson that most closely resembles *Turbinatocaninia*. The differences between these two genera have been discussed by Dobrolyubova (1970: 130) and Sayutina (1973: 103).

Turbinatocaninia tyszowcensis sp.nov.
(pl. 16: 1*a*, *b*, 2*a*, *b*, 5)

Holotype: specimen number IG-1403.II.126; pl. 16: 2*a*, *b*.
Type horizon: Lower Namurian.
Type locality: Tyszowce IG 1, depth of 1375—1376 m.
Derivation of the name: after the type locality.
Material. — 4 turbinate specimens; the largest one is 35 mm long, and its calice attains 38 mm in width; 13 peels.

Diagnosis. — Conical *Turbinatocaninia* with the diameter of 30—33 mm, and (44—52) × 2 septa; major septa attain one-half the corallite diameter; the counter septum alike all other major septa; several septal lamellae within the axial structure.

Dimensions:

Specimen No.IG-1403.II.	d.c	n.smj	l.smj (av)	l.smn (av)	w.dism (av)
126	25.3	44	5.03	1.33	2.6
	30.0	46	7.7	2.09	5.62
	35.0	52	7.03	1.43	5.2
128	16.0	36			

Description. — Major septa are approximately one-half the corallite radius in length. Their tabular parts are dilated up to 1.3 mm in the cardinal quadrants, while in the counter quadrants they are only a little thicker than the dissepimental parts. Within the dissepimentarium the septa are in average 0.03—0.04 mm thick. In the cardinal quadrants the stereoplasmatic outlays of septa often fuse laterally, whereas their mesoplasmatic parts elongate towards the corallite axis. The cardinal septum is shorter than the adjacent ones; it occupies a well developed cardinal fossula. The counter septum does not differ from the other septa. The length of minor septa is variable; they are most commonly short, but somewhat longer in the cardinal quadrants. The axial structure is more than 1/3 the total diameter in width. It consists of a short and thin columella, several septal lamellae that do not reach the columella, and regular and convex axial tabellae. Septal lamellae may be situated at the surface of tabellae; in cross section they look like short spines. The axial structure is developed up almost to the calice bottom. At the latest developmental stages both the columella and septal lamellae are reduced, the tabellae being the only axial elements in the sections just beneath the calice. The dissepimentarium occupies 1/3 of the corallite and consists of the herringbone, pseudoherringbone, and irregular dissepiments. The external wall is thin.

Individual variability. — The specimen IG-1403.II.127 (pl. 16: 1*a*, *b*) differs from the holotype in the construction of its axial structure: there are only a few septal lamellae, and the axial tabellae are less convex. At the early-ephebic stage of another specimen (pl. 16: 5) the axial structure contains only a few axial tabellae. In the latter specimen the major septa are considerably dilated in the cardinal quadrants.

Remarks. — *Turbinatocaninia tyszowcensis* is different from other *Turbinatocaninia* species in its well developed axial structure disappearing only just below the calice. The ceratoid corallites of the type species, *Caninia okensis* Stuckenberg, exhibit a septal ratio of 58/60, wide dissepimentarium, and weakly developed axial structure (Stuckenberg 1904: 27, pl. 2: 2*a*-*c*; pl. 3: 2*a*). The specimen IG-1403.II.128 (pl. 16: 5) resembles young developmental stages of *Turbinatocaninia besputensis* Dobrolyubova (1970: pl. 46:1) in the constitution of its axial structure, and in considerable dilatation of the major septa in the cardinal quadrants.

Occurrence. — As for the holotype.

Turbinatocaninia aff. *tyszowcensis* sp.n.

(pl. 16: 3, 4)

Material. — 2 fragmentarily preserved specimens; 2 thin sections and 1 peel.

Description. — Corallites with diameter of 30—32 mm and 41 major septa attaining 1/3 the radius in length. Major septa are dilated within the tabularium, especially in the cardinal quadrants; at the periphery they are sometimes interrupted by dissepiments. The counter septum is elongate. Some of the major septa adjacent to it are distinctly shortened. The cardinal septum is thicker and considerably shorter than the adjacent ones. The cardinal fossula deeps into the dissepimentarium. Minor septa are very short. No axial structure is observed; the spine-like sections of lamellae at the surface of tabellae may be the vestiges of an axial structure that had occurred at early developmental stages. The width of dissepimentarium is aproximately 8.3 mm. Most dissepiments are of herringbone type; some are rectangular.

Remarks. — The discussed specimens differ from *T. tyszowcensis* sp.n. not only in the weakly developed axial structure, but also in the structure of dissepimentarium and slight dilatation of major septa in the cardinal quadrants. The same features make also these specimens different from other *Turbinatocaninia*.

Occurrence. — Poland: Upper Viséan (Lublin region).

Genus *Mirka* Fedorowski, 1974

Diagnosis. — See Fedorowski 1971: 126

Mirka prima (Fedorowski, 1971)
(pl. 15: 4*a*, *b*; fig. 34: 1*a*, *b*)

1971: *Mirka prima* Fedorowski: 127, pl. 12: 1—3; fig. 52A/1—9.

Material. — 1 damaged specimen; 1 thin section and 2 peels.

Diagnosis. — See Fedorowski 1971: 126.

Remarks. — The investigated corallite exhibits a diameter of 32—36 mm, and (46—48) × 2 septa. It differs from the holotype in its septal ratio (62/27—36 in the holotype, and 48/24—31 in the paratype), more variable thickness of major septa in the cardinal and counter quadrants, and very short minor septa.

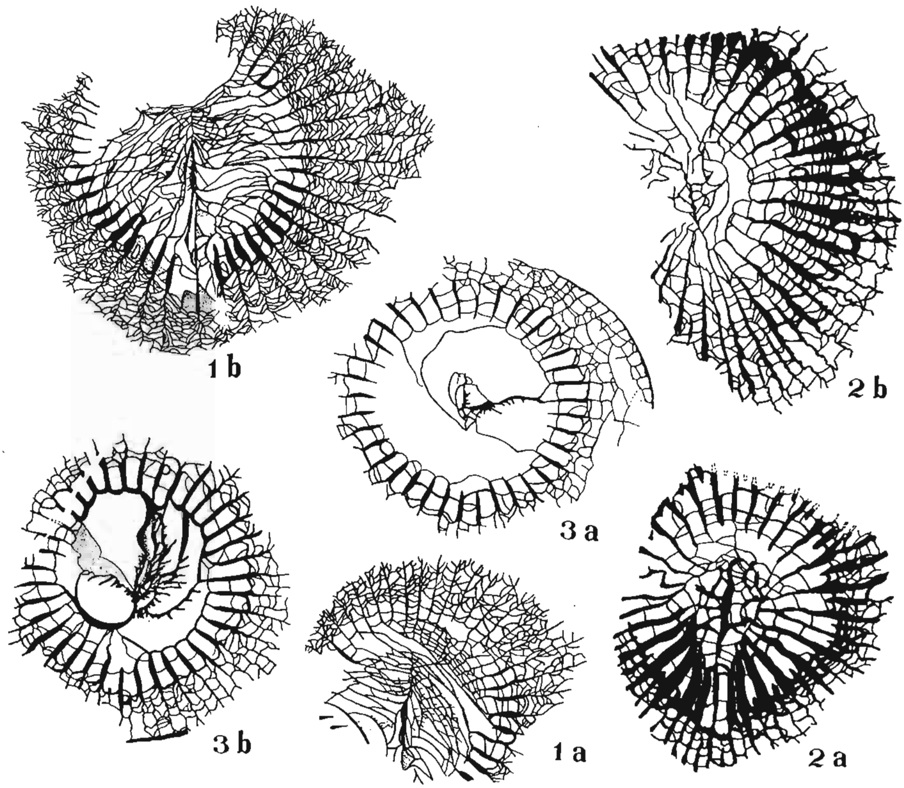


Fig. 34. 1 *Mirka prima* (Fedorowski): *a*, *b* successive cross sections; IG-1403.II.131, borehole Tyszowce IG 1, depth 1375.0—1376.0 m. 2 *Arachnolasma biseptatum* Fedorowski: *a*, *b* cross sections; IG-1403.II.120, borehole Tyszowce IG 2, depth 1470.0—1471.0 m. 3 *Spirophyllum* sp.: *a*, *b* successive cross sections; IG-1403.II.133, borehole Bychawa IG 1, depth 1743.7—1744.7 m, 1 × 2; 2 × 3; 3 × 4.

Occurrence. — Poland: Upper Viséan (Holy Cross Mts), Lower Namurian (Lublin region).

Family **Amygdalophyllidae** Grabau *in* Chi, 1935

Genus *Spirophyllum* Fedorowski, 1970

Diagnosis. — See Fedorowski 1970: 571.

Spirophyllum sanctaecrucense lublinense subsp.n.
(pl. 17: 1*a*-*c*; fig. 35*a*-*e*)

Holotype: specimen number IG-1403.II.132; pl. 17: 1*a*-*c*, fig. 35*a*-*e*.
Type horizon: Upper Viséan.
Type locality: Tyszowce IG 1, depth of 1738.6—1739.6 m.
Derivation of name: after the area of occurrence.

Material. — 3 specimens; one of them 47 mm long, the others with only early developmental stages preserved; 11 peels.

Diagnosis. — *Spirophyllum sanctaecrucense* with 14—15 mm in diameter, a simple axial structure and a narrow dissepimentarium: at the late-ephebic stage lonsdaleoid dissepiments occur; pseudonaotic structures uncommon.

Dimensions:

Specimen No.IG-1403.II	d.c	n.smj	w.dism
132	7.5	32	
	8.6	32	1.2
	14.0	37	2.1
	14.0	38	2.8
	15.0	38	3.2

Description. — Major septa are thin, slightly dilated within the tabularium, and undulate within the dissepimentarium; they do not reach the columella and are variable in length. Some septa adjacent to the external wall decompose to from

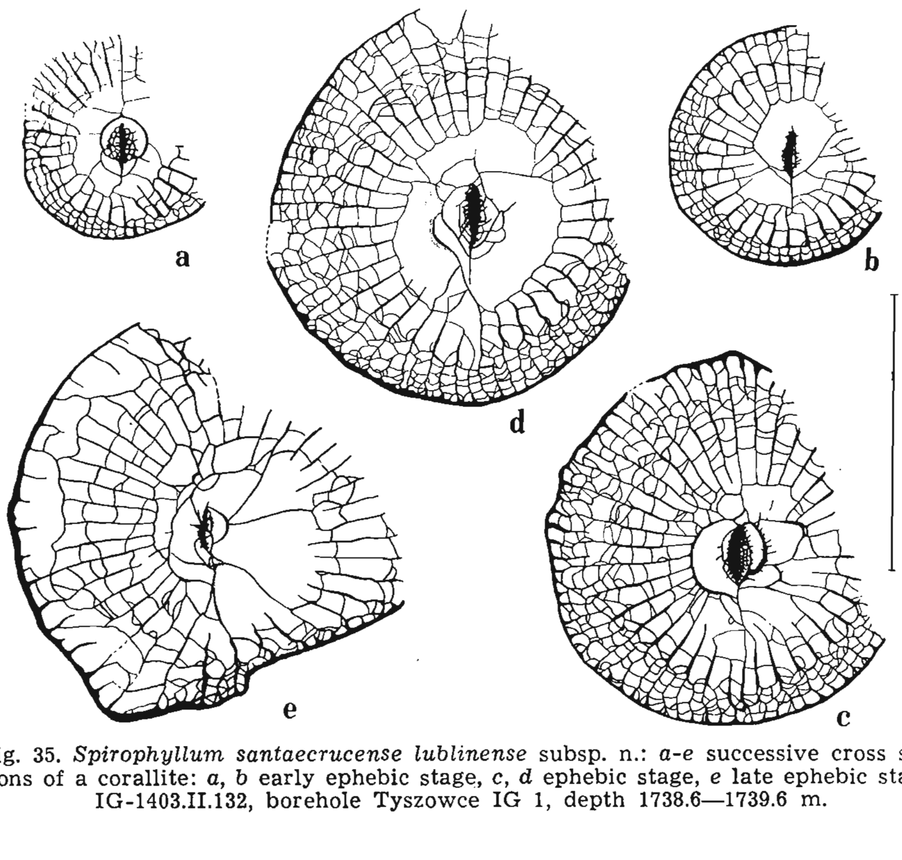


Fig. 35. *Spirophyllum santaecrucense lublinense* subsp. n.: *a*-*e* successive cross sections of a corallite: *a*, *b* early ephebic stage, *c*, *d* ephebic stage, *e* late ephebic stage; IG-1403.II.132, borehole Tyszowce IG 1, depth 1738.6—1739.6 m.

pseudonaotic structures; the latter become better developed at the late-ephebic stage (fig. 35*c-e*). The cardinal septum is shorter than the adjacent ones. The counter septum is alike all the others. Minor septa are the longest in the cardinal quadrants; some of them do almost reach the internal wall. The axial structure consists of a lense-like columella surrounded by several short septal lamellae. The axial tabellae seldom occur. At the latest developmental stages the axial structure becomes simple and reduced (fig. 35*e*). The dissepimentarium is narrow; it is approximately 1/3 the radius in width. Rectangular and concentric dissepiments are common, herringbone dissepiments occur rarely. At the late-ephebic stage (fig. 35*e*) large lonsdaleoid vesicles appear, and the minor septa are shortened or even reduced.

Remarks. — When compared to the holotypes of *S. sanctaecrucense sanctaecrucense* (n/d = 65/30) and *S. sanctaecrucense pauper* (n/d = 54/28) (Fedorowski 1970: fig. 13: 4*a-c*; fig. 15: 3, pl. 6: 1 *a*, *b*); the discussed specimens exhibit a more narrow and simple dissepimentarium, less complex pseudonaotic structures, and more simple axial structures; in the latter structure it resembles *S. sanctaecrucense pauper* Fedorowski (*op. cit.*: pl. 5: 3—7). Lonsdaleoid dissepiments are the most distinctive feature of the new subspecies when compared to the other subspecies. Such dissepiments occur also in *S. regulare* Fedorowski (*op. cit.*: 593, pl. 9: 1).

Occurrence. — Poland: Upper Viséan (Lublin region).

Spirophyllum sp.

(pl. 17: 2*a-c*; fig. 34: 3*a*, *b*)

Material. — 1 specimen with its peripheral part damaged; 9 peels.

Description. — Corallite is conico-cylindrical, approximately 25 mm long, and exhibits 37 × 2 septa at the diameter of 12 mm. Major septa attain one-half the radius in length; within the tabularium they are almost evenly dilated in the cardinal and counter quadrants. The cardinal septum is shortened. Minor septa vary in length, the longest may reach the internal wall. In the sections available (fig. 34: 3*a*, *b*) the axial structure splits similarly to that of *Spirophyllum perditum* Fedorowski (Fedorowski 1970: 596—598, pl. 10: 1, 2; fig. 20: 1*a*, *b*, 2*a*). The columella disintegrates to form several short septal lamellae developing on the surface of tabulae (fig. 34: 3*b*, pl. 17: 2*c*). The axial tabellae seldom occur and are variously developed. Most dissepiments are concentric. The external wall is fragmentarily preserved.

Remarks. — A simple axial structure alike that described above occurs also in *Spirophyllum bifurcatum* Fedorowski (*op. cit*: 598, pl. 12: 7; fig. 21: 1, 2*a*) and *S. perditum* Fedorowski (*l.c.*). Both species differ from the investigated specimen in many characters; e.g., longitudinal splitting of septa, highly complex dissepimentarium, septal ratio, etc.

Occurrence. — Poland: Upper Viséan (Lublin region).

Family **Palaeosmiliidae** Hill, 1940

Genus *Palaeosmilia* Milne-Edwards & Haime, 1848

Diagnosis. — See Hill 1956: F 290.

Remarks. — Corallites resembling in morphology *Palaeosmilia murchisoni* may be solitary as well as colonial. The present author holds that plocoid colonial forms should be regarded as a distinct genus, *Palastraea* McCoy, 1851; whereas only solitary forms should be ascribed to the genus *Palaeosmilia*. This opinion agrees with the original diagnosis of the genus *Palaeosmilia*. The genus has been comprehensively discussed by Fedorowski (1973: 48—49).

Palaeosmilia murchisoni M. Edwards & Haime, 1848
(pl. 17: 3*a*, *b*; pl. 18: 1*a*, *b*)

1938—1941. *Palaeosmilia murchisoni* M. Edwards & Haime; Hill: 117—121, pl. 6: 12, 13 (*cum synon.*).
1973. *Palaeosmilia murchisoni* M. Edwards & Haime; Fedorowski *in* Fedorowski & Gorianov: 47—49, pl. 11: 2, 3 (*cum synon.*).
1974. *Palaeosmilia murchisoni* M. Edwards & Haime; Semenoff-Tian-Chansky: 160—167, pl. 39; pl. 40; pl. 41; pl. 42.
1974. *Palaeosmilia multiseptata* Semenoff-Tian-Chansky: 169—172, pl. 43: 4,5; pl. 45: 5.

Material. — 2 incomplete specimens; 32 peels.

Diagnosis. — See Hill 1938—1941: 118.

Remarks. — The specimen IG-1403.II.134 exhibits septal ratio (n/d) as follows: 77/30—32, 81/40—41, and 82/50. In this specimen many morphological characters change independently of the growth. Septa may be dilated either within both the dissepimentarium and tabularium, or exclusively within the tabularium. In some cross sections (pl. 18: 1*a*) the septa rapidly dilate in the middle of dissepimentarium, within the range of 1.5 mm. The terminal parts of major septa may either be almost straight (pl. 17: 3*b*) or tend to bent and attach one to another (pl. 18: 1*a*). Minor Hsepta vary in length; they attain 1/2-2/3 the length of major septa. Two minor septa adjacent to the cardinal septum are considerably longer than others. In some sections they are almost as long as the adjacent major septa to which they attach (pl. 17: 3*b*; pl. 18: 1*a*). Some other minor septa also attach to or incline towards the major septa thus, resembling contratingent septa. The length of cardinal and counter is also variable. In the specimen IG-1403.II.134, a disturbance (maybe, a mechanical one) and disruption of septa have been found (pl. 17: 3*a*; pl. 18: 1*a*). The present author regards all the above described differences as an ontogenetic variability of the corallite, and does not consider them as diagnostic characters. Fedorowski (1973) found a wide individual variability within *Palaeosmilia murchisoni*; he suggested that at the present knowledge of the genus *Palaeosmilia* it would be unsound to erect species other than *P. murchisoni*.

Semenoff-Tian-Chansky (1974: 169—172, pl. 43: 4, 5; pl. 45: 5) described the new species *Palaeosmilia multiseptata*. The present author regards the main diagnostic characters of this species, i.e., high septal ratio and septa twisted up to form an axial structure, as merely an individual variability. This opinion is supported by similar ontogentic changes in the specimens investigated herein.

Occurrence. — Poland: Upper Viséan (Holy Cross Mts and Lublin region). Great Britain, France, Belgium, Germany: Viséan. USSR: ?Lower Carboniferous-Lower Namurian. Turkey, China: Viséan. Sahara: Lower Namurian.

Family **Cyathopsidae** Dybowski, 1873
Genus *Caninia* Michelin *in* Gervais, 1840

Diagnosis. — See Hill 1938—1941: 105.

? *Caninia cornucopiae brokleyensis* (Thomson, 1893)
(pl. 18: 3, 4)

Material. — 11 poorly preserved specimens lacking their proximal and peripheral parts; 1 thin section and 26 peels.

Diagnosis. — See Hill 1938—1941: 107.

Dimensions:

Specimen No.IG-1403.II	d.c	n.smj	l.smj	l.smn	w.tm	w.dism
138		31	2.5	1.1	11.2	1.1
136	16.7	32	3.3—3.4	2.0—2.5	11.8	2.4—2.5
	6.6	24				
135	17.5	32				3.2
137	14.3—20.0	36				2.0—3.5

Description. — Major septa are thin, slightly dilated within the tabularium (pl. 18: 3). They attain 1/3—1/2 the radius in lenght. Minor septa attain up to one-half the length of the major septa. The cardinal septum is usually shorter than the others; the counter septum is alike all the others. The dissepimentarium is narrow, it attains 1/6—1/4 the radius in width. It consists of 3—5 verticils of concentric dissepiments. Adjacent the external wall the pseudoherringbone dissepiments may occur (pl. 18: 4). In a single specimen the lonsdaleoid dissepiments occur distally (pl. 18: 4).

Remarks. — The specimens from Tyszowce resemble those described by Hill (1938—1941: 107—108, pl. 5: 10—15). They differ from the latter in a larger number of dissepiment verticils and the occurrence of pseudoherringbone dissepiments. The latter character does not fit the diagnosis of the genus *Caninia*; however, lonsdaleoid dissepiments have also been observed in the same specimen.

Occurrence. — Poland: Lower Namurian (Lublin region).

Genus *Siphonophyllia* Scouler, 1842

Diagnosis. — See Hill 1956: F 292, and Cotton 1973: 189.

Remarks. — The genus *Siphonophyllia* and its type species have been discussed by Semenoff-Tian-Chansky (1974: 178—179).

Siphonophyllia cf. *siblyi* Semenoff-Tian-Chansky, 1974
(pl. 19: 1*a-e*)

Material. — 1 specimen with dissepimentarium fragmentarily preserved; 12 peels.

Dimensions:

Specimen No.IG-1403.II.	w.tm	w.dism	n.smj	l.smj
139	22.0		44	average 1/2 tm
	22.2		44	most reach the axis
	22.5		44	some reach the axis
	26.0	2.05	47	average 8.6 mm
	26.5	2.3	47	average 9.5 mm =2/3 tm
	27.5	4.6	48	average 9 mm = = 1/3 tm

Description. — Major septa are amplexoid, slightly dilated, especially in the cardinal quadrants. In the younger part of a corallite some of them may reach the axis (pl. 19: 1*b*). In the distal part they gradually shorten (pl. 19: 1c) to become half as long as the radius or less (pl. 19: 1*d*). Most minor septa are long and penetrate the tabularium. The cardinal fossula is well marked. In some sections the alar and counter pseudofossulae can also be distinquished. The dissepimentarium is narrow; it occupies 1/7—1/4 of the lumen. Lonsdaleoid dissepiments occur peripherally, at the external wall, while herringbone dissepiments are developed close to the internal wall; in places, concentric dissepiments occur. The tabularium is wide; most tabulae are complete, somewhat concave at the axial part, with long and flat tabellae (pl. 19: 1*e*).

Remarks. — The specimen from Terebin differs from both the holotype (Semenoff-Tian-Chansky 1974: pl. 50: 1) and paratypes (*op. cit.*: 184—186, pl. 47: 1—3) in the variability in length of major septa, and the longer minor septa.

Occurrence. — Poland: Upper Viséan (Lublin region).

Genus *Lublinophyllum* Khoa gen.n.

Type species: *Lublinophyllum fedorowskii* sp.n.

Synonymy: Campophyllum Vassiljuk, 1960 (non M. Edwards & Haime).

Derivation of the name: after the town Lublin.

Diagnosis: — Colony fasciculate; lateral increase; minor septa short; cardinal septum shortened in the ephebic stage; counter septum equal to or longer than the other major septa; peripheral dissepiments often lonsdaleoid; tabulae trapezoid; microstructure trabecular.

Species assigned: *L. fedorowskii* sp.n. *Campophyllum caninoides* Vassiljuk, 1960 (non Sibly, 1906).

Geographical and stratigraphical range. — USSR: Tournaisian-Viséan (Donets Basin). Poland: Upper Viséan (Lublin region).

Remarks. — The genus *Lublinophyllum* is assigned herein to the family Cythopsidae on the basis of its similarity to *Siphonophyllia* and *Caninia*. The arrangement of septa with a well marked cardinal fossula, lonsdaleoid dissepiments, and the structure of tabularium are alike in the above mentioned genera. In *Siphonophyllia* and *Caninia* the septal microstructure is fibro-normal, whereas it is trabecular in *Lublinophyllum*. Ontogeny of protocorallite remains unknown.

The colonial genus *Kusbassophyllum* Dobrolyubova (1966: fig. 36) is closely related to *Lublinophyllum*. The main differences between the holotypes of the type species of these two genera are as follows:

	Kusbassophyllum tychtense Dobrolyubova	*Lublinophyllum fedorowskii* sp.n.
C	short, sometimes invisible	long at neanic stage, shortened at ephebic stage
K	alike all the others	somewhat thinner and longer than the others
smj	dilated within dissepimentarium, thin within tabularium	dilated within tabularium, thin within dissepimentarium
ew	densely distributed, laterally accrete	stereoplasmatic swellings of inner verticil of dissepiments

The colonial specimens ascribed by Vassiljuk (1960: 62—63, pl. 14: 1—1*d*) to *Campophyllum caninoides* Sibly are here attributed to the genus *Lublinophyllum* gen.n. They fit the diagnosis of *Lublinophyllum*, while they do not significantly resemble the solitary corallites of *Cyathophyllum flexuosum* Goldfuss, i.e., the type species of the genus *Campophyllum* M. Edwards & Haime. In arrangement of dissepiments and septa the genus *Lublinophyllum* resembles also the specimens of *Campophyllum caninoides* Sibly (Sibly 1906: 368, pl. 31: 2*a*, *b*), the specimens of *Campophyllum* aff. *caninoides* as described by Gorskij (Gorsky 1932: 35, pl. 4: 13) or Volkova (1941: 31, pl. 3: 5), and the colonial specimens of *Koninckophyllum protocolonicum* Fedorowski (Fedorowski 1971: 90, pl. 9: 4; fig. 34: A1—3).

Lublinophyllum fedorowskii sp.n.

(pl. 18: 2*a*, *b*; pl. 19: 2; pl. 20: 1*a-c*, 2—4; fig. 36; fig. 37: 1—3; fig. 38*a-h*)

Holotype: the specimen number IG-1403.II.140; pl. 18: 2*a*, *b*; pl. 20: 1*a-c*.
Type locality: Strzelce IG 2, depth of 811.4—812.4 m.
Type horizon: Upper Viséan.
Derivation of the name: in honour of Dr. Jerzy Fedorowski.

Material. — 5 colony fragments; 11 thin sections and 53 peels.

Diagnosis. — Number of septa (44—46) × 2 at the diameter 20—23 mm, minor septa short; dissepimentarium attains one-third the corallite diameter in width.

Dimensions:

Specimen No. IG-1403.II	d.c	n.smj	l.smj	l.smn	w.dism
141	6.5	30			
	8.0	33			
	9.0	34			
	14.0	39			
	17.1	44	4,6	1.1	2.3
	21.4	44	5.3	0.9	2.8
	22.1	42	5.7	0.9	2.8
144	17.4	43	5.1	2.9	3.3
142	21.1	43	6.2	3.5	3.5
143	21.6	45	6.9	0.7	3.3
	22.5	46	6.8	1.1	3.5
140	20.6	43	5.6	1.1	2.9

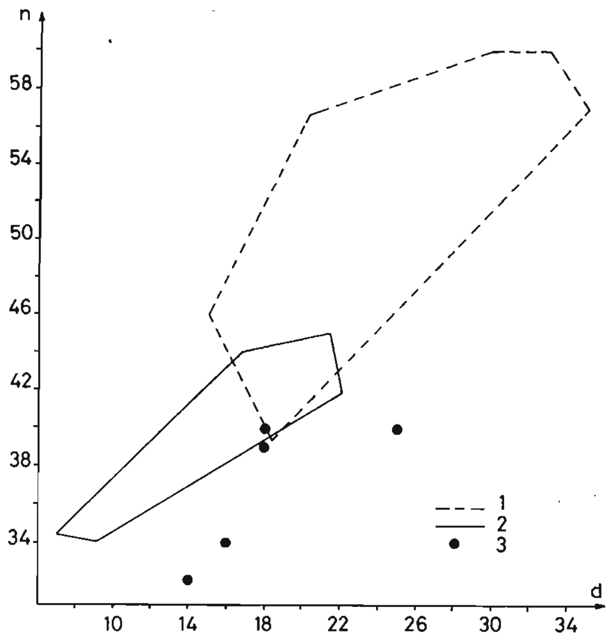


Fig. 36. Ratio of number of septa to the corallite diameter (n:d) for specimens of *Kusbassophyllum* and *Lublinophyllum*: n:d variation fields for (*1*) *Kusbassophyllum tychtense* Dobrolyubova (after Dobrolyubova 1966), (*2*) *Lublinophyllum fedorowskii* sp.n., and septal ratio in (*3*) *Campophyllum caninoides* Vassiljuk non Silby (after Vassiljuk 1960).

Description. — Colony fasciculate. Offsets sparse, rapidly developing into the normal individual (pl. 20: 1*a*). Major septa are equal in length, slightly exceeding one--half the radius. They are thin within the dissepimentarium, clearly dilated within the tabularium (fig. 37), and a little elongated on the surface of tabulae. Minor septa vary in length; in general, they do not reach the internal wall. The first minor septa appear in the lumen at the corallite diameter of some 9 mm, when 34 major septa occur. At the neanic stage the cardinal septum reaches the corallite axis (fig. 38*h*). At the ephebic stage it is somewhat shortened and occupies inconspicuosus fossula (fig. 37: 2, 3). The counter septum is longer than the others (pl. 20: 2,4;fig. 37: 3). The dissepimentarium is 0.27—0.37 the total diameter in width. It consists commonly of angulo-concentric and randomly of pseudoherringbone dissepiments between major and minor septa, whereas between adjacent major septa the herringbone dissepiments occur. The lonsdaleoid dissepiments of various length are commonly developed in the middle of a dissepimentarium. Some lonsdaleoid dissepiments attain 7.5 mm in length and disrupt up to 12 septa of both orders. Such dissepiments may occur only in the ontogenetically older part of a corallite (pl. 21: 2*a*, *b*). In the longitudinal section the dissepiments are inclined downward at about 45 degrees (pl. 20: 1*b*, *c*; fig. 37: 1). The wide tabularium consists of trapezoid, flat

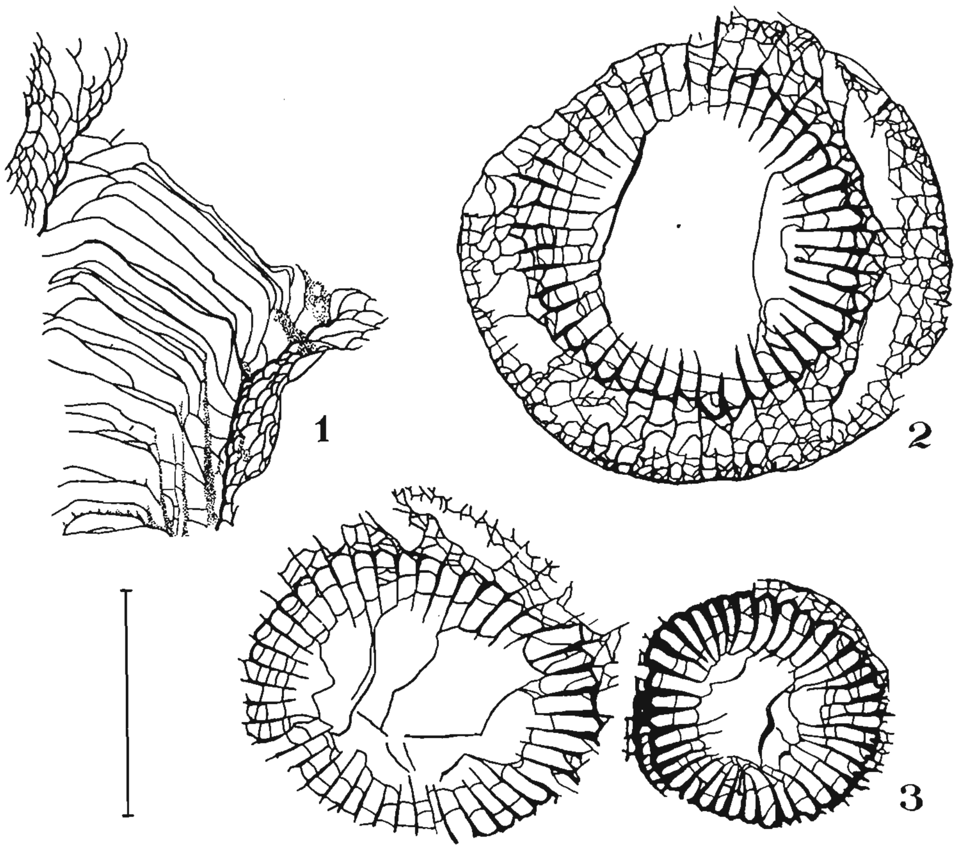


Fig. 37. *Lublinophyllum fedorowskii* sp.n.: *1* longitudinal section, IG-1403.II.140, holotype; *2* cross section, IG-1403.II.143; *3* cross section of a parent corallite and an offset in the late neanic stage, IG-1403.II.141. All specimens from the borehole Strzelce IG 2, depth 811.4—812.4 m.

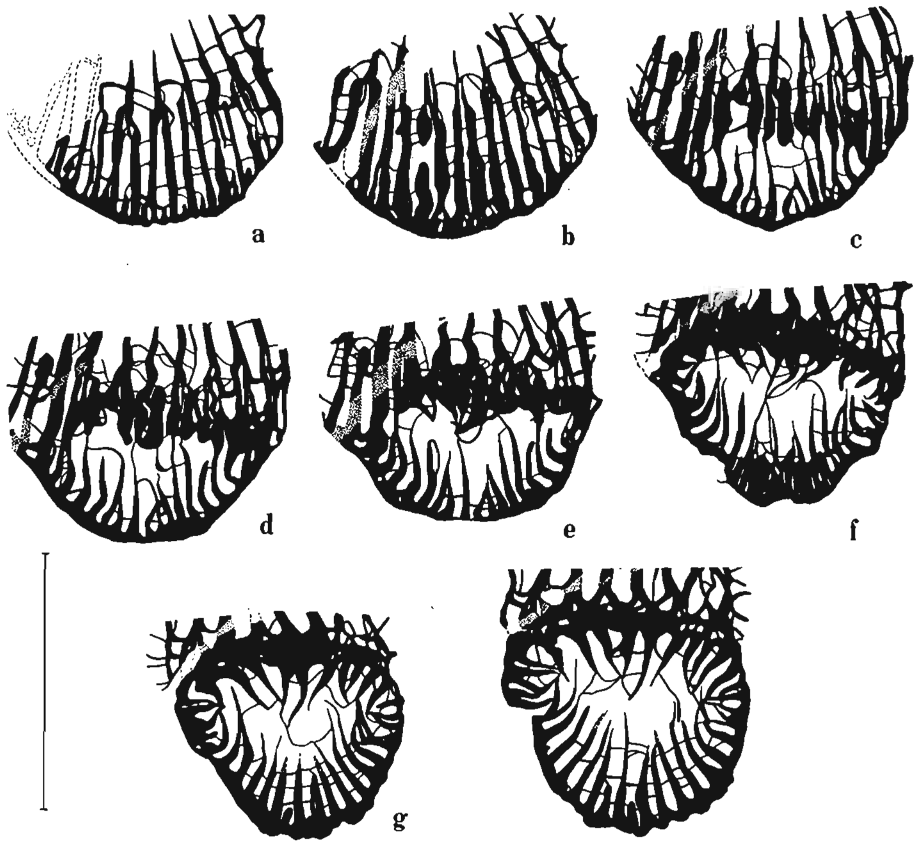


Fig. 38. *Lublinophyllum fedorowskii* sp.n.: *a-h* successive stages of blastogeny: *a*, *b* initial stages, *c*, *d* neanic stage, *e-h* neanic stage; IG-1403.II.141, borehole Strzelce IG 2, depth 811.4—812.4 m.

or slightly concave tabulae approximately 10 per 10 mm. The frequent horizontal peripheral tabellae, separate the axial part of tabularium (fig. 37: 1). The external wall is very thin, while the internal one is slightly thickened.

Blastogeny. — The increase is lateral. The sector of increase covers 7—8 major septa. The septa of both orders dilate there up to 0.8—1 mm (fig. 38*a*). Minor septa become considerably elongate and join the major septa. Simultaneously short, temporary septa are formed close to the parent wall. These may be either the offset minor neo-septa or the third-order septa (fig. 38*a*). They are reduced soon (fig. 38*b*, *c*). Later on, the resistant septa are constricted and interrupted to form the offset calice (fig. 38*b*, *c*). The peripheral parts of disrupted septa are transformed into the offset major septa. One of these septa remains initially continuous to form the axial septum. It gives the origin to the cardinal septum (at the external wall) and the counter septum (fig. 38*c-e*). Originally, the cardinal septum is longer than the others, and it becomes short at the moment when the young individual attain 8.6—8.8 mm in diameter and 34 major septa. The thick partition appears (fig. 38*d-f*) and major septa are almost simultaneously inserted on it. The epitheca separating the offset appears after the dissepimentarium formation.

Occurrence. — As for the holotype.

Family **Bothrophyllidae** Fomitchev, 1953

Genus *Bothrophyllum* Trautschold, 1879

Diagnosis. — See Fedorowski 1975: 57.

?*Bothrophyllum juddi* (Thomson, 1893)

(pl. 15: 5; pl. 22: 3; fig. 39: 1*a-c*)

1924. *Caninia juddi* (Thomson); Lewis: 391, pl. 27, 28, 29.
1974. *Pseudozaphrentoides juddi* (Thomson, 1893); Semenoff-Tian-Chansky: 190, pl 47: 6; pl. 49: 4; figs. 70, 72, 73 (*cum synon.*).

Material. — 12 poorly preserved specimens, often with their dissepimental and axial parts damaged; 54 peels.

Dimensions:

Specimens No.IG-1403.II	d.c	w.dism	n.smj
146	10.0—11.3		29
	18.0	2.7	36
	21.5—24.0	2.7—2.8	37
	25.0—26.0	4.0	38
147	16.5—24.0	3.0—4.0	37
145	21.0—31.0	3.2—4.0	43

Description. — Major septa are short (1/3—1/2 the radius in length) thin within the dissepimentarium and dilated within the tabularium. Their axial ends taper

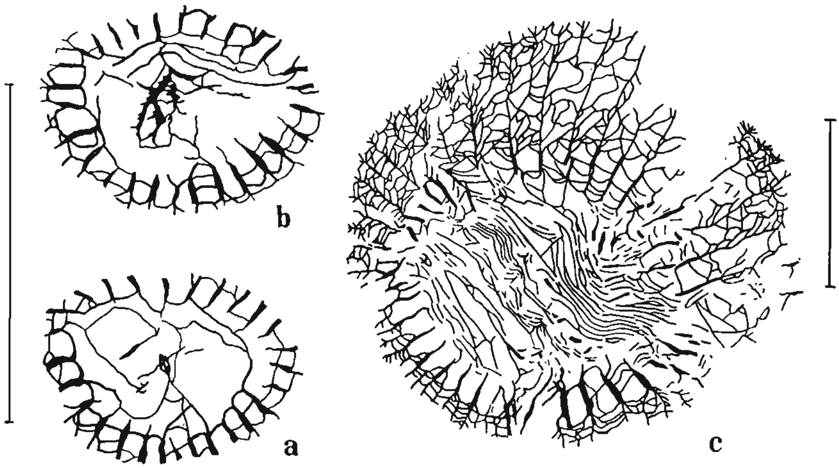


Fig. 39. ?*Bothrophyllum juddi* (Thomson): *a-c* successive cross sections; IG-1403.II.145, borehole Tyszowce IG 1, depth 1375.0—1376.0 m.

rapidly just where the stereoplasmatic layers of septa separate from the septal blade to fuse with the stereoplasmatic layers of the adjacent septa thus, forming a sort of a wall (pl. 23: 3). The cardinal septum is often shortened. At the young stage the counter septum is elongated and reaches the corallite axis; at the ephebic stage it is alike all the other major septa. Minor septa are thin and short; they attain one--half the dissepimentarium in width (in a single specimen they penetrate the tabularium). The variable axial structure occurs only at the neanic stage. It may be complex, formed by either some axial tabelae and numerous axial ends of septa, or septal lamellae (fig. 39: 1*b*); or it may be simple, consisting of a few small axial tabellae and the elongate counter septum (fig. 39: 1*a*). It disappears at the ephebic stage (fig. 39: 1*c*). The dissepimentarium is 1/7—1/5 the total diameter in width. It consists mostly of the herringbone and pseudoherringbone dissepiments; rarely the concentric dissepiments occur (fig. 39: 1*c*).

Remarks. — The discussed species has usually been attributed to the genus *Caninia* (see e.g. Lewis 1924, Hill 1938—1941, Vassiljuk 1960). Semenoff-Tian-Chansky (1974; 190—192) assigned it to the genus *Pseudozaphrentoides* Stuckenberg. However, Fedorowski (1975: 33, fig. 1*b*, *c*) suggested to invalidate the genus *Pseudozaphrentoides* because the reinvestigated by him holotype of *P. jefremovi* Stuckenberg is pathologically deformed at the ephebic stage, while its neanic stage is amplexoid just as it is in *Caninia cornucopiae.* The ontogeny, the structure of the dissepimentarium and the morphology of septa (especially of the cardinal and counter septa) indicate that *Campophyllum juddi* Thomson is closely related to the genus *Bothrophyllum.* A similar opinion has already been expressed by Fomitchev (1953: 318).

Occurrence. — Poland: Lower Namurian (Lublin region).

Bothrophyllum pater Ivanovsky, 1967
(pl. 21: 2, 3*a*, *b*; pl. 22: 2*a*, *b*, 4; fig. 40: 1*a*-*d*, 2*a*-*c*)

1967. *Bothrophyllum pater* Ivanovsky: 59, pl. 9: 1*a*-*v*, 2*a*-*b*.

Material. — 3 specimens with their proximal and dissepimental parts damaged (one of these specimens is about 70 mm long); 1 thin section and 39 peels.

Emended diagnosis. — *Bothrophyllum* with 17—20 mm in diameter and (36—42) × 2 septa; counter septum is always longer than all the others; minor septa penetrate the tabularium.

Dimensions:

Specimen No.IG-1403.II.	w.tm	w.dism	n.smj
150	7.5—9.0		25
	14.5—15.0		31
	19.0—22.0		37
149	18.0—19.0	7.5	42
148	23.0—24.5		41
	24.5—25.0		42

Description. — Major septa are long, subequal, and dilated within the tabularium (especially in the cardinal quadrants). The cardinal septum is variable in length (pl. 22: 2*a*, *b*; fig. 40: 1*c*-*d*), often shortened. The counter septum is thinner and longer than the adjacent ones; at the young stages it join the pseudocolumella (fig. 40: 1*a*, 2*a*, *b*). Minor septa penetrate the tabularium and dilate therein. The dissepimentarium consists mostly of concentric dissepiments; the lateral-cystose dissepiments seldom occur.

Remarks. — The Lublin specimens differ from the holotype (Ivanovsky 1967: 59, pl. 9: 1*a*-*v*) in their shorter major septa; in this feature they resemble the paratype of Ivanovsky (*op. cit.*: pl. 9: 2*a*). The investigated specimens vary in the dilatation of septa within the tabularium (pl. 21: 3*a*, *b*; pl. 22: 4; fig. 40: 1*a*-*d*, 2*a*-*c*). This represents a rather insignificant individual variability.

The present author has somewhat changed the original diagnosis given by Iva-

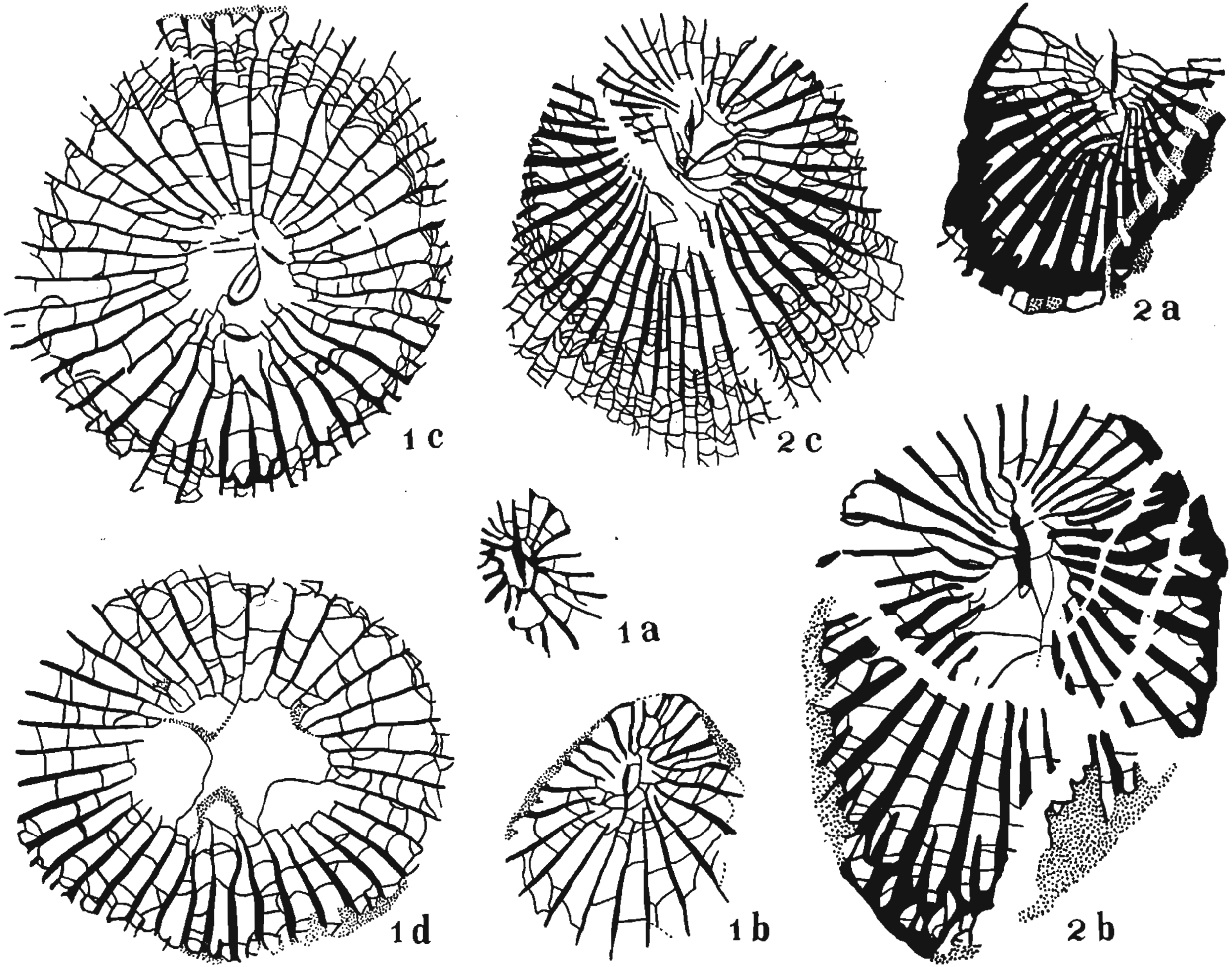


Fig. 40. *Bothrophyllum pater* Ivanovsky: *1a-d* successive cross sections of a corallite; *a* early neanic stage, *b-d*, neanic stage, IG-1403.II.150, borehole Kaplonosy IG 1, depth 432.6—433.6 m; *2a-c* successive cross sections of a corallite: *a*, *b* neanic stage, *c* ephebic stage, IG-1403.II.149, borehole Tyszowce IG 1, depth 1737.6—1738.6 m. *1a*, *b*, *2a*, *b* × 3,8; *1c*, *d*, *2c* × 2.6.

novsky (*l.c.*) since he had not found any separate columella in the illustrations given by Ivanovsky or in the ontogeny of the Lublin specimens.

Occurrence. — Poland: Upper Viséan (Lublin region). USSR: Upper Tournaisian — ? Lower Namurian (Turgay Lowland).

Bothrophyllum sp.

(pl. 21: 1*a*-*c*; fig. 41 *a*, *b*)

Material. — 1 specimen with its peripheral part damaged and proximal part lacking; 6 peels.

Dimensions:

w.tm	w.dism	n.smj
10.5—11	4.5	36
11.0—14.5	6.5	36
11.0—14.5	5.0	37
13.5	6.0	37
14.5	6.0	37

Description. — Major septa are long, most of them twist at the corallite axis. The tabular parts of septa are slightly dilated, especially in the cardinal quadrants. The dilatations may start in the middle of dissepimentarium (pl. 21: 1*b*). Minor septa are thin and attain usually one-half the dissepimentarium in length only a few of them reach the internal wall. The cardinal septum is a little shortened. The counter septum is alike all the others. There are some thick septal lamellae in cross sections of the axial part of the distal corallite portion (fig. 41*a*, *b*) but no axial lamella have been found. The dissepimentarium has more than one-half the total diameter in width. It consists of thin concentric dissepiments at the periphery, and thick herringbone dissepiments adjacent to the internal wall.

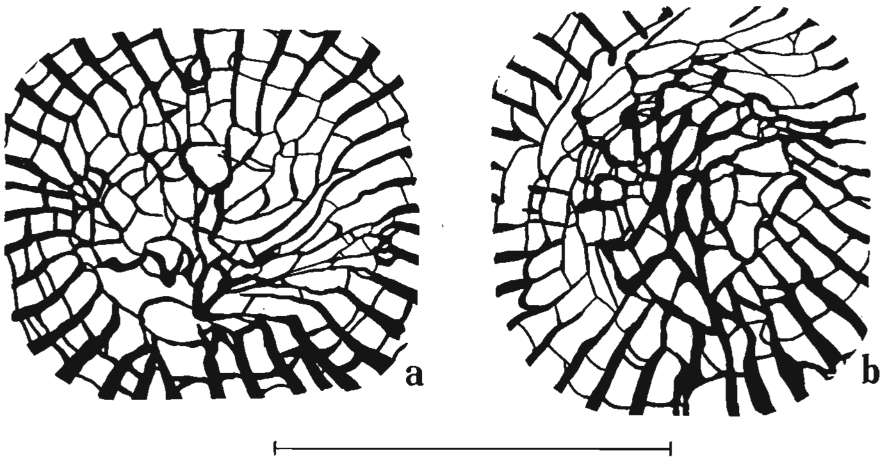


Fig. 41. *Bothrophyllum* sp.: *a*, *b* cross sections of the axial structure, IG-1403.II.151, borehole Koczmin IG 1, depth 1162.6—1163.6 m.

Remarks. — In the structure of both dissepimentarium and major septa the specimen from Korczmin resembles *Caninophylum archiaci monense* Lewis (1929, pl. 12: 2). It differs from the latter in a smaller size and lower septal ratio. Rowett (1969: 70) regards *Caninophyllum* Lewis, 1929 as the younger synonym of *Bothro-*

phyllum Trautschold. A similar supposition has also been expressed by Fedorowski (1975: 58).

Occurrence. — Poland: Upper Viséan (Lublin region).

Suborder **Columnarina** Rominger, 1876

Family **Lonsdaleiidae** Chapman, 1893

Genus *Lonsdaleia* McCoy, 1849

Diagnosis. — See Hill 1938—1941: 151.

Lonsdaleia floriformis floriformis (Martin, 1809)
(pl. 23: 1—5; pl. 24: 1*a-h*; fig. 3*a-h*; fig. 42: 1*a-e*, 2*a-f*)

1916. *Lonsdaleia floriformis floriformis* Martin emend. Smith; Smith: 247, pl. 19: 1—5 (*cum synon.*).
1938—1941. *Lonsdaleia floriformis floriformis* (Martin); Hill: 155, pl. 8: 15, 16.
1958. *Lonsdaleia floriformis floriformis* (Martin); Dobrolyubova: 7*a*, pl. 1—3; figs 11, 12.

Material.— 7 fragments belonging probably to the same colony; 2 thin sections and 101 peels.

Dimensions:

Specimen No.IG-1403.II.	d.c	n.smj	w.tm	d.col
154	4.8× 5.7	18	3.7—4.3	1.0—1.3
	7.2× 7.5	21	4.8—5.0	1.6—2.0
	15.5×16.0	25	8.2—8.7	2.7—3.8
	13.8×16.5	27	6.7—7.5	2.0—3.2
	15.0×18.9	28	8.0—9.5	4.5—4.8

Blastogeny — The process of increase in the genus *Lonsdaleia* has been investigated by Smith (1916) and Jull (1967). The increase similar to that investigated by Jull (*op. cit.*) in *Lonsdaleia floriformis floriformis* occurs in most specimens here examined, and it may be regarded as typical of this subspecies. The sector of increase occurs commonly in a corner of the parent corallite (fig. 42: 1*a-e*, 2*a-f*). The partition is formed by dilatation of lonsdaleoid dissepiments. In an offset, long cardinal septum appears at first; it may by formed simultaneously with the formation of partition (fig. 42: 1*a*, 2*c-d*). The counter septum appears at the end of a hystero-brephic stage or at the beginning of a hystero-neanic stage. Apart from this type of increase two other types have also been found in the colony from Kaplonosy; these are as follows:

Type A (fig. 3*a-f*, offset A): In the zone of increase 3 long septa and an initial partition appear at first. The partition, originating from transformation of a small dissepiment, separates the near-wall part of the offset (fig. 3*a*; pl. 24: 1*b*, *c*) Next, 3 other septa appear. At the early hystero-brefic stage 4 of the mentioned septa join one to another. Later on they shorten (fig. 3*a-f*; pl. 24: 1*e*, *f*). At the early-neanic stage the offset joins the adjacent one, the development of which is presented below. The process of junction of these 2 individuals has already been discussed (page 316).

Type B (fig. 3*a-f*, offset B): Peripheral parts of the parent septa are reduced in the zone of increase, only the lonsdaleoid dissepiments remain there (pl. 24: 1*a*). Some of these dissepiments thicken to form an aseptal offset closed by a thick ste-

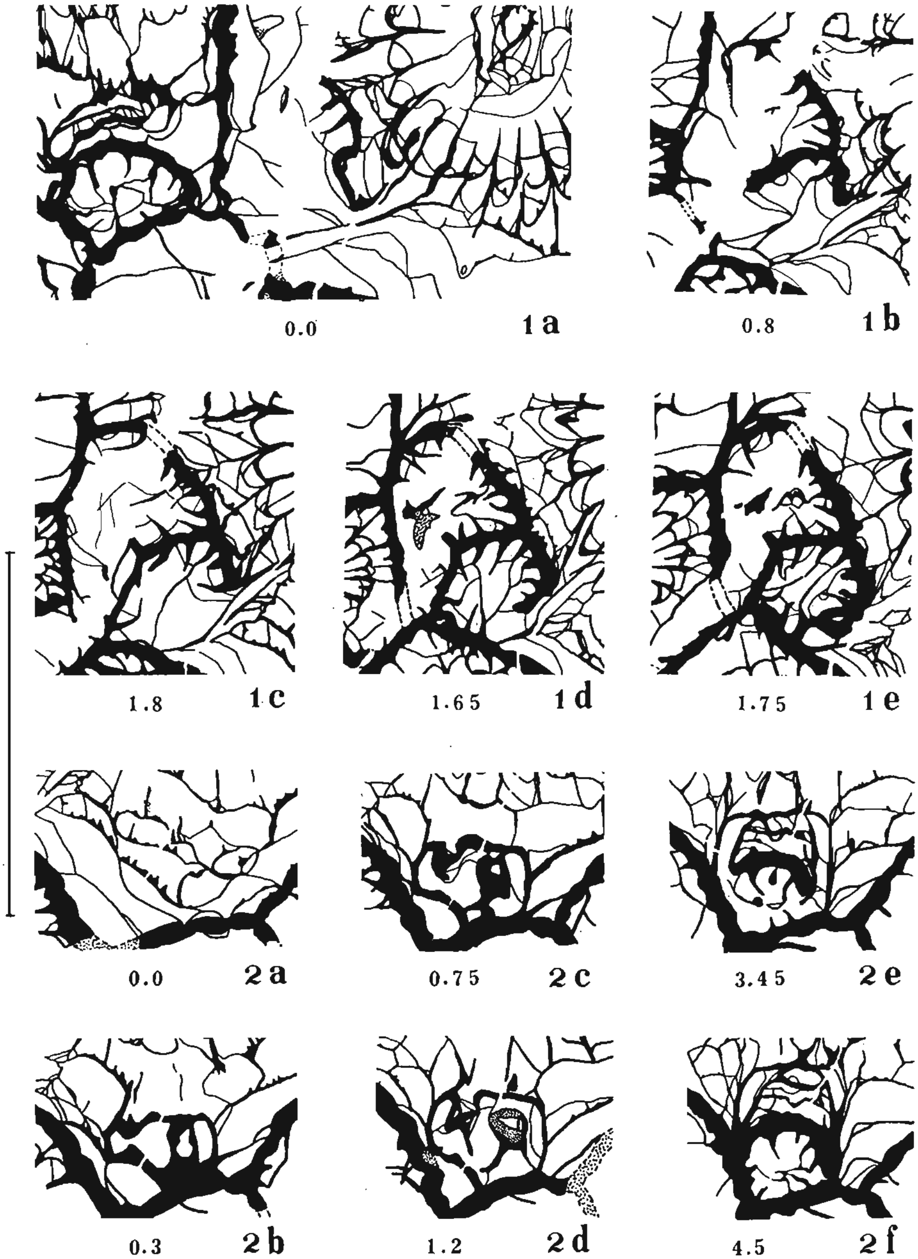


Fig. 42. *Lonsdaleia floriformis floriformis* (Martin): *1a-e* successive stages of increase of two offsets developing in one parent calice; *2a-f* successive stages of increase of the offsets developing in a corner of the parent corallite; IG-1403.II.152, borehole Kaplonosy IG 1, depth 434.0—434.5 m. Numbers below figures are cumulative distances of distal growth in mm.

reoplasmatic wall (fig. 3*a-d*; pl. 24: 1*a-d*). A few septa appear irregularly (fig. 3*e-f*) and thereafter, the offset joins that one described above.

Other types (pl. 24): In some offsets the partitions are formed by inflation of a large peripheral lonsdaleoid dissepiment. In these offsets the initial calices are omega-like in cross sections. The septa may appear either before the inflation occurs or simultaneously with it (pl. 24: 1*b-e*). Thus, the variability in the increase of *Lonsdaleia floriformis floriformis* consists in the formation of partition, insertion of septa, and presence (or absence) of axial septum (see also Jull 1967, fig. 2).

Remarks. — The investigated specir ›n differs from the neotype (Smith 1916: 247, pl. 19: 1—3) in the more numerous but smaller dissepiments and the more steep tabulae (pl. 23: 5). Apart from the above-described variability in the increase, the specimen supported also the view of Swann (1947), Fedorowski (1965), and Fedorowski & Jull (1976) who maintained. That in cerioid colonies the polyps may be entirely intergrated; it contradicts the opinion expressed by Shouppé & Oekentorp (1974). The septothecal wall separating adjacent corallites gradually disappears (pl. 24: 1*a-e*) being replaced by the dissepiments common for both corallites (pl. 24: 1*d-h*). In some offsets the walls become completely closed only at the late-neanic stage (pl. 23: 3; fig. 3*e-h*). Both indiviuals remain for a long connected by channels. The connecting channel, 0.8—2.4 mm in width (pl. 23: 4) remains open for an unsually long time. In this case the parent produced a wide dissepimentarium in proximity of the channel, while the offset attained the early-ephebic stage.

Occurrence. — Poland: Upper Viséan (Lublin region). Great Britain: zone D_{1-3}. USSR: Upper Viséan (Russian platform). China: Viséan (Kuangsi province).

Order **Heterocorallia** Schindewolf, 1941

Family **Heterophyllidae** Dybowski, 1873

Genus *Hexaphyllia* Stuckenberg, 1904

Diagnosis. — See Hill 1938—1941: 203.

Remarks. — Schindewolf (1941: 286, pl. 10: 8; pl. 11: 2, 3: pl. 14: 2) assigned to *Hexaphyllia mirabilis* (Duncan) the corallites from 1.75—2 mm to 3.2—3.5 mm in diameter. Hill (1938—1941: 202—204) distinguished 3 distinct species within the genus *Hexaphyllia*, related to the corallite diameter, surface ornamentation, and tabulae distribution. These species are: *Hexaphyllia m'coyi* (5—5.5 mm in diameter), *H. marginata* = *H. lyelli* (2.5 mm), and *H. mirabilis* (1 mm).

Among the Lublin specimens of *Hexaphyllia* two distinct groups can be recognized, which are regarded in this study as the species: namely, the specimens with 0.5—1 mm in dimeter, and those with 1.6—2.3 mm in diameter. These groups differ also in the relation of external wall thickness to corallite diameter. Specimens with intermediate diameters have not been found. The structure and distribution of septa, and the structure of external wall and tabulae are very similar in all the species of *Hexaphyllia*. In many investigated specimens the cross sections exhibit only 5 septa (pls 25, 26; figs 43, 44). Różkowska (1969: 161—173) found the 5-septal early developmental stages in *Oligophylloides pachythecus pachythecus* (fig. 69: A2, A4), *O. pachythecus pentagonus* (fig. 70: A4, A5, D), and *Heterophyllia famenniana* (fig. 72: I1, I2). Dr J. Fedorowski (oral communication) observed 5-septal specimens in the Upper Viséan of Gałęzice (Holy Cross Mts). Thus, 5-septal corallites of *Heterocorallia* are common in Poland. Thomson (1883: 120) maintained that some Scottish corallites of *Hexaphyllia mirabilis* do also exhibit 5 septa.

Fragmentary preservation state of the investigated specimens did not allow to conclude whether we deal with a 5-septal developmental stage of *Heterophyllia* or *Hexaphyllia*, or whether these specimens represent a distinct taxon (genus ?). The outline of some specimens resembles that typical of the genus *Hexaphyllia* (pl. 25: 4*a*, *b*), while other specimens are pentagonal in shape, with regularly distributed septa (pl. 25: 6, 10; fig. 43: 4, 5). In a single piece of rock a 6-septal specimen (*Hexaphyllia mirabilis*) occurs along with a 5 septal one; the latter being larger in size.

It seems that a fairly strong correlation occurs between the situation of one of the septa and the possibility to insert the next one (the fifth and, maybe, the sixt septum). The present author has found that a corallite may exhibit more sides than the number of septa it possesses actually (pl. 26: 7*a*, *b*: fig. 43: 9*a*, *b*); furthermore, one of these septa does not reach any corallite corner but it is atached to the middle of a corallite side. Later on, this particular septum bifurcates (pl. 26: 7*c*, fig. 43: 9*c*) and both the daugther septa direct to the corners. The present author holds that no new septum originate from bifurcation of a corner septum. Then, one may conclude that either sixth septum does never occur in regular 5 — septal specimens (such specimens should be recognized for a new genus); or one of the corallite corners becomes flattened thus, forming the sixth side of the corallite with septum coming at the middle of it (in such a casé an appearance of the sixth septum is quite possible). The present author has not found such a hypothetical stage but nevertheless, its non-existence cannot be proved; therefore, the 5-septal specimens are herein recognized as Heterophyllidae sp. indet.

Hexaphyllia mirabilis (Duncan, 1867)

(pl. 25: 2, 3; fig. 43: 2)

1938—1941. *Hexaphyllia mirabilis* (Duncan); Hill: 202.
1961. *Hexaphyllia mirabilis* (Duncan); Fontaine: 204, pl. 5: 6—8; pl. 6: 3; pl. 7: 2, 3.
1971. *Hexaphyllia mirabilis* (Duncan); Perret & Semenoff-Tian-Chansky: 587, pl. 3: 4, 5 (*partim*).

Material. — 15 specimens; 1 thin section and 85 peels.

Diagnosis. — See Hill 1938—1941: 202.

Dimensions:

Specimen	d.c	(continued)	
No.IG-1403.II.		158	0.60×0.80
165	0.46×0.50	162	0.60×0.63
12A	0.50×0.55	164	0.70×1.00
160	0.50×0.60		
163	0.75×0.60		

Remarks. — Hill (1938—1941) found that the specimens ascribed by Duncan and Thomson to *Hexaphyllia mirabilis* have been lost. She gave diagnosis of the species after the descriptions and illustrations. The morphology and size of the specimens attributed by the present author to *H. mirabilis* agree with the diagnosis given by Hill (*l.c.*). In fact, these are the least corallites assigned to the genus *Hexaphyllia* that occur in the Lublin region. These specimens exhibit a slight individual variability in thickness of the external wall and structure of the corallite corners. The external wall may be 0.07 mm (pl. 25: 2) or 0.04 mm (pl. 25: 3) thick at the diameters of 0.48 and 0.66 mm, respectively. The corners may be either elongáte and rather sharp-ended, or gently rounded and with a small depression at the apical part (pl. 25: 2).

Occurrence. — Poland: Upper Viséan (Sudetes and Lublin region). Scotland: ?Viséan (Lower Limestone Series). Laos; Viséan (Ban Phit limestone); Hautes Pyrenées: Viséan — ? Namurian (Ardengost limestone).

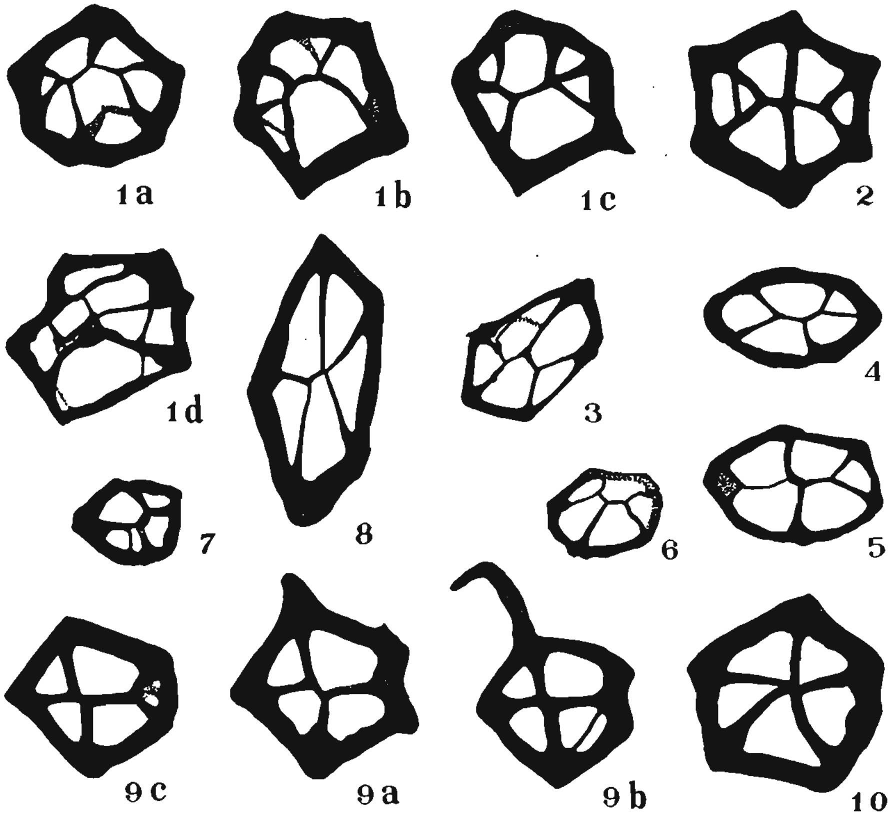


Fig. 43. 1, 5 *Hexaphyllia* sp.: *1a-d* successive cross sections of a corallite with an irregular arrangement of septa, IG-1403.II.161D; *5* cross section of a corallite with an initial stage of the sixth septum IG-1403.II.12D. *2 Hexaphyllia mirabilis* (Duncan): cross section, IG-1403.II.162A. *3, 4, 6—10* Heterophyllidae gen.indet.: *3* IG-1403.II. 164D, *4* IG-1403.II.12C, *6, 7* IG-1403.II.161B and E, *8* IG-1403.II.176, *9a-c* successive cross sections of a corallite pentagonal in shape, with an initial stage of the fifth septum, IG-1403.II.12E; *10* cross section of a corallite with an axial junction of septa resembling that in *Hexaphyllia prismatica* Struckenberg, IG-1403.II.12G. Derivation of the material: specimens IG-1403.II.12 — borehole Koczmin IG 1, depth 1223.1—1224.1 m; IG-1403.II.161 — borehole Lublin IG 1, depth 1197.3—1197.5 m; IG-1403.II. 162, borehole Kaplonosy IG 1, depth 438.5 m; IG-1403.II.164, borehole Bychawa IG 1, depth 1738.2—1739.2 m; IG-1403.II.176, Tyszowce IG 1, depth 1705.7—1706.7 m. 1—8 × 40; 9a-c, 10 × 60.

Hexaphyllia marginata (Fleming, 1828)

(pl. 25: 1*a-c*; fig. 44: 1)

1938—1941. *Hexaphyllia marginata* (Fleming); Hill: 203; pl. 11: 24 (*cum synon.*).

1967. *Hexaphyllia prismatica* Stuckenberg; Fedorowski: 24: fig. *a*, *b*.

Material. — 2 specimens; 2 thin sections and 20 peels.

Dimensions:

Specimen No.IG-1403.II.	d.c	(continued)	
		161	1.9×2.0
40	1.5×1.6		2.0×2.0
161	1.6×1.9		2.0×2.3
	1.8×2.0		

Remarks. — Hill (1938—1941: 203—204) found that the specimens of both *Lithostrotion marginatum* Fleming and *Hexaphyllia lyelli* Duncan, 1867 have been lost. On the basis of the descriptions and illustrations, this author has recognized *H. lyelli* Duncan for the junior synonym of *H. marginata* Fleming. In the Lublin region *H. marginata* differs from *H. mirabilis* in its larger size and thicker external wall.

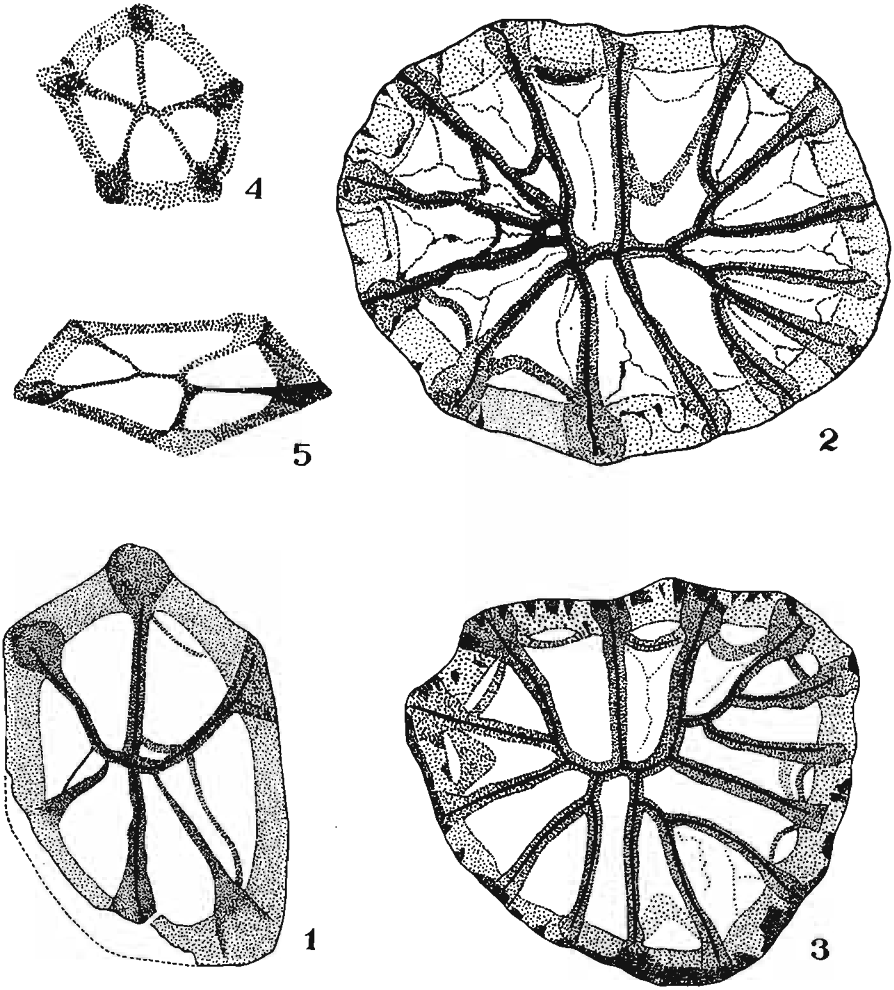


Fig. 44. *1 Hexaphyllia marginata* (Fleming): cross section, IG-1403.II.161C, borehole Lublin IG 1, depth 1197.3—1197.5 m, × 22. *2*, *3 Heterophyllia angulata* Duncan: cross sections of specimens IG-1403.II.169 and 170, borehole Ulhówek IG 1, depth 1445.0—1446.0 m, × 22. *4*, *5* Heterophyllidae gen.indet.: *4* cross section of the 5-septal corallite regularly pentagonal in outline, IG-1403.II.162B, borehole Kaplonosy IG 1, depth 438.5 m; *5* cross section of the 5-septal corallite, IG-1403.II.168B, borehole Rudnik IG 1, depth 1826.8—1827.8 m; × 40.

The average size of all Lublin specimens attributed to these two species, and the ratio of their external-wall thickness to corallite diameters, are as follows:

H. mirabilis	0.62 mm	1/12
H. marginata	1.89 mm	1/8

Occurrence. — Poland: Upper Viséan (Sudetes and Lublin region). Scotland: Viséan.

Hexaphyllia sp.
(pl. 25: 7, 12; pl. 26: 3; fig. 43: 1*a-d*, 5)

Material. — 3 specimens; 3 peels.

Remarks. — In the Lublin region some specimens have been found the size of which fits the diagnosis of *Hexaphyllia mirabilis*, while the morphology is somewhat different from that typical of the genus *Hexaphyllia*. The specimen IG-1403.II.12D (pl. 25: 7) exhibits 6 septa but only 5 sides. One couple of its lateral septa is poorly developed and does not come at any corallite corner. The second specimen is also 6-septal (specimen number IG-1403.II.12F, pl. 25: 12; fig. 43: 5). It is oval in the cross section and exhibits one couple of poorly developed lateral septa. The third specimen (specimen number IG-1403.II.161D, pl. 26: 3; fig. 43: 1*a-d*) exhibits 6 septa but it lacks the symmetry typical of *Hexaphyllia mirabilis*.

Occurrence. — Poland: Upper Viséan (Lublin region).

Genus *Heterophyllia* McCoy, 1849

Diagnosis. — See Hill 1956: F 327.

Remarks. — In the Lublin specimens the septa are grouped in 4—6 "parabolae" (fig. 45); this contrasts with the limit of 5 parabolae, determined in the diagnosis given by Hill (1938—1941: 196). Schindewolf (1941) has divided the genus *Heterophyllia* into 2 subgenera related to the number of septa occurring in the cardinal quadrants; 1—2 septa are typical of the subgenus *Heterophylloides*, while 3—5 septa characterise the subgenus *Heterophyllia*. The present author observed that in a single specimen from the Lublin region, attributed to *H. angulata* Duncan (fig. 45), in some sections 3 septa occur in the cardinal quadrants (fig. 45*b-e*), whereas in some other sections only a single septum occurs. This may indicate that the number of septa occurring in the cardinal quadrants cannot be regarded as a diagnositc. This conclusion remains to be tested by studies on a larger material.

Heterophyllia grandis McCoy, 1849
(pl. 26: 1*a*, *b*, 2*a-d*)

1938—1941. ***Heterophyllia grandis*** McCoy; Hill: 198, pl. 11: 11—13.
1941. ***Heterophyllia grandis*** McCoy; Schindewolf: 292, pl. 9: 1, 2; pl. 10: 5, pl. 11: 1; pl. 12: 1; pl. 14: 1; figs 17, 18, 27, 47, 48.

Material. — 3 specimens; 1 thin section and 27 peels.

Diagnosis. — See Hill 1938—1941: 198.

Dimensions:

Specimen No.IG-1403.II.	d:c	n.smj	septal formula	external-wall thickness
167	5.8×8.2	22	2.9—3.8	0.3
166	5.7×7.6	21	3.7—3.8	0.2—0.3
	5.0×7.2	28	1.11—4.12	0.3—0.4
	5.1×7.0	28	1.6—3.18	0.4—0.7
	6.4×8.0	29		
	6.0×6.8	31		

Remakrs. — The specimen IG-1403.II.167 (pl. 26: 1*a*, *b*) differs from the holotype (McCoy 1855: 112, pl. 3A: 1; Hill 1938—1941: 198, pl. 11: 11—13) in its smaller size and less numerous septa in the cardinal quadrants. According to Hill (*l.c.*) the septal ratio of *H. grandis* is 27/6—9, according to Schindewolf (1941) it is 32—40/7—10.4; The second specimen (specimen number IG-1403.II.166, pl. 26: 2*a-d*) is highly variable. Its proximal sections are larger and exhibit more numerous septa than do the distal ones. In the latter sections the septa are deformed and shortened, they do not reach the corallite axis (pl. 26: 2*b-d*); the tabulae are densely distributed there. The structure of marginarium and the general septal pattern resemble *Heterophyllia phillipsi* Thomson (1883: pl. 10: 14; Hill 1938—1941: pl. 11: 22); however, the latter attains 10—12 mm in diameter (Hill, *l.c.*) and its distal sections are smaller.

Occurrence. — Poland: Upper Viséan (Sudetes, Lublin region). Scotland: Upper Viséan.

Heterophyllia angulata Duncan, 1867
(pl. 27: 1*a*, *b*, 2*a*, *b*, 5—7; fig. 44: 2, 3; fig. 45*a-h*)

1938—1941. *Heterophyllia angulata* Duncan; Hill: 202, pl. 9: 23.
1940. *Heterophyllia kitakamiensis* Yabe & Sugiyama: 82, pl. 4: 1—7; fig. 1: 1—7.
1940. *Heterophyllia* cf. *kitakamiensis* Yabe & Sugiyama: 83, pl. 4: 8, 9; fig. 1: 8.
1941. *Heterophyllia angulata* Duncan; Schindewolf: 295, pl. 10: 3, 4; pl. 15: 6, 7; figs 9, 10, 11.

Material. — 7 specimens; 4 thin sections and 53 peels.

Diagnosis. — See Hill 1938—1941: 202.

Dimensions:

Specimen No.IG-1403.II.	d.c	n.s	septal formula	external-wall thickness (av)	n.t/10 mm
171	1.1×2.0	12	1 3 3 5	0.15	
	1.6×1.9	12	1 4 2 5	0.11	
170	2.2×2.4	14	1 5 3 5	0.17	
	2.1×2.5			0.19	8—10
4B	2.3×2.6	14	1 5 3 5	0.21	
	2.6×2.8	20	3 6 5 6		
170	2.2×2.7			0.28	12—13
	2.5×3.2	14	1 6 1 6	0.23	

Remarks. — Schindewolf (1941: 295—296) noticed the similarity of *Heterophyllia kitakamiensis* Yabe & Sugiyama to *Heterophyllia angulata* Duncan. The former species exibits 13 septa at the diameter of 2.5 mm. Most Lublin specimens approach to it very closely. The specimen IG-1403.II.169 (pl. 27: 2) is oval in the cross section just as *H. kitakamiensis* is. In another specimen (IG-1403.II.170, pl. 27: 1; fig. 44: 3) the septal pattern resembles that of the Japanese specimens, but the shape is triangular in cross section. The specimen IG-1403.II.4B (fig. 45) is variable (some 70 successive sections were investigated). In the middle part of the corallite the diameter is larger than in the extreme ones; in some sections the septa are almost 4 times as thick as some others; the septa appear and disappear irregularly. In some sections there are up to 20 septa. In the extreme sections the septal pattern resembles that occurring in *H. kitakamiensis*. It seems that the character of septa and size of the corallite were strongly influenced by environmental factors. When its development taken into account, this corallite resembles in structure (first of all the septal formula and number of septa either *H. kitakamiensis* (pl. 27: 7; fig. 45*a-f*) or *H. angulata* (fig. 45*b-e*), or appears intermediate (fig. 45 *g*, *h*). This is regarded by the present author as the sufficient premise to recognize *Heterophyllia kitakamiensis* Yabe & Sugiyama for the junior synonym of *H. angulata* Duncan. In *Heterophyllia angu-*

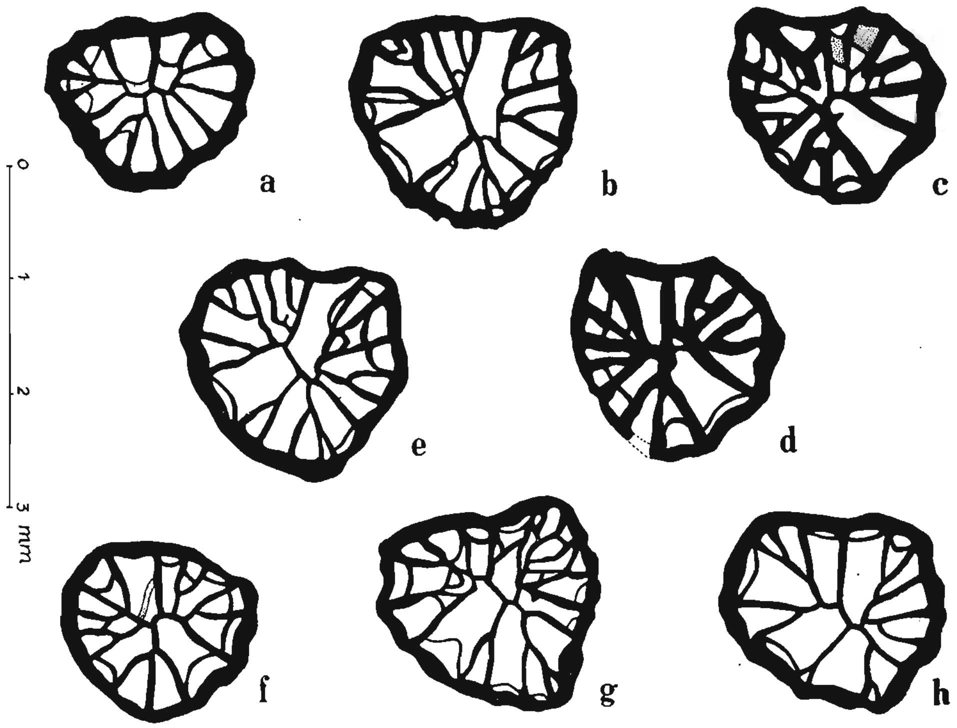


Fig. 45. *Heterophyllia angulata* Duncan; *a-h* successive cross sections, of a corallite, IG-1403.II.4B, borehole Ulhówek IG 1, depth 1281.0—1283.0 m.

lata the septa range in number from 13 to 22; but the septal pattern remains all the same.

Occurrence. — Poland: Upper Viséan (Sudetes and Lublin region). Scotland: Upper Viséan. Japan: Lower Carboniferous.

Heterophyllia parva Schindewolf, 1941
(pl. 25: 8; pl. 27: 3, 4, 8a-c)

1941. *Heterophyllia parva* Schindewolf: 294, pl. 9: 5—9; pl. 10: 6; pl. 14: 4, 6; pl. 15: 1a-d; figs 5, 8, 19, 20, 23, 24, 49, 50.

Material. — 8 specimens; 34 peels.

Diagnosis. — Cylindrical *Heterophyllia* with 13—21 septa at the diameter of 2—5 mm; 2—3 of these septa in the cardinal quadrants.

Dimensions:

Specimen No.IG-1403.II.	d.c	n.s	septal formula
173	1.6×2	13	2 5 2 4
174	1.5×2,6	13	2 5 2 4
160	1.8×2.1	13	1 4 3 5

Remarks. — The investigated specimens are smaller than the holotype. The holotype diameter is 3.4 to 5—5.5 mm; the septal formula is as follows: 2 4 4 4, 2 7 4 5, 3 7 5 5 (Schindewolf 1941: 294—295, fig. 5*a-f*). In the specimen IG-1403.II.173 the proximal sections exhibit septal pattern of *Heterophyllia angulata* type (pl. 27: 8*a*). In the proximal part of this specimen (up to 4 mm of the corallite growth) there is a single septum in the cardinal quadrants. In the distal sections of the same specimen two septa already occur in the cardinal quadrants. This fits diagnosis of *Heterophyllia parva* Schindewolf. *H. parva* might delvelop from *H. angulata.*

Occurrence. — Poland: Upper Viséan (Sudetes and Lublin region).

Nguyên Duc Khoa
Phòng Cô sinh — Dia tâng
Viên Dia chât và Khoáng san
Dông Da
Hanoi
Wietnam
May, 1977

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NGUYEN DUC KHOA

KARBOŃSKIE RUGOSA I HETEROCORALLIA Z WIERCEŃ NA LUBELSZCZYŹNIE

Streszczenie

Opisane w tej pracy 52 gatunki, podgatunki i oznaczone rodzajowo formy Rugosa i Heterocorallia zostały zebrane z rdzeni 21 otworów wiertniczych z osadów górnowizeńskich i dolnonamurskich. Opisano następujące nowe gatunki i podgatunki: *Lithostrotion (Siphonodendron) rossicum strzelcense, L. (S.) rossicum parvum, L. (S.) dobrolyubovae, Diphyphyllum rarevesiculosum, Turbinatocaninia tyszowcensis, Spirophyllum sanctaecrucense lublinense, Lublinophyllum fedorowskii.* Najliczniej reprezenowane są rodziny Lithostrotionidae i Aulophyllidae. W podrodzaju *Siphondendron* opisano m.in. gatunki bez dissepimentów (*L. (S.) junceum*) i z dissepimentami we fragmentach koralita (*L. (S.) rossicum rossicum, L. (S.) rossicum strzelcense, L. (S.) rossicum parvum*). Jeden gatunek z rodzaju *Diphyphyllum* (*D. rarevesiculosum*) także posiada tę cechę. Stwierdzono obecność rodzajów *Orionastraea* i *Turbinatocaninia* na Lubelszczyźnie. Opisano blastogenezę 13 gatunków i podgatunków: *Lithostrotion (Siphonodendron) junceum, L .(S.) rossicum rossicum, L. (S.) rossicum strzelcense,*

L. (*S.*) *volkovae*, *L.* (*S.*) cf. *martini*, *L.* (*S.*) *affine*, *L.* (*S.*) *dobrolyubovae*, *L.* (*S.*) cf. *portlocki*, *Diphyphyllum simplex*, *D. rarevesiculosum*, *Lublinophyllum fedorowskii*, *Lonsdaleia floriformis floriformis*. Stwierdzono, że ściana typu „partition" może być formowana różnie w tym samym procesie pączkowania osiowego u *L.* (*S.*) *dobrolyubovae* (figs. 19, 20, 21, 22). W formowaniu partition mogą tutaj brać udział septa i lamelle septalne koralita macierzystego. Oprócz normalnego pączkowania, zdarza się u *L.* (*S.*) *junceum*, że partition może być pochodzenia septalnego (fig. 6) a u *L.* (*S.*) *rossicum strzelcense* — dissepimentalnego (fig. 13). U *Lonsdaleia floriformis floriformis*, oprócz podobnego sposobu pączkowania jakie przedstawił Jull (1967), zaobserwowano, że protosepta mogą powstać w miejscu pączkowania przed formowaniem partition, a zakładanie protoseptów może odbywać się jednocześnie z formowaniem partition. Pączek u tego podgatunku może przechodzić stadium aseptalne i może wytworzyć septum osiowe.

Obserwacje nad blastogenezą pozwoliły autorowi stwierdzić, że blastogeneza nie jest stałą cechą diagnostyczną gatunku, nie zawsze też daje się zastosować jako kryterium rodzajowe.

Obecność holoteki u *Orionastraea* aff. *magna* (pl. 8: 1c), zanik ściany między koralitami u *Lonsdaleia floriformis floriformis* (pl. 27) oraz zlewanie się koralitów u tego podgatunku (fig. 3) przemawiają za poglądem, że kolonia masywna koralowców jest jednostką biologiczną. Autor obserwował także podobne zjawisko zlewania się dwóch koralitów w wiązkowej kolonii *L.* (*S.*) *junceum* (fig. 7, 8).

Na Lubelszczyźnie w utworach górnowizeńskich dominują Rugosa o koloniach wiązkowych. Fauna dolnonamurska jest uboga, znaleziono ją tylko w otworach Tyszowce IG 1 i Ulhówek IG 1. Na podstawie analizy fauny Rugosa i Heterocorallia autor stwierdził, że w okolicy Ulhówka i Kosmowa morze późno-wizeńskie było dość głębokie. Najlepsze warunki dla rozwoju koralowców w tym basenie miał obszar przybrzeżny w okolicy Kaplonosów.

НГУИЕН ДЫК КХОА

КАРБОНСКИЕ RUGOSA И HETEROCORALLIA ИЗ БУРОВЫХ СКВАЖИН ЮГО-ВОСТОЧНОЙ ПОЛЬШИ

Резюме

В статье было разработано 52 вида, подвида и форм определённых до рода Rugosa и Heterocorallia, взятых из кернов 21 буровых скважин из отложений верхнего виза и нижнего намюра (фиг. 1, 2).Были описаны следующие новые виды и подвиды: *Lithostrotion* (*Siphonodendron*) *rossicum strzelcense*, *L.* (*S.*) *rossicum parvum*, *L.* (*S.*) *dobrolyubovae*, *Diphyphyllum rarevesiculosum*, *Turbinatocaninia tyszowcensis*, *Spirophyllum sanctaecrucense lublinense*, *Lublinophyllum fedorowskii*. Самыми многочисленными являлись семейства Lithostrotionidae и Aulophyllidae. В подроде *Siphonodendron*, среди прочих, описаны виды без диссепиментов (*L.* (*S.*) *junceum*) и с диссепиментами в частях кораллита (*L.* (*S.*) *rossicum rossicum*, *L.* (*S.*) *rossicum strzelcense*, (*L.* (*S.*) *rossicum parvum*). Один вид рода *Diphyphyllum* (*D. rarevesiculosum*) также имеет это свойство. Определено присутствие родов

Orionastraea и *Turbinatocaninia* в Люблинской области. Подан бластогенез 13 видов и подвидов: *Lithostrotion (Siphonodendron) junceum, L. (S.) rossicum rossicum, rossicum strzelcense, L. (S.) volkovae, L. (S.)* cf. *martini, L. (S.) affine, L. (S.) dobrolyubovae, L. (S.)* cf. *portlocki, Diphyphyllum simplex, D. rarevesiculosum, Lublinophyllum fedorowskii, Lonsdaleia floriformis floriformis.*

Было обнаружено, что стенка типа „partition" может формироваться по-разному в том же самом процессе осевого почкования у *L. (S.) dobrolyubovae* (фиг. 19, 20, 21, 22). При образовании стенок „partition" в данном случае могут принимать участие септы и септальные перегородки основного кораллита. Кроме нормального почкования, у *L. (S.) junceum* стенки „partition" могут быть септального происхождения (фиг. 6), а у *L. (S.) rossicum strzelcense* — диссепиментального (фиг. 13). У *Lonsdaleia floriformis floriformis* кроме подобного способа почкования, на что указал Джулл (1967), замечено, что протосепты могут образовываться в месте почкования перед образованием стенок „partition", образование протосептов также может происходить одновременно с образованием стенок. Почки этого подвида могут переходить асептальные стадии и могут образовать осевые септы.

Наблюдения над бластогенезисом позволили автору утверждать, что бластогенезис не является неизменной диагностической чертой вида, и также не всегда его можно применять в качестве родового критерия.

Наличие голотеки у *Orionastraea* aff. *magna* (пл. 8 : 1c), исчезновение стенки между кораллитами у *Lonsdaleia floriformis floriformis* (пл. 24), а также слияние кораллитов этого подвида (фиг. 3) приводит к выводу, что массивная колония кораллов является биологическим индивидуумом. Автор заметил также подобное явление слияния двух кораллитов кустистой колонии *L. (S.) junceum* (фиг. 7, 8).

В районе города Люблина в образованиях верхнего виза преобладают кустистые колонии. Нижне намюрская фауна очень бедна, была найдена фауна только в кернах Тышовце IG-1 и Ульхувек IG-1. На основе анализа фауны Rugosa и Heterocorallia автор обнаружил, что в районе Ульхувка и Космова поздне визейское море было довольно глубоким. Самые лушчие условия для развития кораллов в этом бассейне существовали в прибрежной зоне в районе Каплоносы.

EXPLANATION OF THE PLATES

All the figured specimens, unless stated otherwise, are from the Upper Viséan
Depths of boreholes are indicated by number in parenthesis

Plate 1

Cyathaxonia cornu Michelin

1. A little oblique longitudinal section, ×12. IG-1403.II.10, Ulhówek IG 1 (1278—1279 m).
2. Cross section showing differentiated thickness of axial ends of septa and different length of minor septa, ×12. IG-1403.II.8, Ulhówek IG 1 (1280—1281 m).

3. *a*, *b*, shortened septa in successive cross sections beneath the calice, ×12. IG-1403.II.3, Ulhówek IG 1 (1280—1281 m).
4. Cross section of a corallite with a small columella, ×12. IG-1403.II.6, Ulhówek IG 1 (1280—1281 m).
5. Cross section of a fragment of corallite with minor septa dilated and differentiated in length, ×30. IG-1403.II.9B, Ulhówek IG 1 (1281—1282 m).
6. Cross section of a fragment of a corallite with minor septa slender and differentiated in length, ×30. IG-1403.II.11, Ulhówek IG 1 (1281—1282 m).

Plate 2

Lithostrotion (*Siphonodendron*) *junceum* (Fleming)

1. *a* cross section, ×6; *b* cross section of a corallite with minor septa of various length; the corallite joined with a neighbouring one by a connecting tubula, ×10. IG-1403.II.15, Lublin IG 1 (1997.5—1998.5 m).
2. Cross section of a colony with small corallites possessing columellae of various size and septa of various length, ×5. IG-1403.II.20, Lublin IG 1 (1997.5—1998.5 m).
3. Cross section of an immature corallite with septa extending deeply into the external wall, ×10. IG-1403.II.23, Korczmin IG 3 (1116—1117 m).

Lithostrotion (*Siphonodendron*) *rossicum strzelcense* subsp. n.

4. Cross section, ×6. IG-1403.II.29 (see also pl. 3:2), Strzelce IG 2 (810—811 m).

Plate 3

Lithostrotion (*Siphonodendron*) *rossicum strzelcense* subsp. n.

1. *a* longitudinal section, ×3; *b* longitudinal section of a corallite with dissepiments developed only in the upper part of the section, ×10. Holotype, IG-1403.II.28, Strzelce IG 1 (561 m).
2. *a* fragment of longitudinal section of a corallite with merely three dissepiments at the external wall, ×20; *b* cross section of corallite with dissepiments developed only near the cardinal and counter septa, ×10. IG-1403.II.29, Strzelce IG 2 (810—811 m).
3. Cross section of a chain-like colony, ×5. IG-1403.II.30, Ulhówek IG 1 (1672.3—1673.3 m).

Lithostrotion (*Siphonodendron*) cf. *portlocki* M. Edwards & Haime

4. Cross section, ×6. IG-1403.II.12A, Korczmin IG 1 (1223.1—1224.1 m).

Plate 4

Lithostrotion (*Siphonodendron*) *rossicum parvum* subsp. n.
Lower Namurian

1. *a* cross section, ×3; *b* cross section of a fragment of corallite with an offset that does not form any protuberance, ×20; *c* cross section: hystero-brephic stage with some dilated septa of both orders and with one branching major septum, ×20; *d* longitudinal section of corallite, ×3. Holotype, IG-1403.II.36, Strzelce IG 1 (437 m).

Lithostrotion (Siphonodendron) cf. *martini* M. Edwards & Haime

2. *a* cross section; *b* longitudinal section; ×3. IG-1403.II.43, Strzelce IG 2 (766.1—767.1 m).

Lithostrotion (Siphonodendron) affine (Fleming)

3. *a* cross section; *b-d* successive cross sections of an offseting corallite; ×3. IG-1403.II.51, Tyszowce IG 1 (1753.2—1754.2 m).

Plate 5

Lithostrotion (Siphonodendron) cf. *martini* M. Edwards & Haime

1. *a* cross section, ×3, *b* fragment of the same section showing dilation of septa of both orders, thickening of the external wall and disappearance of the internal wall in the sector of increase, ×10. IG-1403.II.46, Bychawa IG 1 (1743.7—1744.7 m).

Lithostrotion (Siphonodendron) rossicum rossicum Stuckenberg

2. Cross section, ×3. IG-1403.II.24, Tyszowce IG 1 (1642.4—1643.4 m).

Lithostrotion (Siphonodendron) volkovae Dobrolyubova

3. Cross section, ×3, IG-1403.II.41, Korczmin IG 1 (1299.4—1299.8 m).
4. A little oblique longitudinal section, ×3. IG-1403.II.40A, Kaplonosy IG 1 (432.8—433.8 m).

Diphyphyllum simplex (Thomson)

5. *a* cross section of a colony with corallites producing numerous offsets; *b* longitudinal section; ×6. IG-1403.II.65, Korczmin IG 1 (1167.2—1168.2 m).

Plate 6

Lithostrotion (Siphonodendron) dobrolyubovae sp. n.

1. Cross section, ×3. IG-1403.II.60, Korczmin IG 1 (1167.2—1168.2 m).
2. *a* longitudinal section; *b* cross section; ×3. Holotype, IG-1403.II.52, Korczmin IG 1 (1167.2—1168.2 m).
3. Longitudinal section, ×3. IG-1403.II.53, Kaplonosy IG 1 (432.8—433.8 m).
6. Cross section of an offsetting corallite with three partitions being formed, ×3. IG-1403.II.55, Lublin IG 1 (1997.5—1998.5 m).

Diphyphyllum rarevesiculosum sp. n.

4. *a*, *b* cross sections, ×3; *c* cross section of a fragment of corallite with three small dissepiments at the external wall, ×20; *d* cross section of an offset possessing long counter septum, ×10. Holotype, IG-1403.II.70, Tyszowice IG 1 (1753.2—1754.2 m).
5. Longitudinal section of a corallite with five small dissepiments at the external wall, ×4. IG-1403.II.72, Tyszowce IG 1 (1753.2—1754.2 m).

Plate 7

Diphyphyllum cf. *ingens* Hill

1. *a*, *b* cross and longitudinal sections of fragments of a colony, ×3. IG-1403.II.81, Tyszowce IG 1 (1691.4—1692.4 m).

2. *a* cross section; *b* longitudinal section; ×3. IG-1403.II.78, Tyszowice IG 1 (1691.4—1692.4 m).

Diphyphyllum lateseptatum McCoy

3. *a* cross section; *b* longitudinal section; ×3. IG-1403.II.75, Rudnik IG 1 (1825.8—1826.8 m).

Orionastraea cf. *ensifer* (M. Edwards & Haime)

4. *a* cross section, ×7; *b* cross section of a single corallite, ×10. IG-1403.II.82, Tyszowce IG 2 (1478.5—1479.5 m).

Plate 8

Orionastraea aff. *magna* Kato & Mitchell

1. *a* cross section, ×6; *b* longitudinal section of a corallite with well marked columella, ×10; *c* fragment of section of a colony with the holotheca preserved on its lower surface, ×20. IG-1403.II.83, Lublin IG 1 (1197.3—1197.5 m).

Orionastraea aff. *kurakovensis* Dobrolyubova

2. Cross section near the periphery of a colony with corallites in various stages of development, ×2. IG-1403.II.84 (see also pl. 9:1), Korczmin IG 1 (1166.6—1167.2 m).

Plate 9

Orionastraea aff. *kurakovensis* Dobrolyubova

1. *a* section of a colony with accompanying *Lithostrotion* (*Siphonodendron*) *dobrolyubovae* sp. n. and *Diphyphyllum simplex* (Thomson), X1; *b* longitudinal section, ×4; *c* cross section, ×2. IG-1403.II.84, Korczmin IG 1 (1166.6—1167.2 m).

Plate 10

Aulophyllum fungites (Fleming)

1. Cross section: ephebic stage, ×3. IG-1403.II.88, Jarczów IG 4 (1581—1582 m).
2. *a* cross section: late-neanic stage; *b* cross section: ephebic stage; *c* longitudinal section; ×3. IG-1403.II.89, Strzelce IG 2 (767—768 m).

Clisiophyllum delicatum Smyth

3. *a*, *b* successive cross sections of a corallite, ×3. IG-1403.II.93, Kaplonosy IG 1 (431.2—431.4 m).
4. Cross section: ephebic stage, ×3. IG-1403.II.94, Rachanie IG 1 (1155—1156 m).
5. Cross section: ephebic stage of a corallite with long minor septa, ×3. IG-1403.II.95, Rudnik IG 1 (1825.8—1826.8 m).
6. *a-c* successive cross sections: ephebic stage of a corallite with short minor septa and simple axial structure, ×3: *d* fragment of cross section of the same specimen showing underdeveloped minor septa, ×20. IG-1403.II.97, Bychawa IG 1 (1750—1751 m).

Plate 11

Dibunophyllum cf. *pseudoturbinatum* Stuckenberg

1. *a-e* successive cross sections of a corallite with long minor septa (*e*), ×2. IG-1403. II.100, Korczmin IG 1 (1167.2—1168.2 m).

Dibunophyllum bipartitum (McCoy)

2. Cross section: ephebic stage, ×2. IG-1403.II.103, Korczmin IG 3 (1136—1137 m).

Dibunophyllum sp. 1

3. *a, b* successive cross sections: late-neanic and ephebic stages, ×3. IG-1403.II.109, Rudnik IG 1 (1824.8—1825.8 m).

Dibunophyllum aff. *lonsdaleioides* Vassiljuk

4. Cross section: ephebic stage, ×2. IG-1403.II.113, Kock IG 2 (1146.0—1146.1 m).

Plate 12

Dibunophyllum sp. 1

1. *a-c* successive cross sections: ephebic stage; *c* section just beneath the calice; ×3; *d* a little oblique longitudinal section, ×3; *e, f* fragments of cross sections showing the stereoplasma not closely adhering to the septa, ×30. IG-1403.II.108, Bychawa IG 1 (1744.7—1745.7 m).

Dibunophyllum bipartitum (McCoy)

2. Cross section of a corallite possessing the axial structure of the "craigianum" type, ×3. IG-1403.II.106, Jarczów IG 4 (1581—1582 m).

Plate 13

Dibunophyllum cf. *percrassum* Gorsky

1. *a-c* successive cross sections: ephebic stage; *c* section just beneath the calice, ×2. IG-1403.II.112, Lublin IG 1 (1197.3—1197.5 m).
3. Cross section: early-ephebic stage, ×3. IG-1403.II.111, Korczmin IG 1 (1180.6—1181.6 m).

Dibunophyllum sp. 2

2. *a, b* successive cross sections; *c* oblique, longitudinal section; ×2. IG-1403.II.110, Terebin IG 2 (1203.9—1204.9 m).

Nervophyllum sp.
Lower Namurian

4. Cross section: early-ephebic stage (see also pl. 22:1), ×3. IG-1403.II.125, Tyszowce IG 1 (1375—1376 m).

Plate 14

Arachnolasma biseptatum Fedorowski

1. *a-c* successive cross sections; *c* section just beneath the calice, ×3. IG-1403.II.120, Tyszowce IG 2 (1470—1471 m).

Arachnolasma cylindricum Yü

2. *a*, *b* successive cross sections: ephebic stage, ×3. IG-1403.II.119, Korczmin IG 1 (1330.5—1331 m).
3. Cross section: neanic stage, ×3. IG-1403.II.118, Korczmin IG 1 (1180.6—1181.6 m).

Koninckophyllum meathopense (Garwood)

4. *a* cross section: early-ephebic stage; *b* longitudinal section; ×3. IG-1403.II.117, Rudnik IG 1 (1825.8—1826.8 m).

Koninckophyllum interruptum Thomson & Nicholson

5. *a*, *b* cross sections: late-neanic stage; *c* cross section just beneath the calice; *d* longitudinal section; ×2. IG-1403.II.115, Tyszowce IG 1 (1705.7—1706.7 m).

Plate 15

Neokoninckophyllum ? sp.

1. *a* cross section: early-ephebic stage; *b* cross section: ephebic stage; ×2. IG-1403. II.122, Tyszowce IG 1 (1476 m).

Neokoninckophyllum trifossulum Fedorowski
Lower Namurian

2. *a*, *b* successive cross sections: ephebic stage, ×2. IG-1403.II.123, Tyszowce IG 1 (1375—1376 m).

Mirka prima (Fedorowski)
Lower Namurian

4. *a*, *b* cross sections: ephebic stage, ×2. IG-1403.II.131, Tyszowce IG 1 (1375—1376 m).

Nervophyllum primitivum Fedorowski

3. *a*, *b* successive cross sections: ephebic stage, ×2. IG-1403.II.124, Tyszowce IG 1 (1655 m).

? *Bothrophyllum juddi* (Thomson)
Lower Namurian

5. Cross section: ephebic stage, ×2. IG-1403.II.147, Tyszowce IG 1 (1380—1380.5 m).

Plate 16

Turbinatocaninia tyszowcensis sp. n.
Lower Namurian

1. *a*, *b* successive cross sections: ephebic stage, ×2. IG-1403.II.127, Tyszowce IG 1 (1375—1376 m).
2. *a* cross section: ephebic stage; *b* cross section: late-ephebic stage; ×2. Holotype, IG-1403.II.126, Tyszowce IG 1 (1375—1376 m).
5. Cross section: early-ephebic stage, ×3. IG-1403.II.128, Tyszowce IG 1 (1375—1376 m).

Turbinatocaninia aff. *tyszowcensis* sp. n.

3. Cross section: ephebic stage, ×2. IG-1403.II.130, Tyszowce IG 1 (1642.9—1643.4 m).
4. A little oblique longitudinal section, ×2. IG-1403.II.129, Tyszowce IG 1 (1642.9—1643.4 m).

Plate 17

Spirophyllum sanctaecrucense lublinense subsp. n.

1. *a-c* successive cross sections: *a* early-ephebic stage, *b*, *c* ephebic stage; ×3. Holotype, IG-1403.132, Tyszowce IG 1 (1738.6—1739.6 m).

Spirophyllum sp.

2. *a*, *b* successive cross sections: ephebic stage, ×3; *c* cross section of the axial structure, ×10. IG-1403.II.133, Bychawa IG 1 (1743.7—1744.7 m).

Palaeosmilia murchisoni M. Edwards & Haime

3. *a*, *b* cross sections; ephebic stage (see also pl. 18:1), ×2. IG-1403.II.134, Bychawa IG 1 (1751.4—1752.6 m).

Plate 18

Palaeosmilia murchisoni M. Edwards & Haime

1. *a* cross section, ×2; *b* longitudinal section: early ephebic stage, ×3 (see also pl. 17:3). IG-1403.II.134, Bychawa IG 1 (1751.4—1752.6 m).

Lublinophyllum fedorowskii sp. n.

2. *a*, *b* successive cross sections; in ontogenetically younger section (*a*) irregular dissepiments of the lonsdaleoid type appear, ×3 (see also pl. 20:1*a-c*). Holotype, IG-1403.II.140, Strzelce IG 2 (811.4—812.4 m).

? *Caninia cornucopiae brockleyensis* (Thomson)
Lower Namurian

3. Cross section: ephebic stage, ×3. IG-1403.II.137, Tyszowice IG 1 (1375—1376 m).
4. Cross section of several corallites, ×3. IG-1403.II.136, Tyszowce IG 1 (1375—1376 m).

Plate 19

Siphonophyllia cf. *siblyi* Semenoff-Tian-Chansky

1. *a-d* successive cross sections: ephebic stage; *e* longitudinal section; ×2. IG-1403.II.139, Terebin IG 3 (1375.5—1376.5 m).

Lublinophyllum fedorowskii sp. n.

2. Cross section, ×3. IG-1403.II.143, Strzelce IG 2 (811.4—812.4 m).

Plate 20

Lublinophyllum fedorowskii sp. n.

1. *a* external view of a fragment of a colony; *b*, *c* longitudinal sections (see also pl. 18:2*a*, *b*); ×2. Holotype, IG-1403.II.140, Strzelce IG 2 (811.4—812.4 m);
2. Cross section of a fragment of a colony, ×2. IG-1403.II.144, Strzelce IG 2 (811.4—812.4 m).

3. Cross section of a fragment of a colony, ×2. IG-1403.II.141, Strzelce IG 2 (811.4—812.4 m).
4. Cross section of a corallite with long counter septum, ×2. IG-1403.II.142, Strzelce IG 2 (810—811 m).

Plate 21

Bothrophyllum sp.

1. *a* cross section: early-ephebic stage; *b* cross section: late-ephebic stage; *c* longitudinal section; ×3. IG-1403.II.151, Korczmin IG 1 (1162.6—1163.6 m).

Bothrophyllum pater Ivanovsky

2. Cross section: ephebic stage, ×2 (see also pl. 22:2*a*, *b*). IG-1403.II.150, Kaplonosy IG 1 (432.6—433.6 m).
3. *a*, *b* successive cross sections: ephebic stage, ×2. IG-1403.II.148, Korczmin IG 1 (1194.8—1195.8 m).

Plate 22

Nervophyllum sp.
Lower Namurian

1. *a*, *b* successive cross sections (see also pl. 13:4), ×3. IG-1403.II.125, Tyszowce IG 1 (1375—1376 m).

Bothrophyllum pater Ivanovsky

2. *a*, *b* successive cross sections: early-ephebic stage, ×3 (see also pl. 21:2). IG-1403.II. 150, Kaplonosy IG 1 (432.6—433.6 m).
4. Cross section: ephebic stage, ×3. IG-1403.II.149, Tyszowce IG 1 (1737.6—1738.6 m).

? *Bothrophyllum juddi* (Thomson)
Lower Namurian

3. Cross section: ephebic stage, ×2. IG-1403.II.145, Tyszowce IG 1 (1375—1376 m).

Plate 23

Lonsdaleia floriformis floriformis (Martin)

1. Cross section, ×2. IG-1403.II.154, Kaplonosy IG 1 (434—434.5 m).
2. Cross section, ×3. IG-1403.II.156, Kaplonosy IG 1 (434—434.5 m).
3. Cross section with connecting channel, ×10. IG-1403.II.153, Kaplonosy IG 1 (434—434.5 m).
4. Cross section of an immature corallite joined with parent corallite by a connecting channel, ×10. IG-1403.II.153, Kaplonosy IG 1 (434—434.5 m).
5. Longitudinal section, ×3. IG-1403.II.155, Kaplonosy IG 1 (434—434.5 m).

Plate 24

Lonsdaleia floriformis floriformis (Martin)

1. *a-h* successive cross sections showing formation of five offsets, ×4. Distances (in mm) between sections are indicated by numbers beneath the photographs. IG-1403. II.153, Kaplonosy IG 1 (434—434.5 m).

Plate 25

Hexaphyllia marginata (Fleming)

1. *a-c* cross sections, ×20. IG-1403.II.161C, Lublin IG 1 (1197.3—1197.5 m).

Hexaphyllia mirabilis (Duncan)

2. Cross section, ×60. IG-1403.II.165, Lublin IG 1 (1197.5—1198.5 m).
3. Cross section, ×30. IG-1403.II.159, Tyszowce IG 2 (1473—1474 m).

Hexaphyllidae gen. indet.

4. *a* cross section of a hexagonal corallite with one of septa formed in the middle of a side; *b* cross section of the same specimen showing split of a septum on the left side of the figure; ×60. IG-1403.II.12B, Korczmin IG 1 (1223.1—1224.1 m).
5. Cross section of a pentagonal corallite, ×60. IG-1403.II.12C, Korczmin IG 1 (1223.1—1224.1 m).
6. Cross section of a pentagonal corallite with five septa inserted regularly, ×30. IG-1403.II.162B, Kapolonsy IG 1 (438.5 m).
9. Cross section of a five-septal corallite, ×60. IG-1403.II.178, Lublin IG 1 (1195.3—1196.3 m).
10. Cross section of a pentagonal corallite with five septa, ×30. IG-1403.II.168B, Rudnik IG 1 (1826.8—1827.8 m).
11. Cross section of a five-septal corallite, ×30. IG-1403.II.12E, Korczmin IG 1 (1223,1—1224.1 m).

Hexaphyllia sp.

7. Cross section of a pentagonal corallite with six septa, the pair of septa on the right side of the figure is on an initial stage of insertion, ×60. IG-1403.II.12D, Korczmin IG 1 (1223.1—1224.1 m).
12. Cross section of a six-septal corallite, ×30. IG-1403.II.12F, Korczmin IG 1 (1223.1—1224.1 m).

Heterophyllia parva Schindewolf

8. Cross section, ×20. IG-1403.II.175, Terebin IG 3 (1378.6—1379.6 m).

Plate 26

Heterophyllia grandis McCoy

1. *a*, *b* cross sections, ×6. IG-1403.II.167, Tyszowce IG 1 (1642.9—1643.4 m).
2. *a-d* successive cross section, ×6. IG-1403.II. 166, Ulhówek IG 1 (1188—1189 m).

Hexaphyllia sp.

3. Cross section of a pentagonal coralite with six septa, ×30. IG-1403.II.161D, Lublin IG 1 (1197.3—1197.5 m).

Heterophyllidae gen. indet.

4. Cross section of an irregular corallite with five septa, ×60. IG-1403.II.161A, Lublin IG 1 (1197.3—1197.5 m).
5. Cross section of an irregular corallite with four septa; the base of one of them is located on a side of the corallite, ×30. IG-1403.II.161B, Lublin IG 1 (1197.3—1197.5 m).
6. Cross section, of a rounded corallite with five septa, ×60. IG-1403.II.26B, Lublin IG I (1997.5—1998.5 m).

7. *a*, *b*, *d* cross sections of a pentagonal corallite with four septa; *c* cross section of the same specimen showing formation the fifth septum; ×60. IG-1403.II.12G, Korczmin IG 1 (1223.1—1224.1 m).

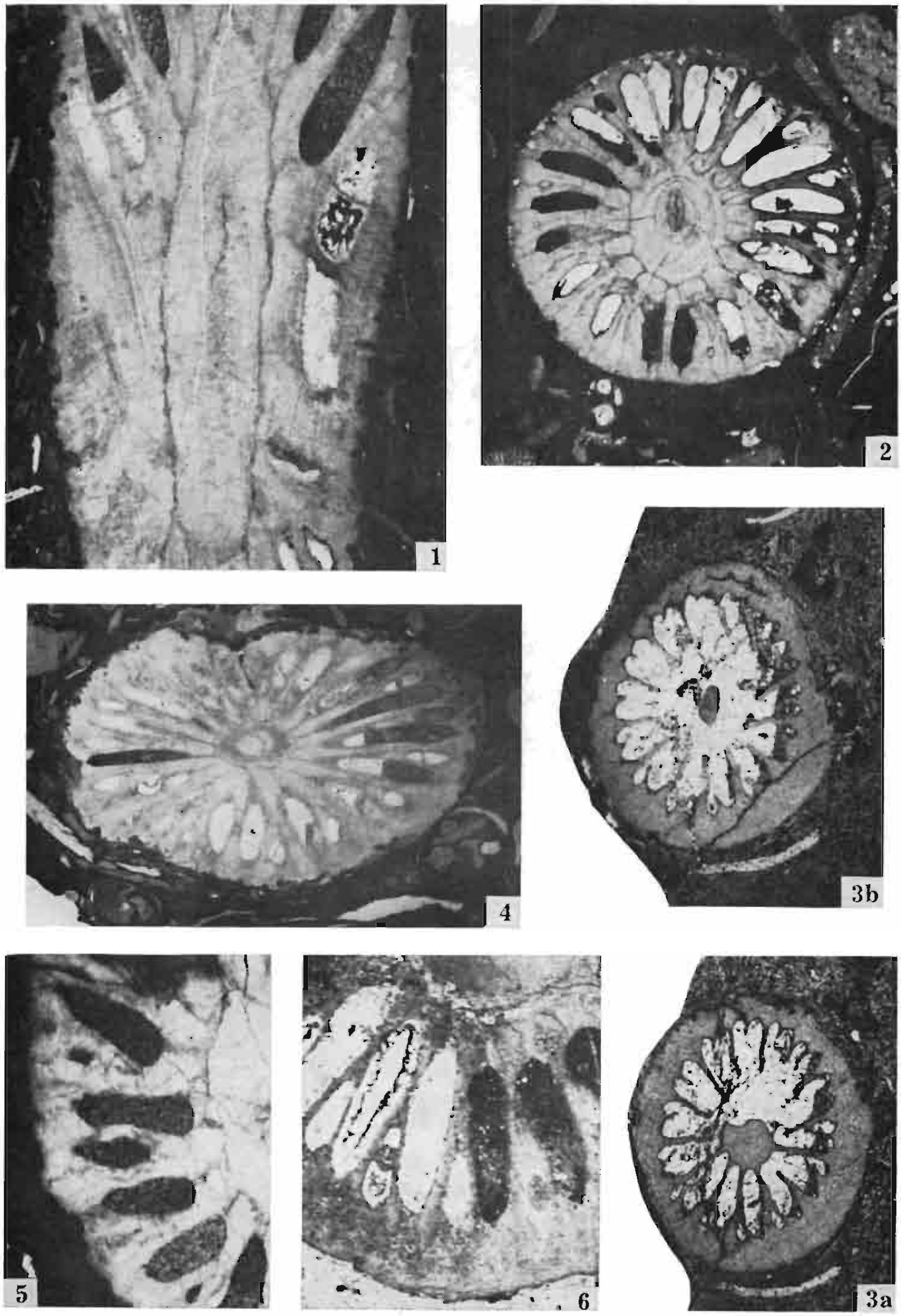
Plate 27

Heterophyllia angulata Duncan

1. *a* cross section; *b* longitudinal section; ×10. IG-1403.II.170, Ulhówek IG 1 (1445—1446 m).
2. *a* cross section; *b* oblique (diagonal) section; ×10. IG-1403.II.169, Ulhówek IG 1 (1445—1446 m).
5. Cross, oblique section, ×10. IG-1403.II.171, Lublin IG 1 (1197.3—1197.5 m).
6. Cross section, ×10. IG-1403.II.172, Tyszowce IG 1 (1753.2—1754.2 m).
7. Cross section, ×15. IG-1403.II.4B, Ulhówek IG 1 (1281—1283 m).

Heterophyllia parva Schindewolf

3. Cross section, ×10. IG-1403.II.173, Terebin IG 1 (1178.9—1179.9 m).
4. Cross section, ×10. IG-1403.II.174, Terebin IG 1 (1178.9—1179.9 m).
8. *a*-*c* successive cross sections; *a* the ontogenetically youngest section with only one septum in cardinal quadrant. This stage resembles *Heterophyllia angulata* Duncan. ×10. IG-1403.II.160B, Terebin IG 3 (1375.5—1376.5 m).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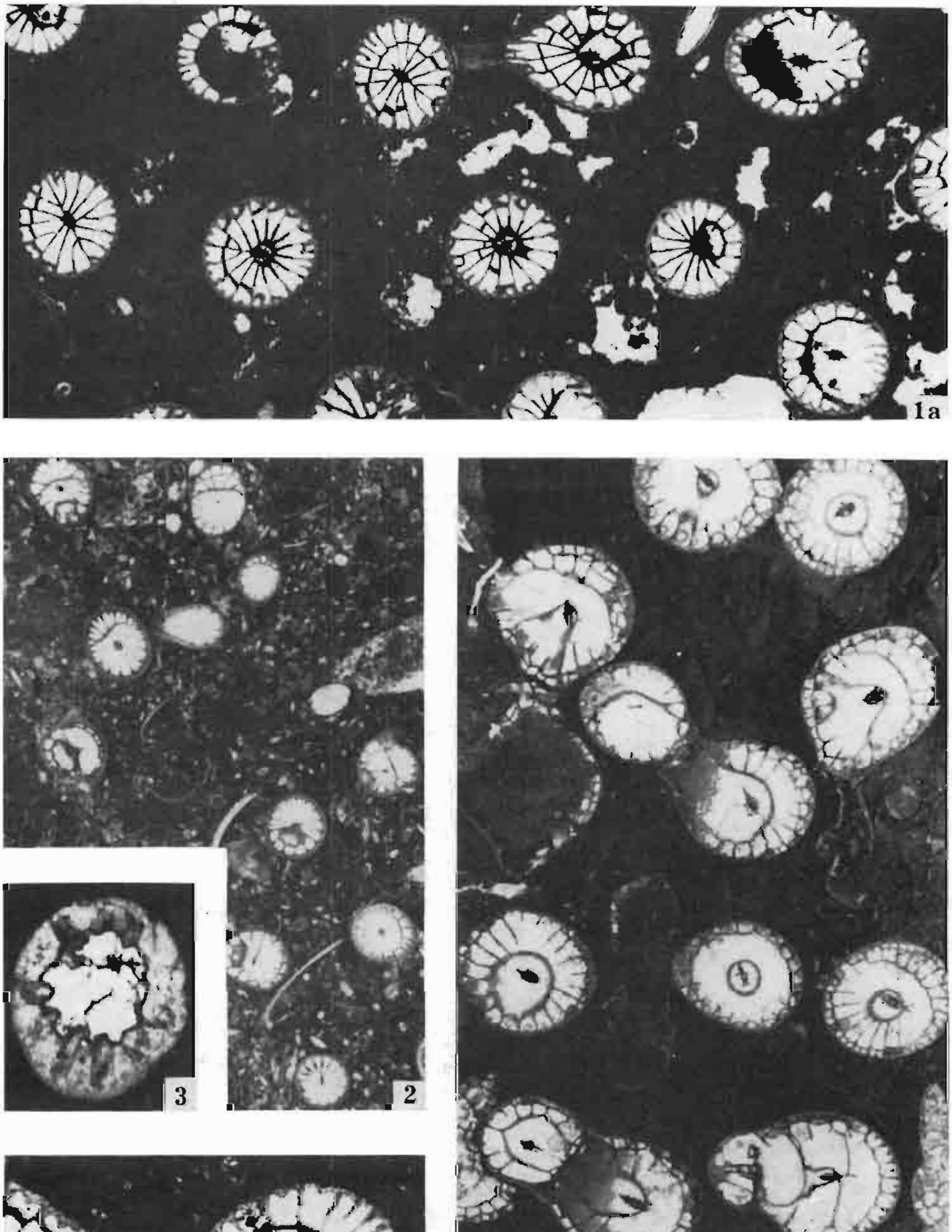
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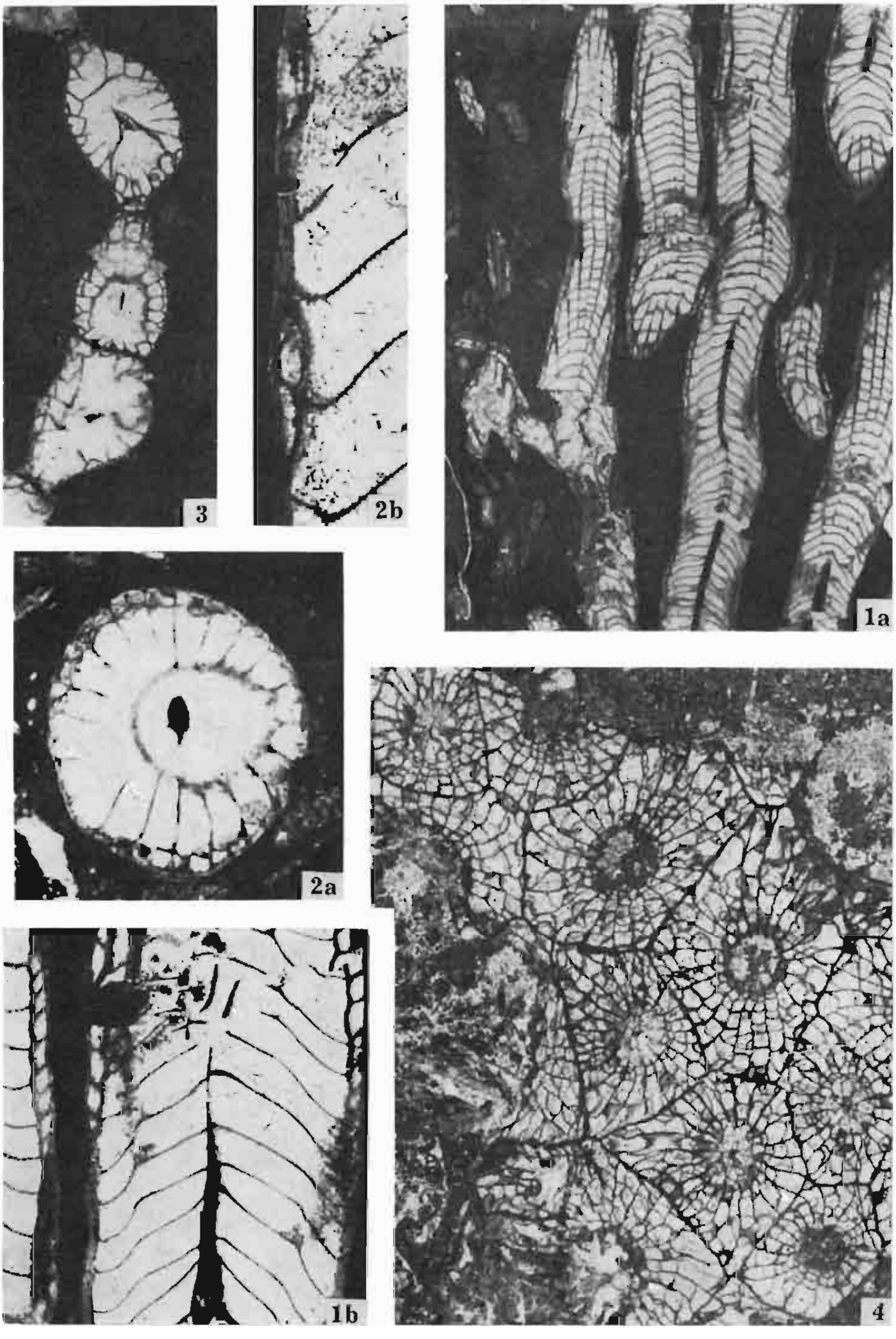
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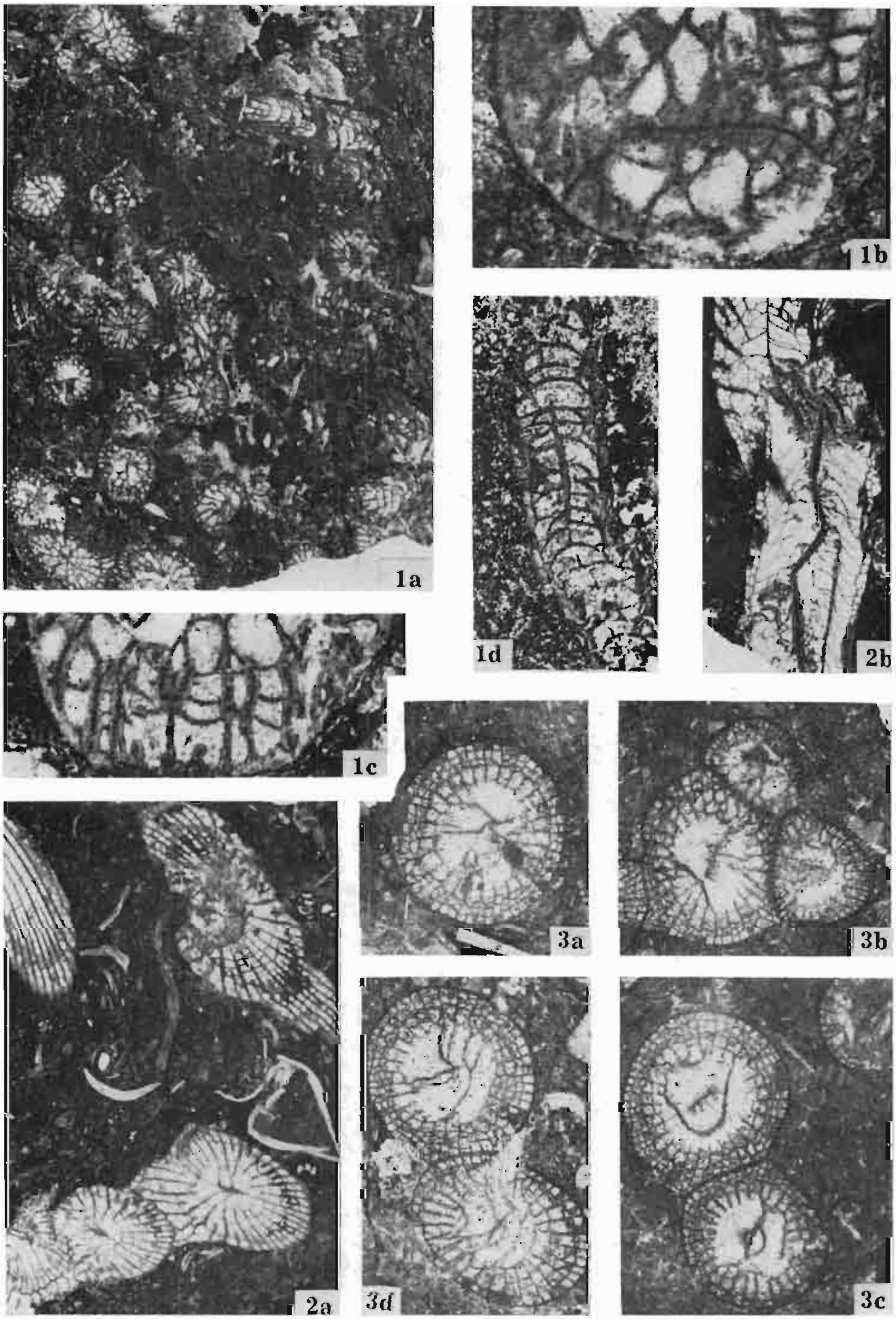
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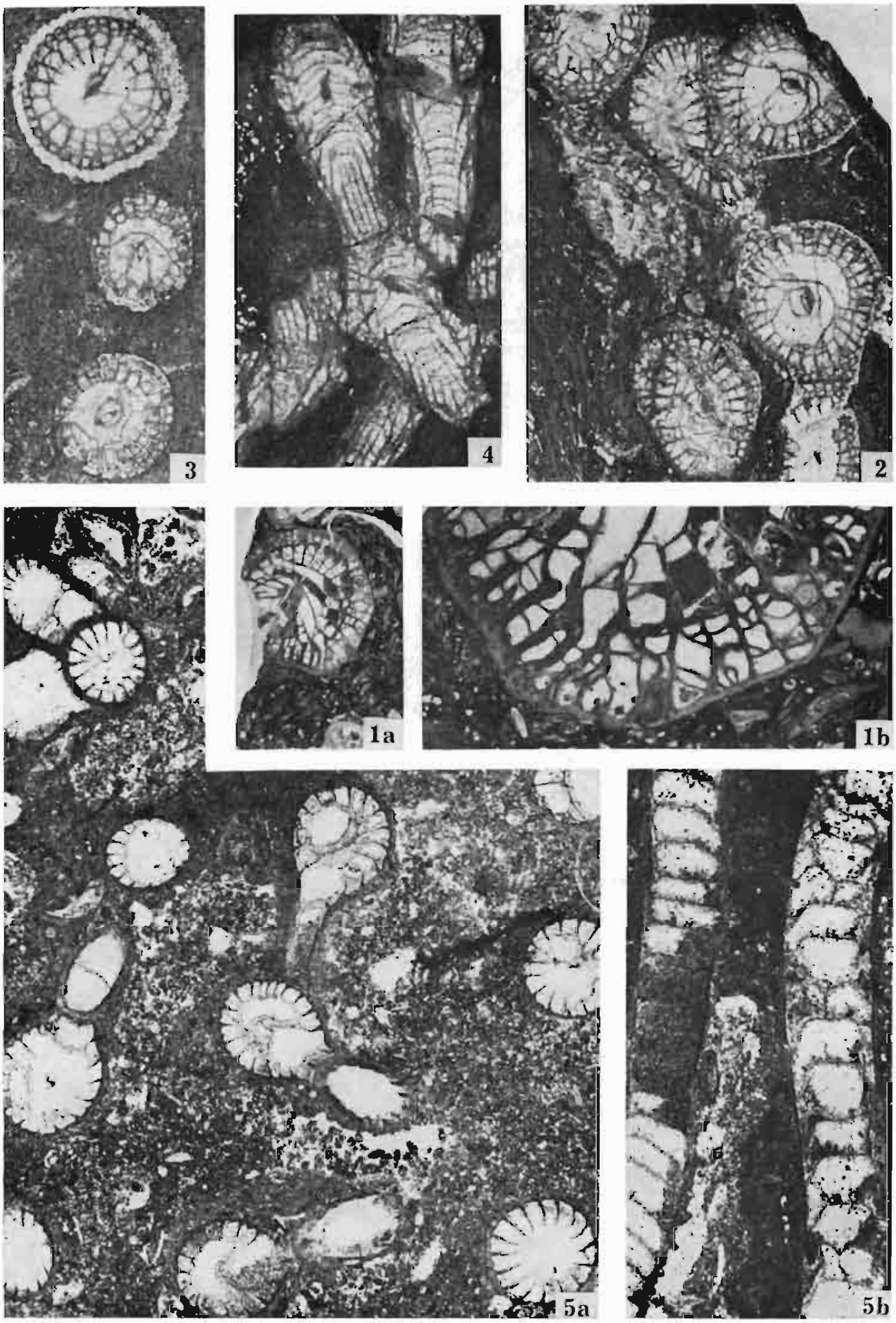
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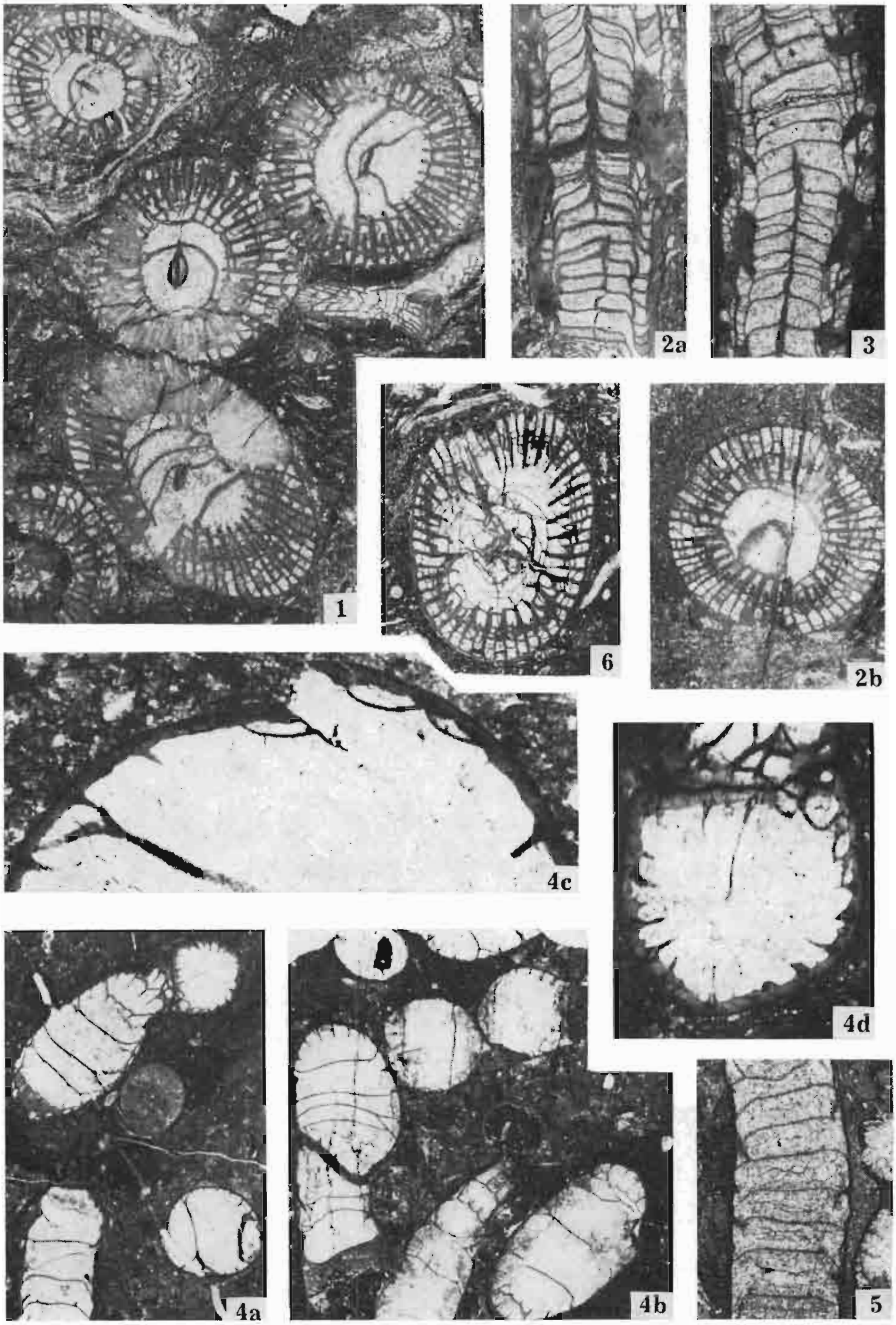
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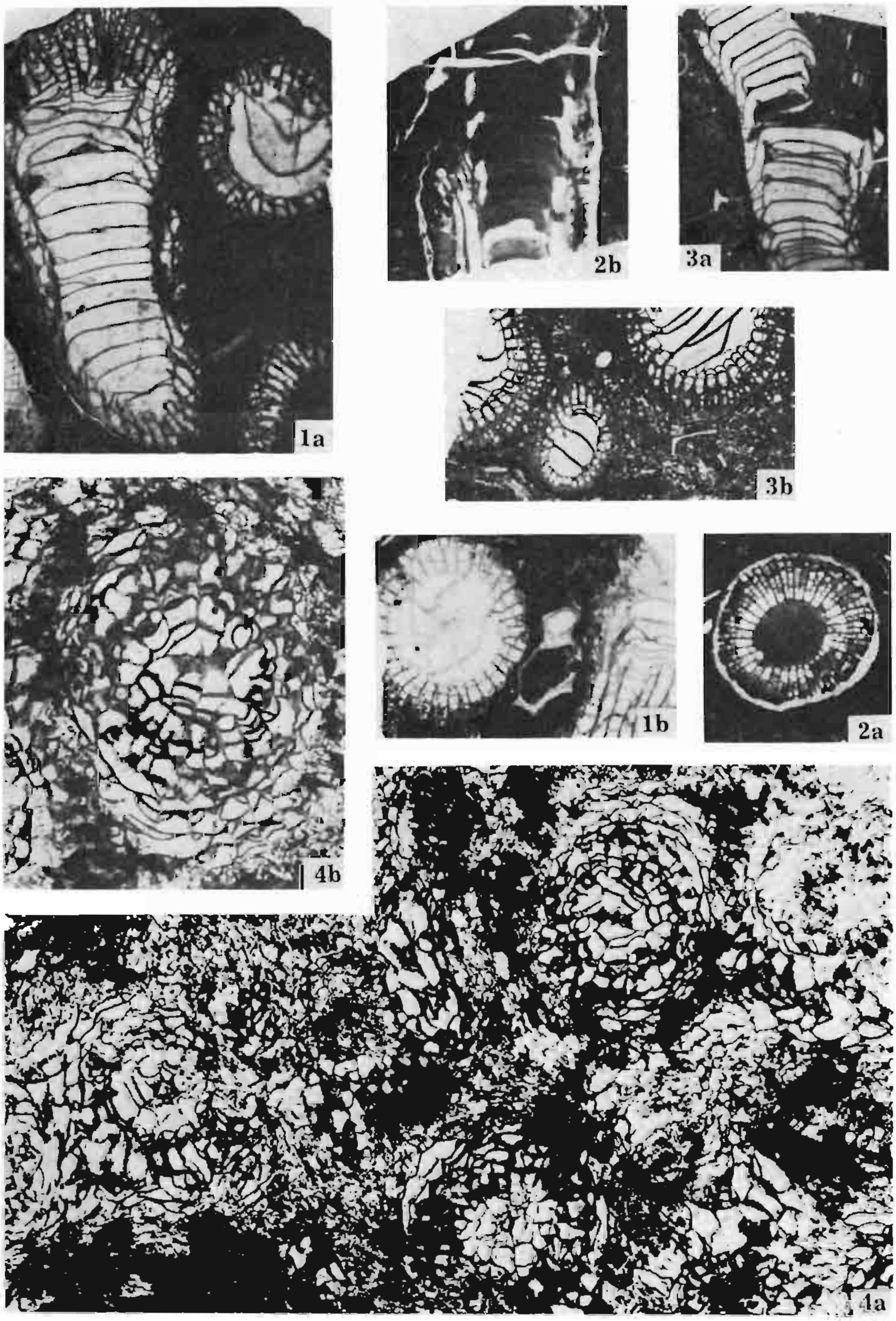
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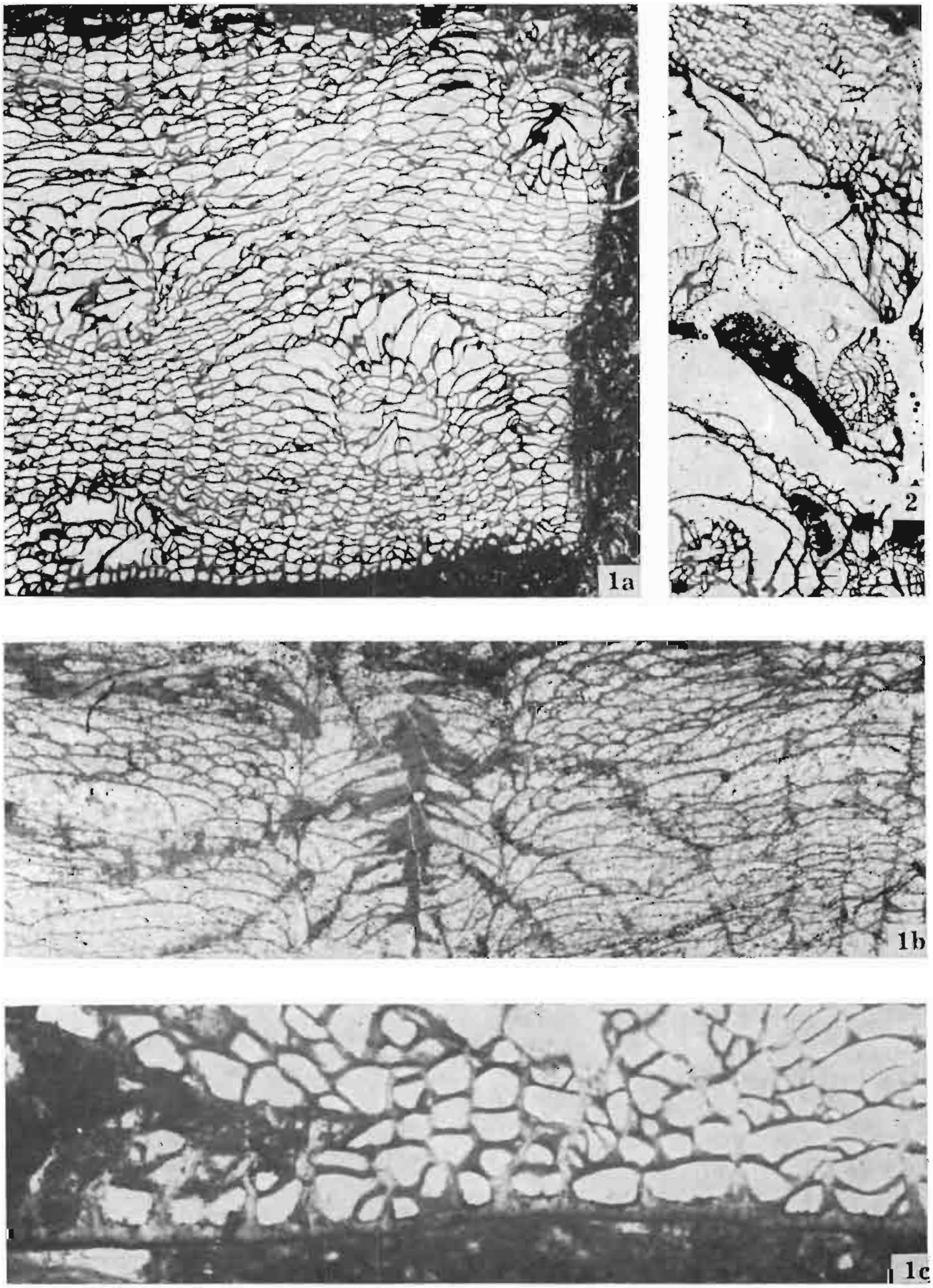
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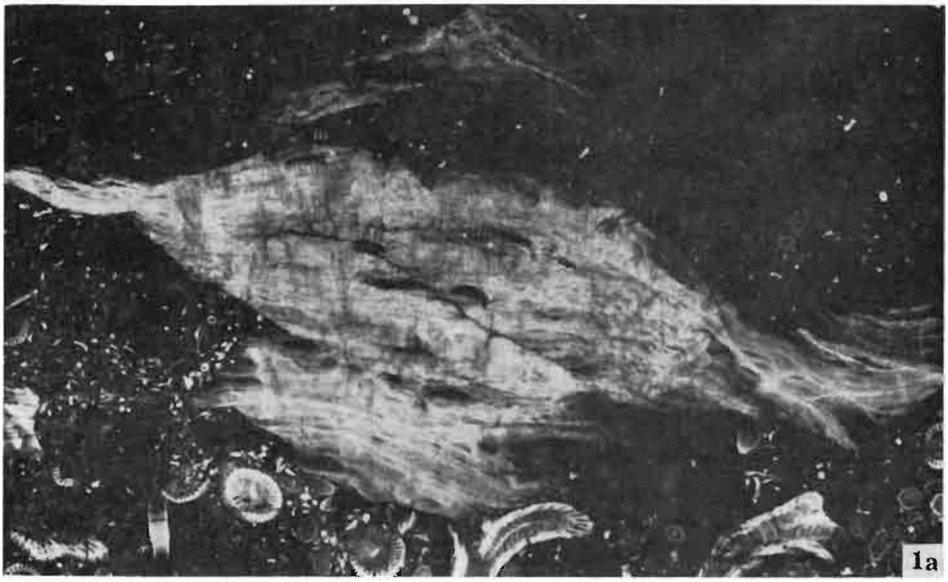
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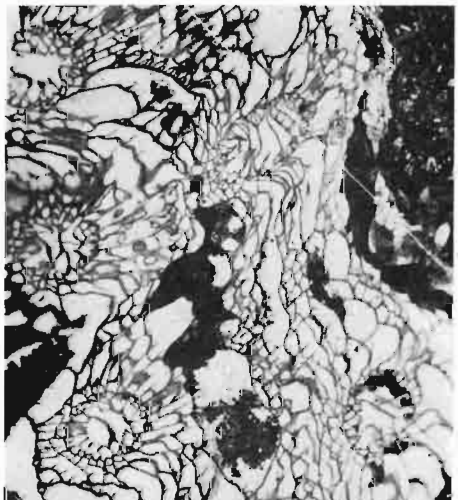
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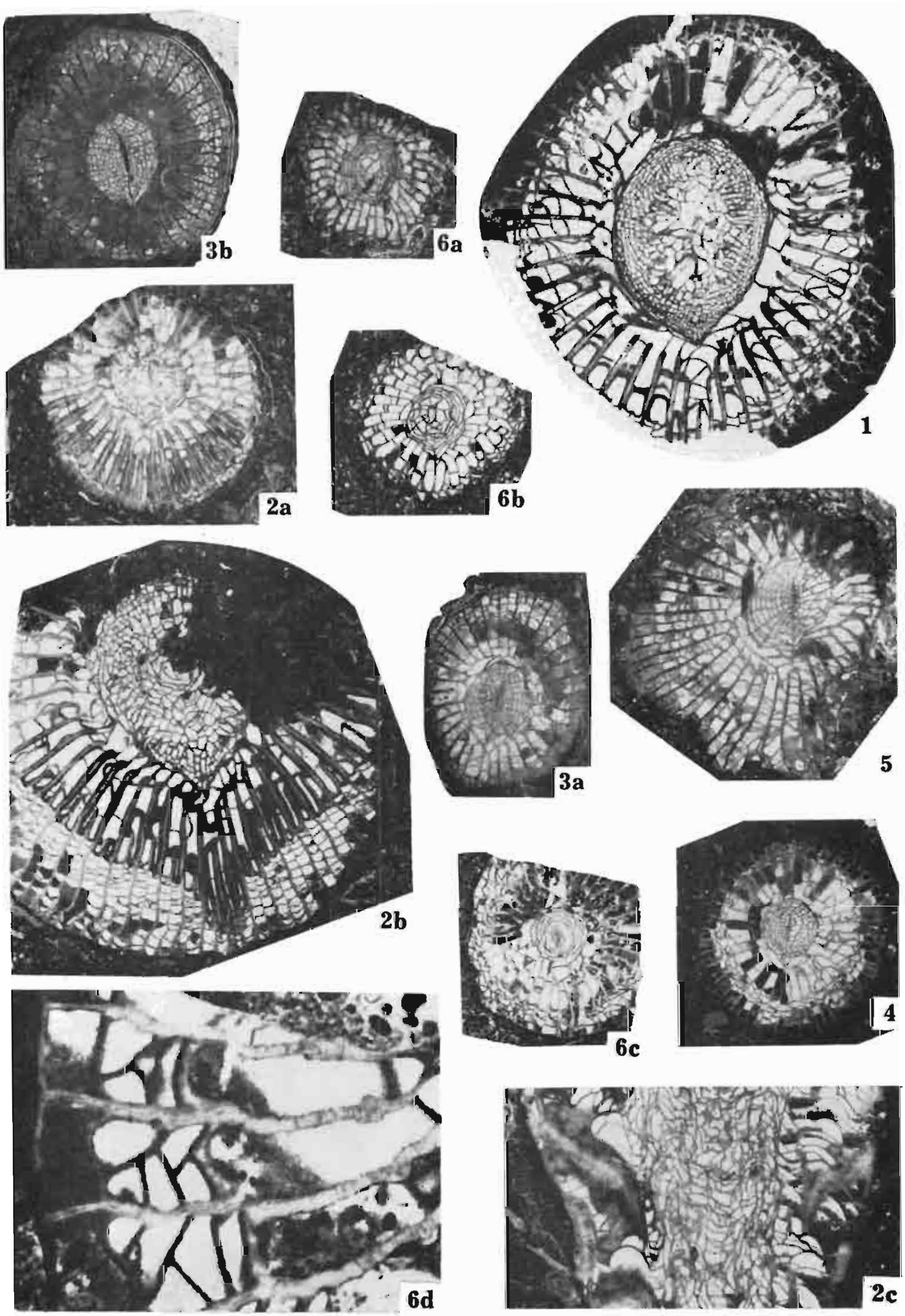
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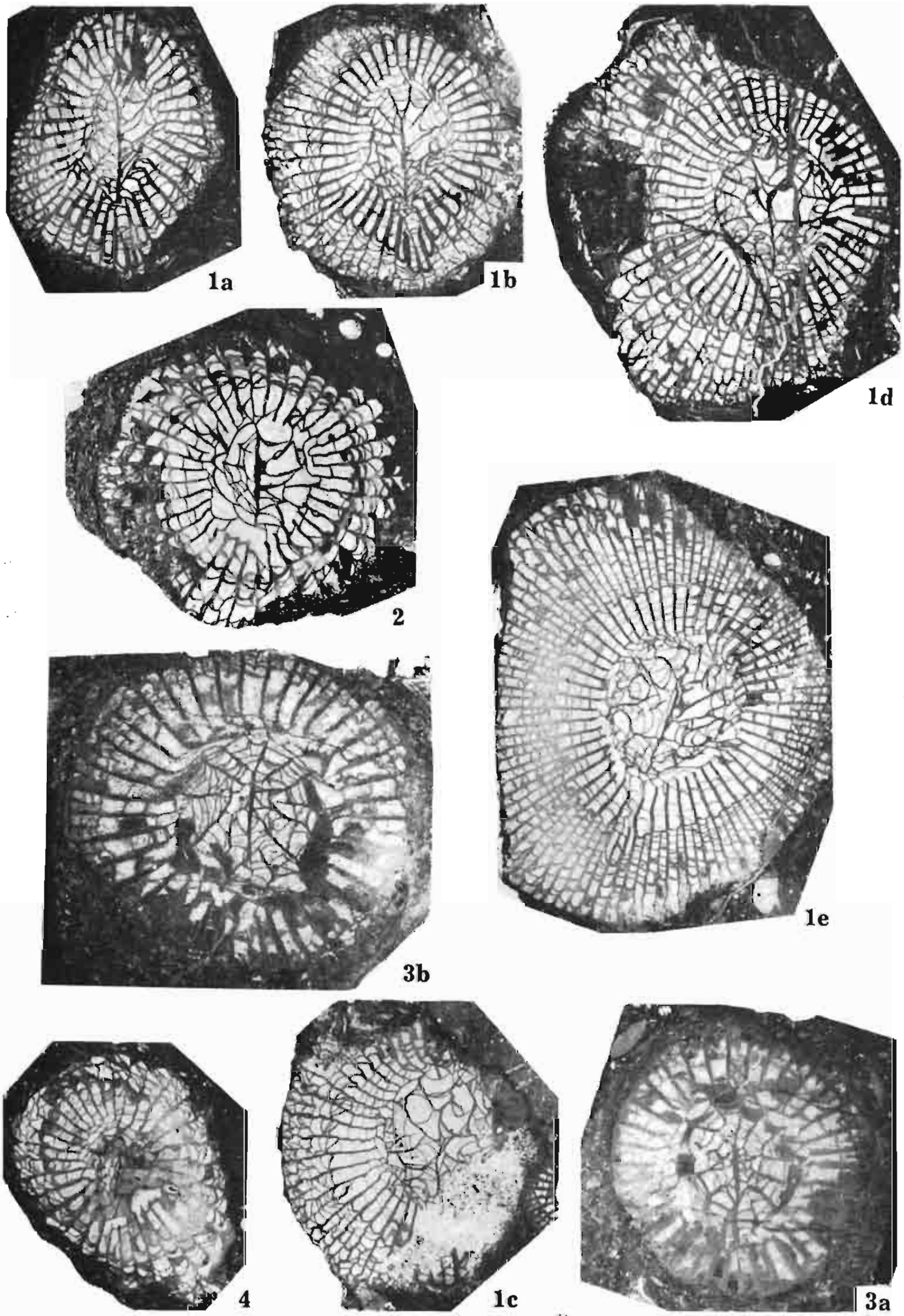
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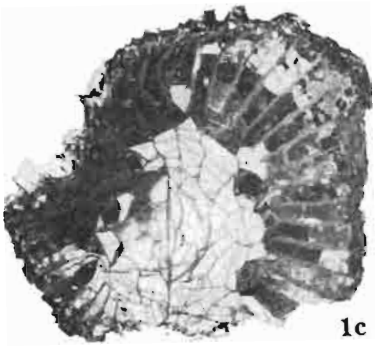

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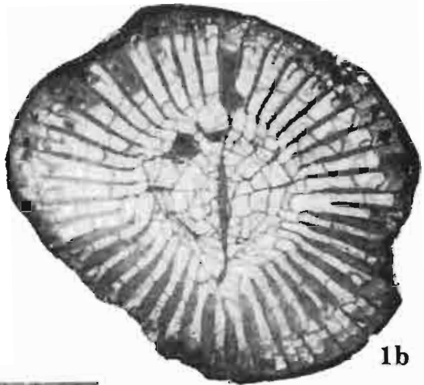

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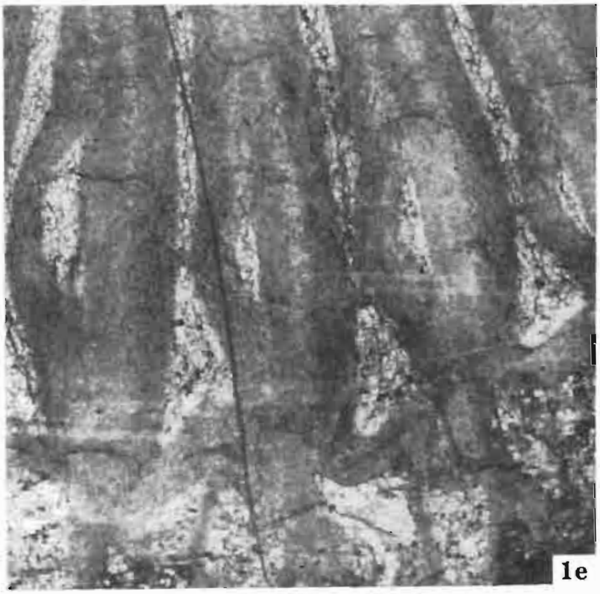

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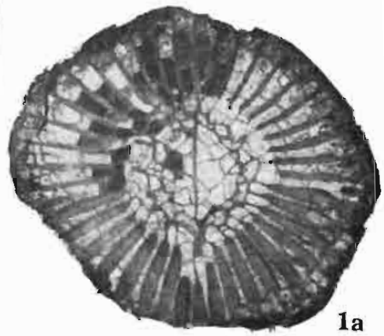

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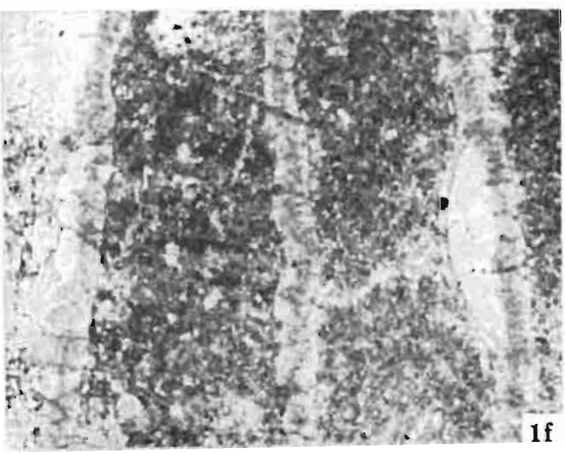

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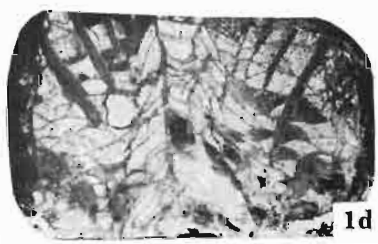

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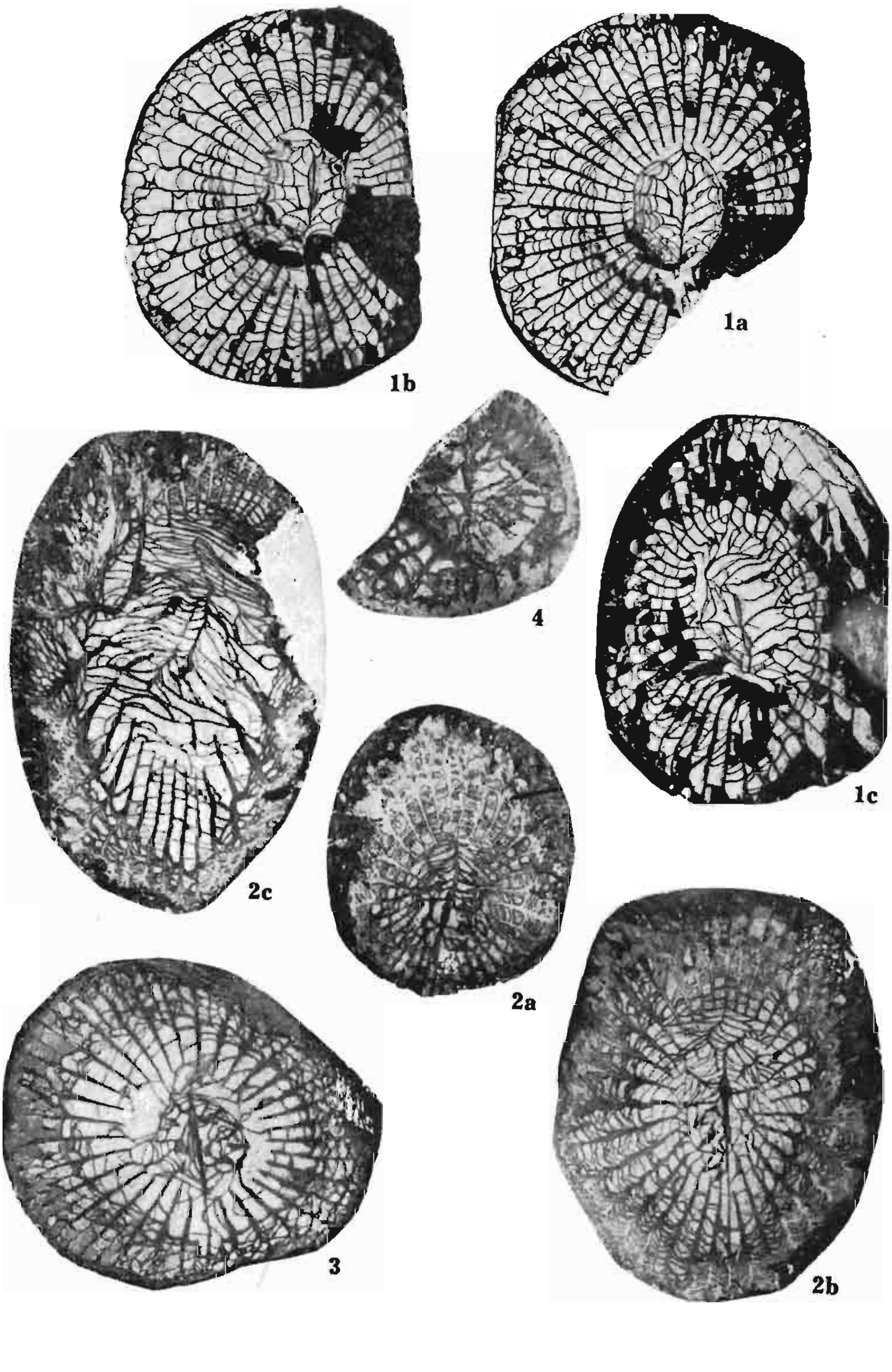
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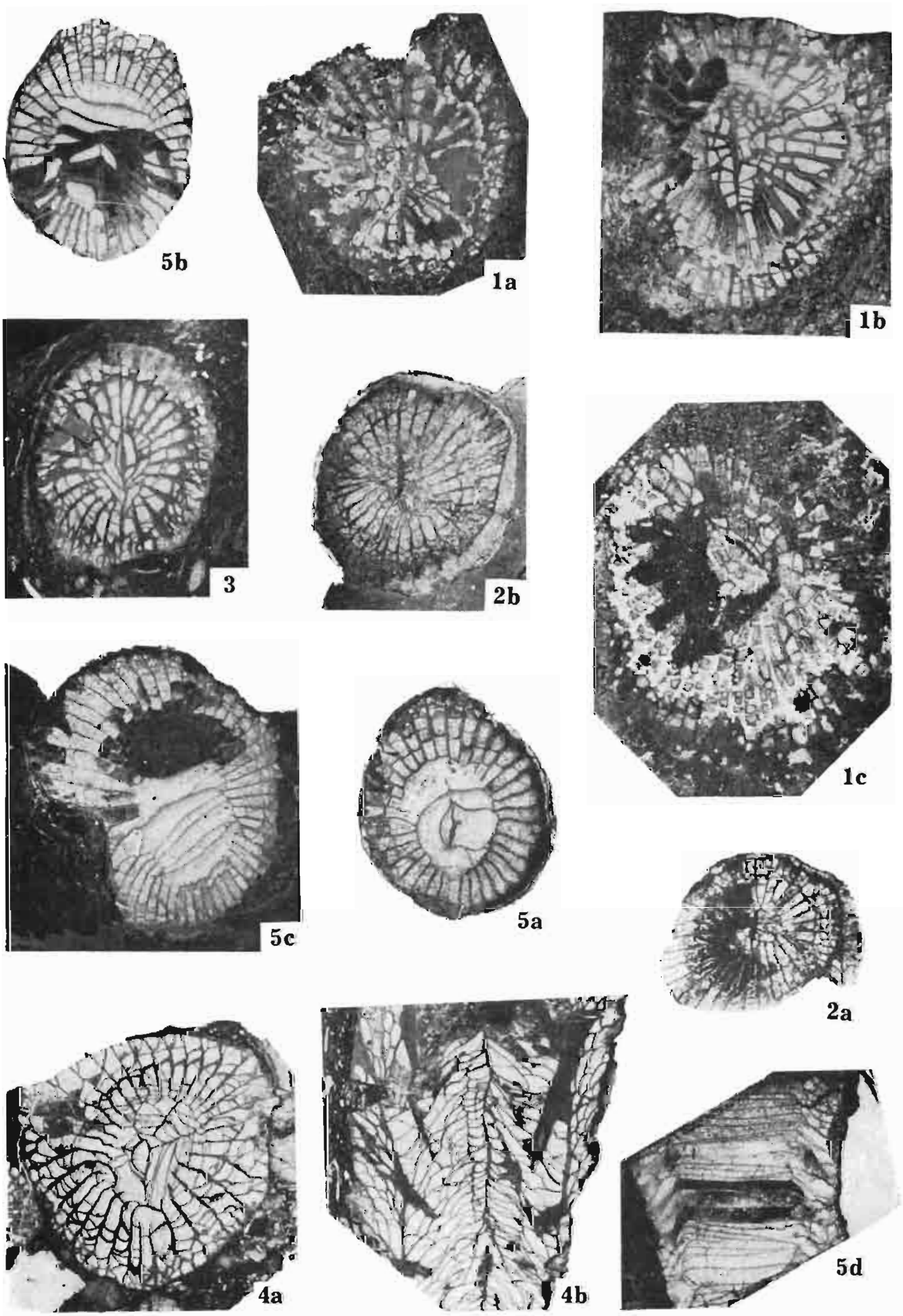
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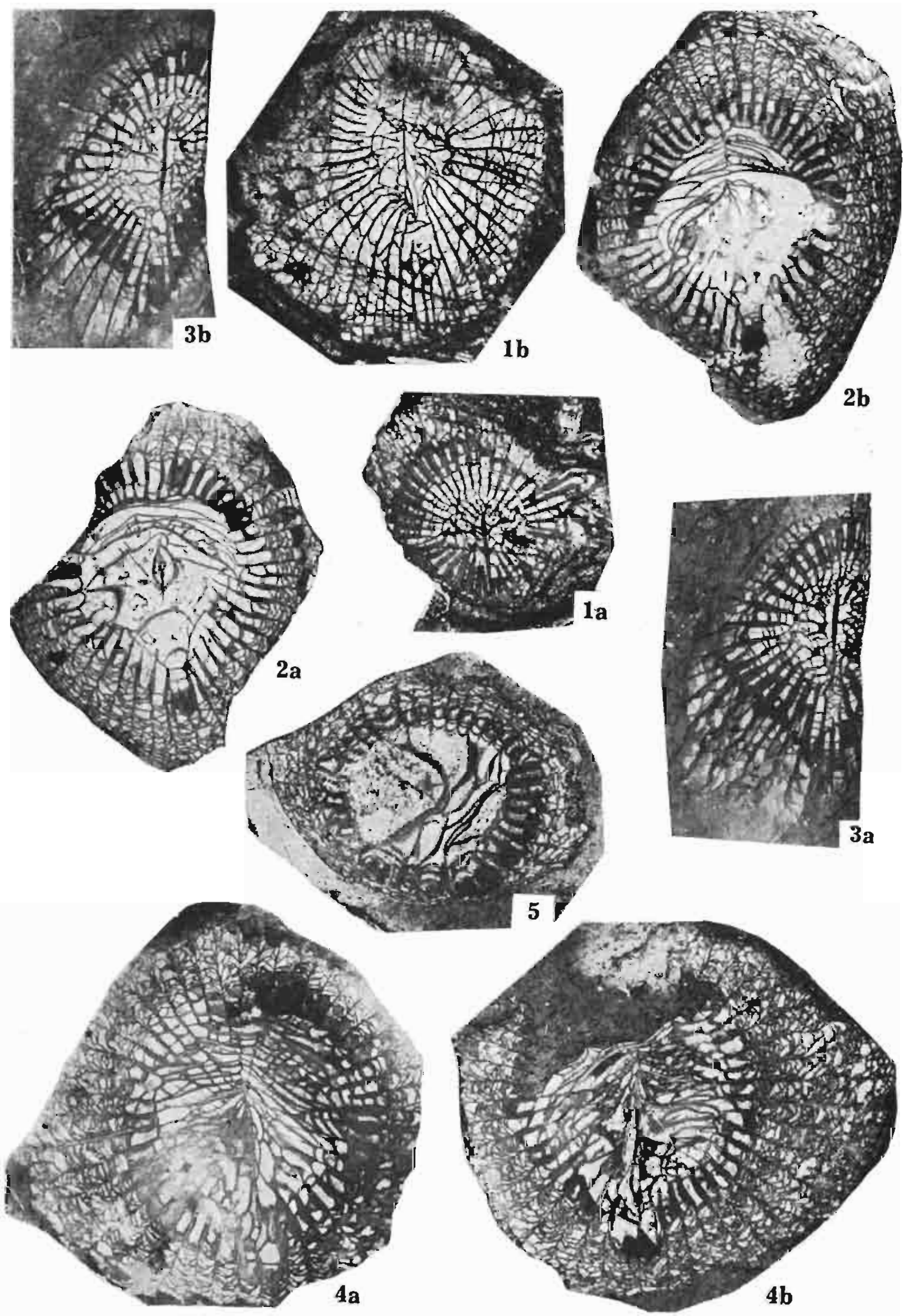
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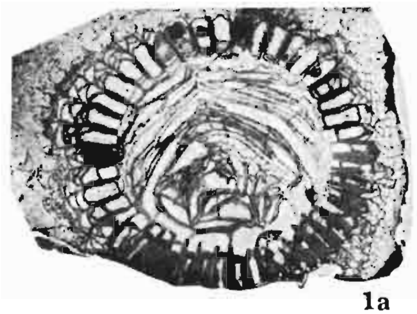
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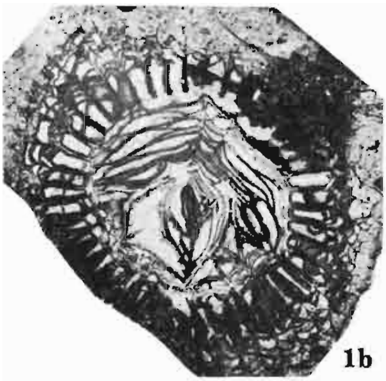
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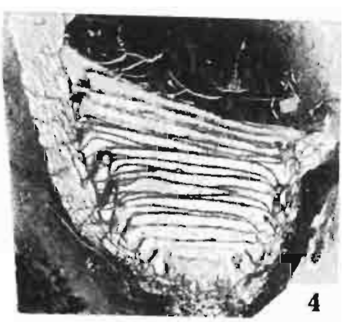
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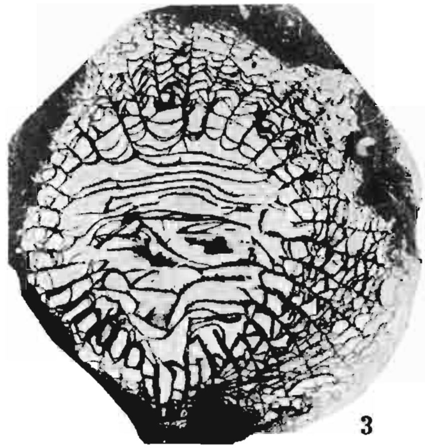
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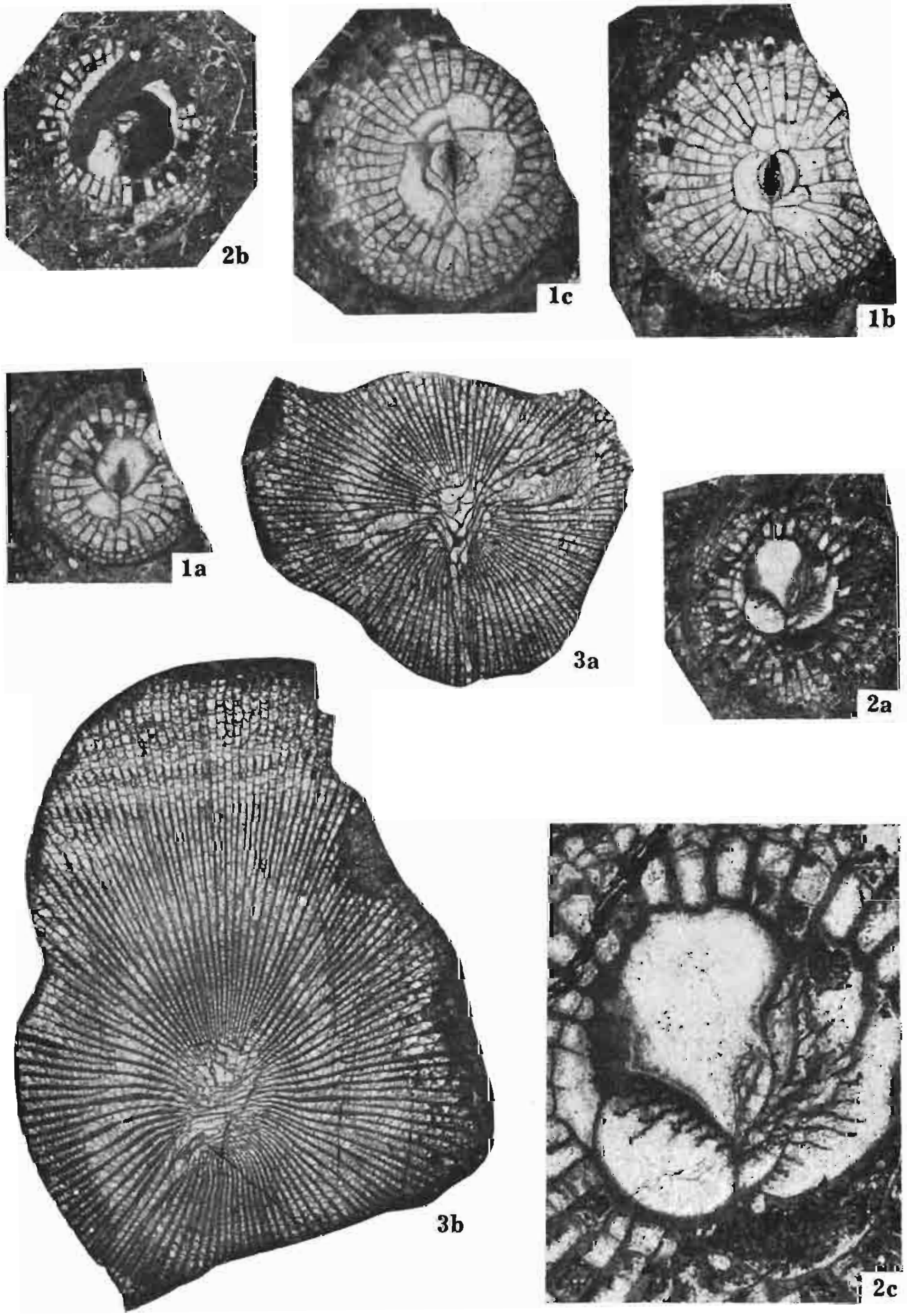
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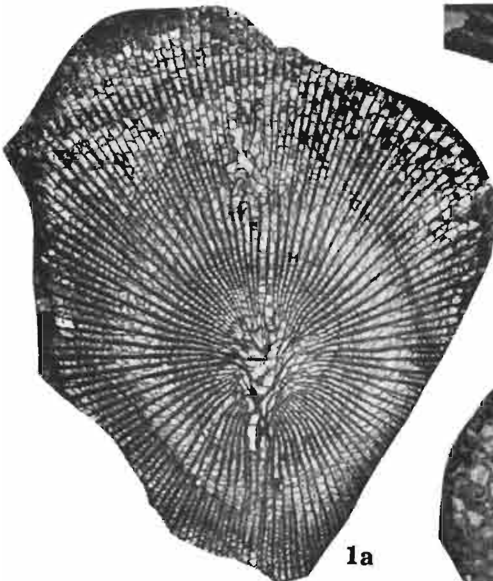

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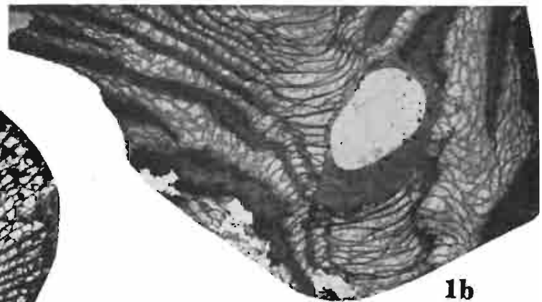

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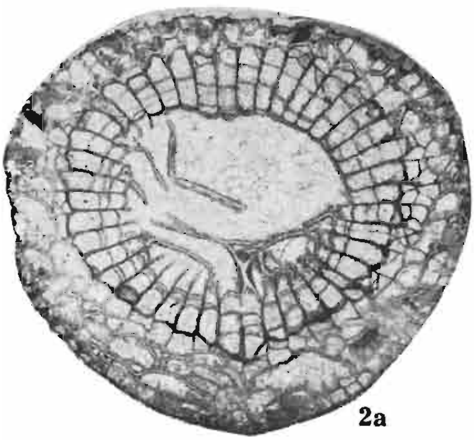

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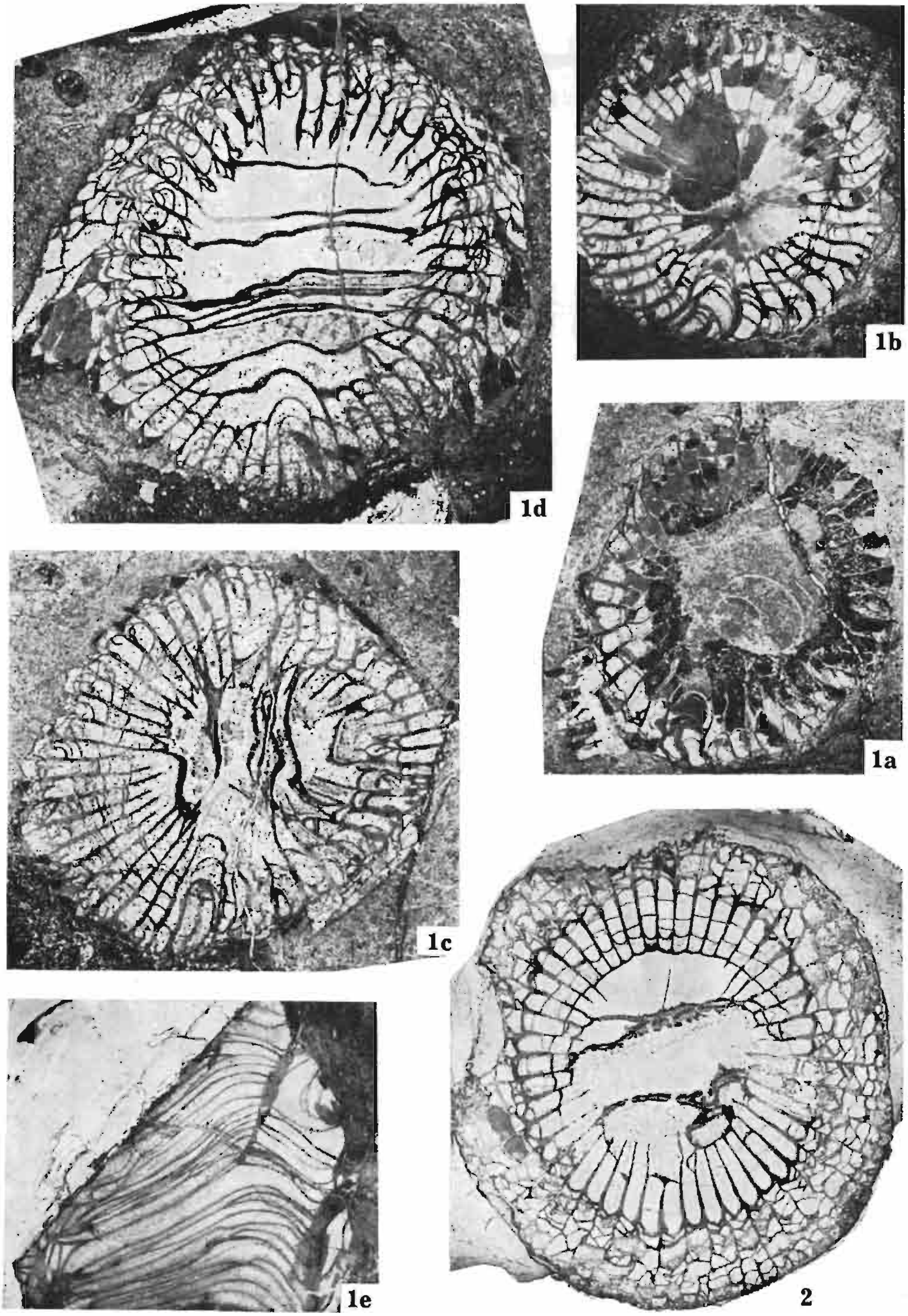
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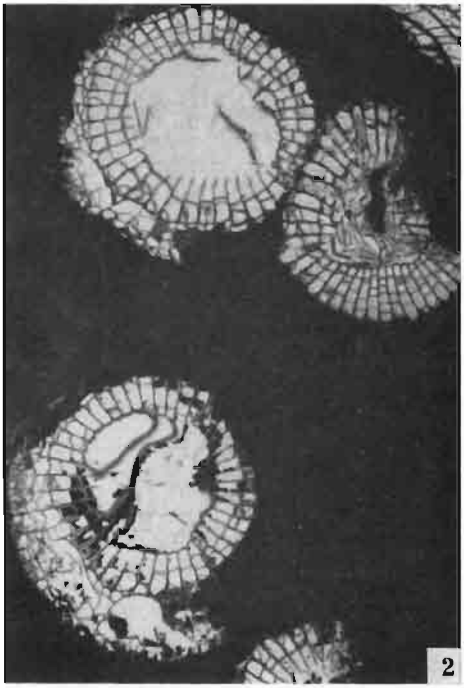

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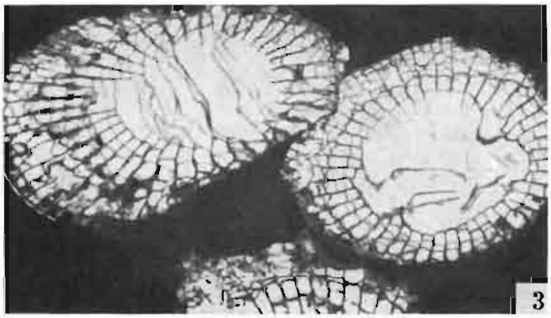

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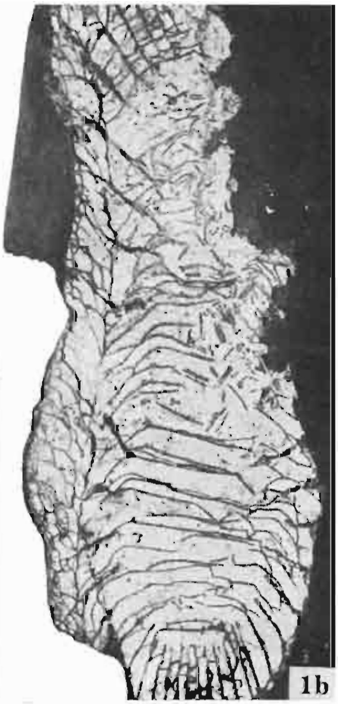

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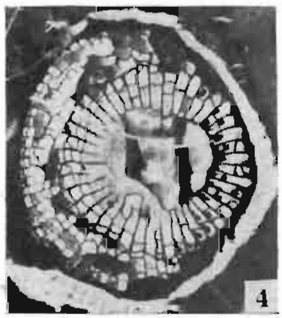

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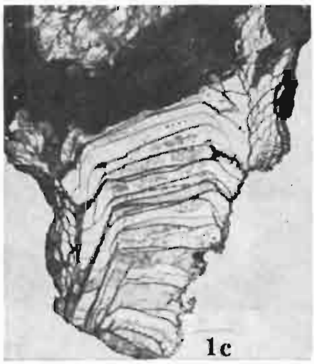

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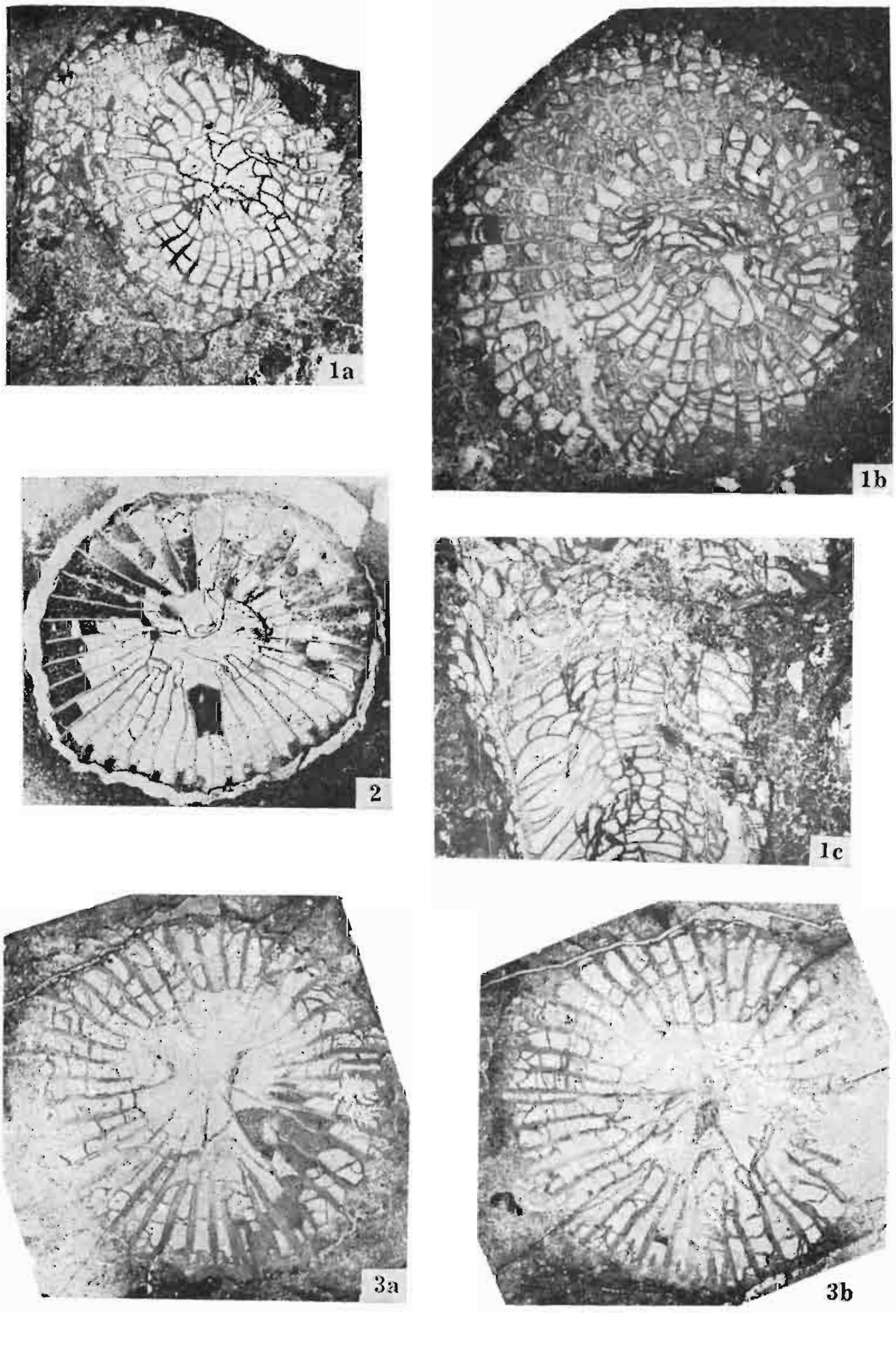
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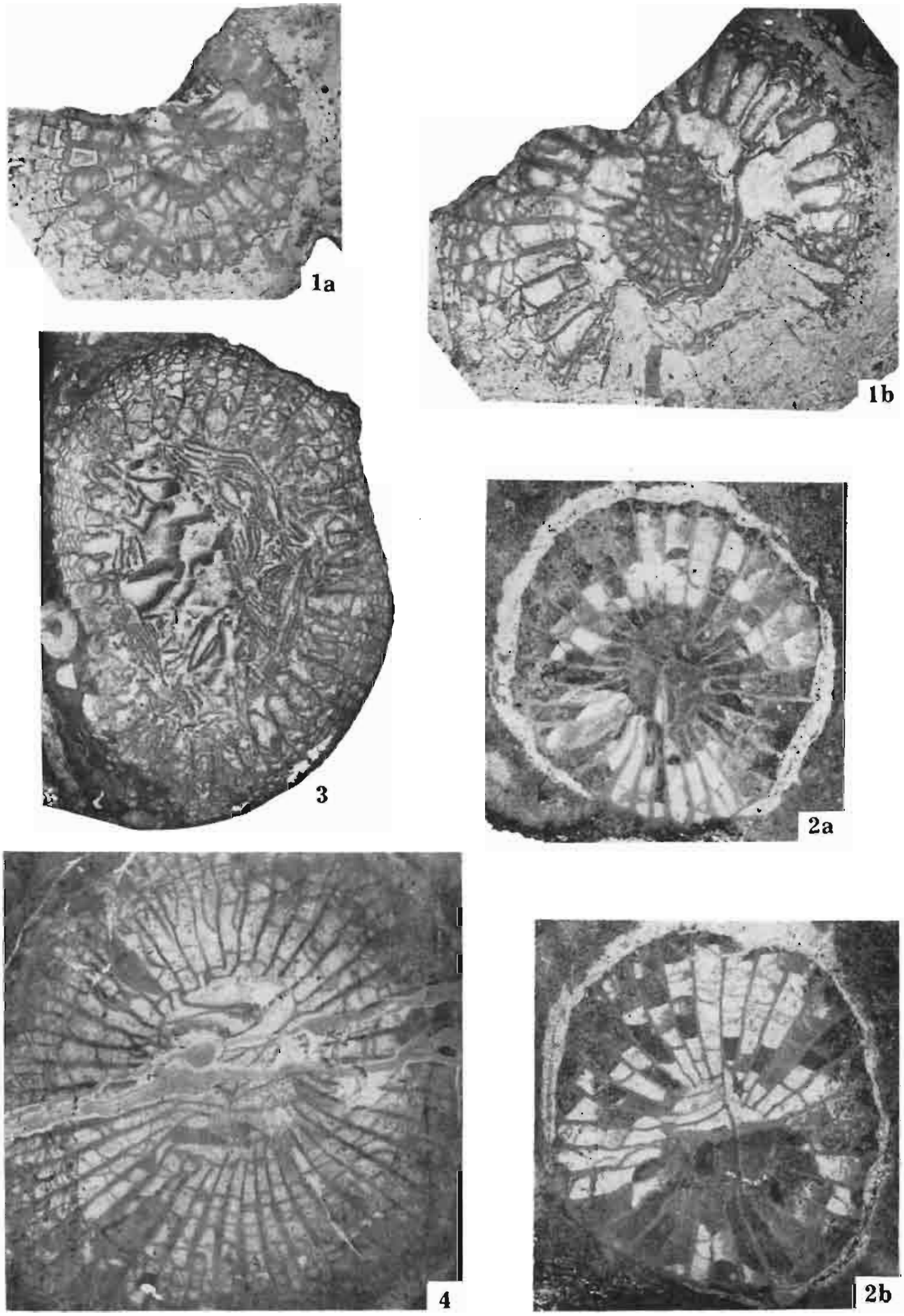
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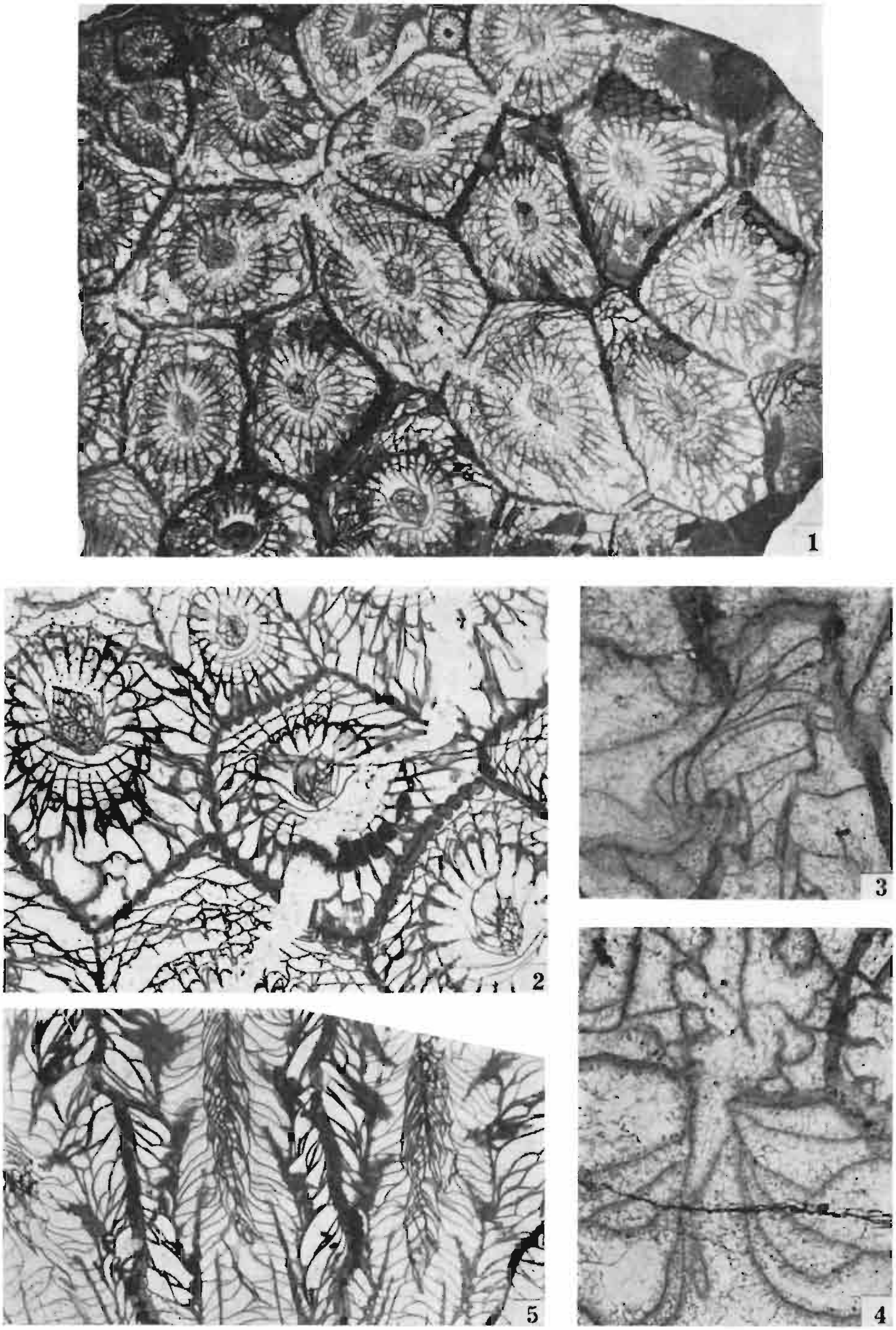
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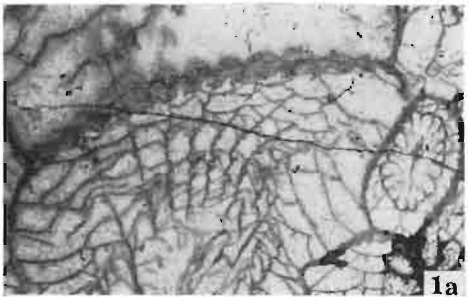

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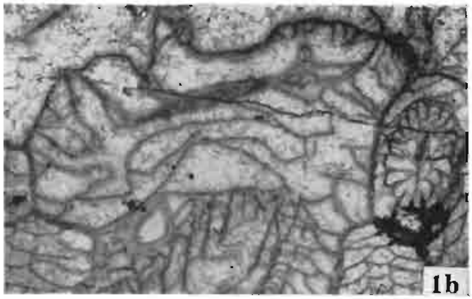

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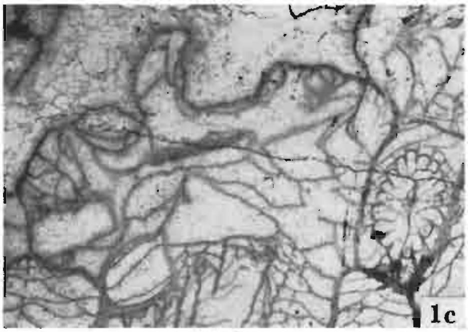

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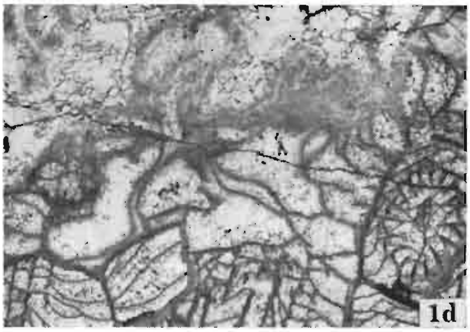

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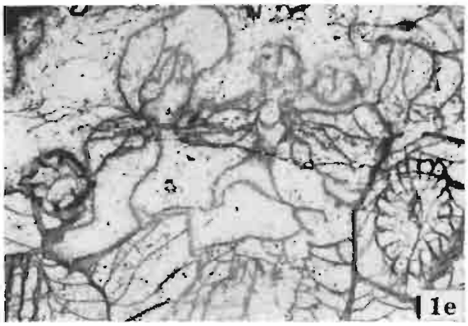

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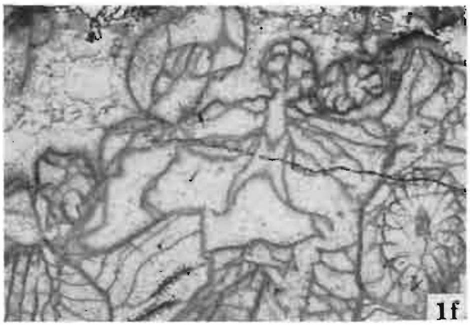

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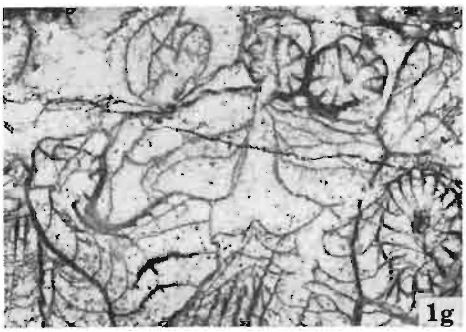

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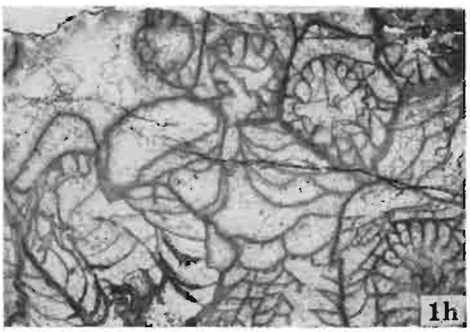

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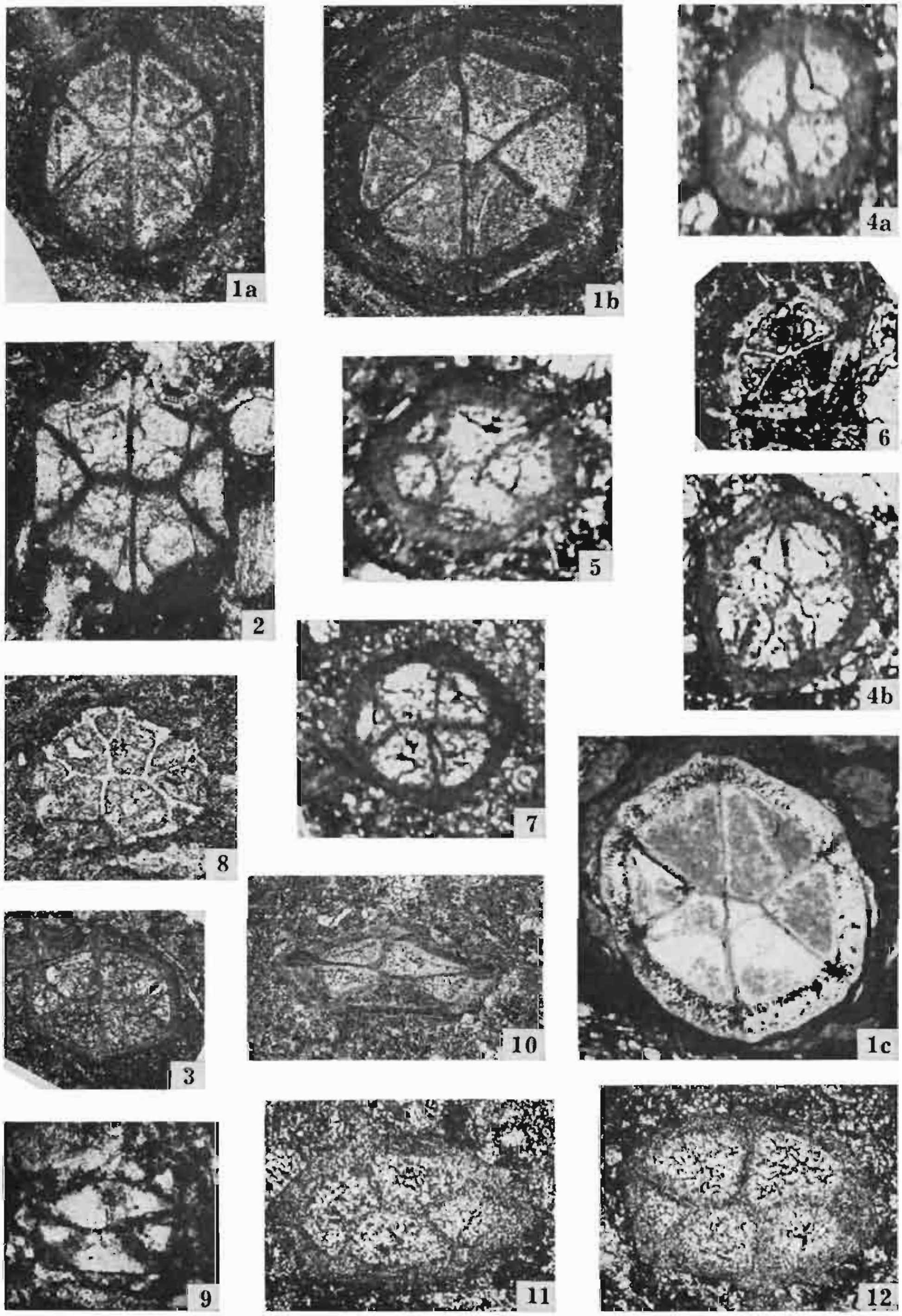
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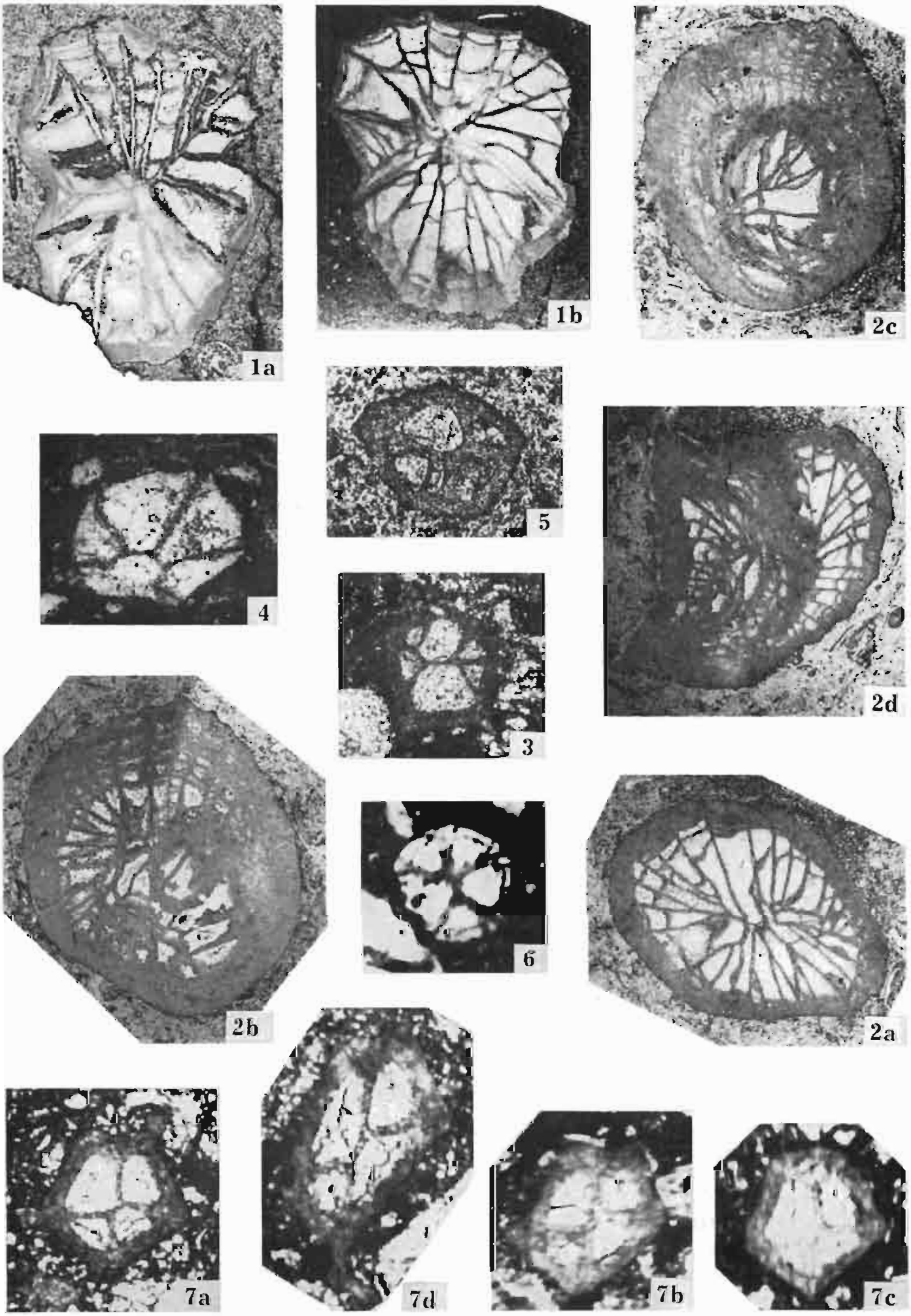
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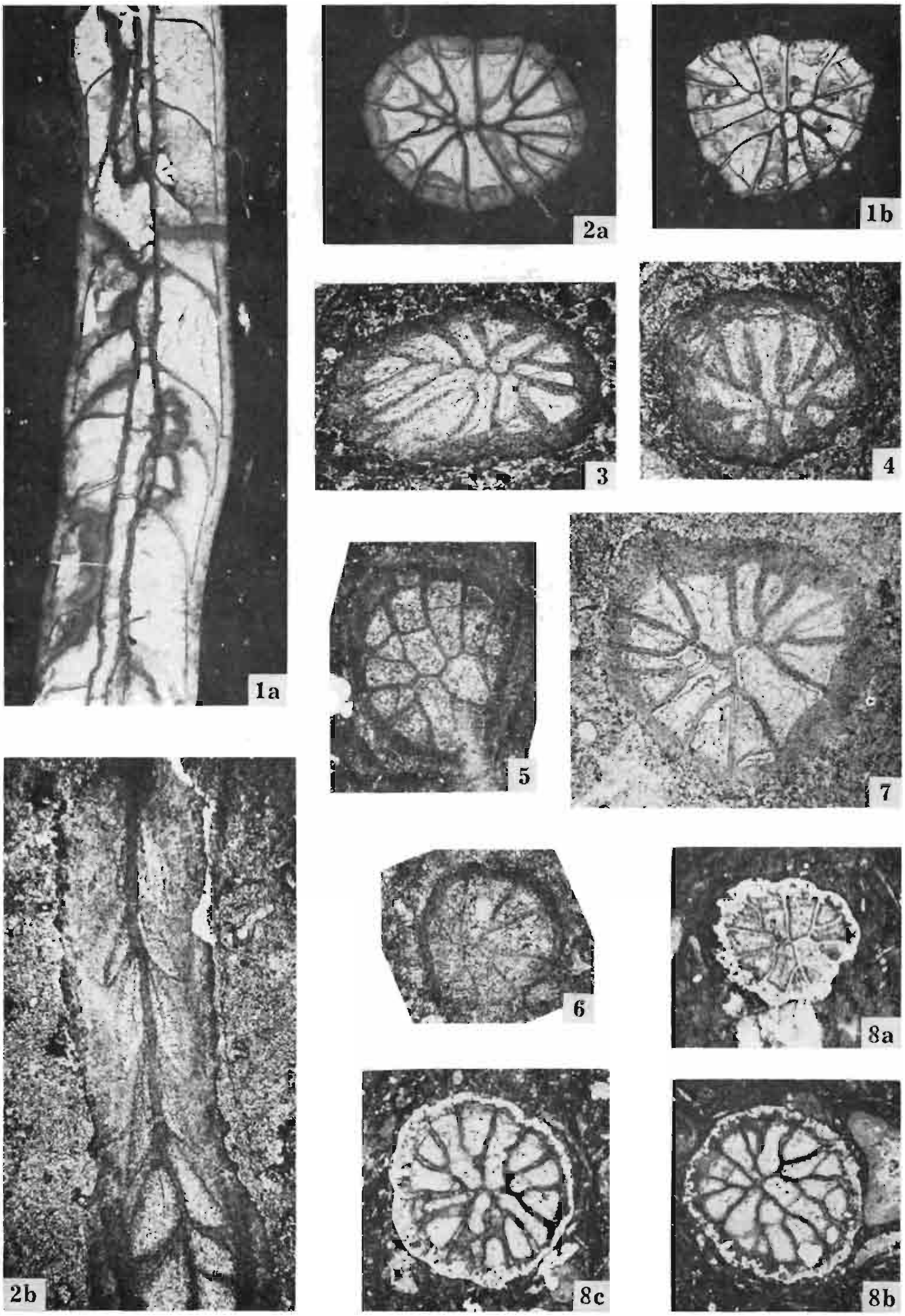
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