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Late Devonian and early Carboniferous Rugosa from Western Pomerania, northern Poland

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ABSTRACT:

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The taxonomic description of the Late Devonian and Early Carboniferous Rugosa from the boundary area of the Precambrian East European Craton and the Palaeozoic platform of Central Europe is presented. Palaeontological analysis and the stratigraphical distribution of the corals in Western Pomerania enabled recognition of several faunistic events, which reflect evolutionary trends in rugose corals.

The pre-crisis Frasnian coral fauna, dominated by colonial forms, both massive [*Disphyllia laxa* (GÜRICH, 1896), *Hexagonaria hexagona kowalae* WRZOŁEK, 1992, ?*Frechastraea*] and branching [*Disphyllum kweihsiense* YOH, 1937, *Peneckiella ?fascicularis* (SOSHKINA, 1952), *Thamnophyllum monozonatum* (SOSHKINA, 1939), *Peneckiella szulczewskii* RÓŻKOWSKA, 1979], developed on the carbonate platform extending along the edge of the East European Craton. The similarity of these faunas to Rugosan faunas from southern Poland is significant.

The coral fauna was reduced significantly after the Kellwasser crisis. Colonial corals disappeared altogether and solitary dissepimented forms were markedly reduced. The subsequent Late Famennian radiation caused a significant quantitative and qualitative differentiation of the coral faunas. In addition to the well-known '*Cyathaxonia* fauna', warm and shallow-water solitary corals appeared in the latest Famennian. The stratigraphically important taxa of the latest Famennian include: *Campophyllum* MILNE-EDWARDS & HAIM, 1850, ?*Palaeosmilia aquisgranense* (FRECH, 1885), *Bounophyllum pomeranicum* sp. nov. and *Guerichiphyllum kowalense* RÓŻKOWSKA, 1969.

The latest Famennian regression caused subdivision of the Pomeranian area into at least two sedimentary basins, separated by shallows, with peculiar ecological conditions, and the appearance of numerous endemic taxa. This regressive interval contains, however, numerous levels yielding less restricted faunas, which suggest the intermittent appearance of more open-sea conditions.

Key words: Rugosa, Late Devonian, Early Carboniferous, Palaeoecology, Palaeogeography, Western Pomerania, Poland.

INTRODUCTION

The aim of the present paper is the description of the Devonian and Early Carboniferous coral fauna of Western Pomerania. This fauna is very poorly known and has been only sparsely documented. The first reports (RÓŻKOWSKA & FEDOROWSKI 1972; RÓŻKOWSKA 1979), provided illustrations and descriptions of a selection of the most important species. Identifications and illustrations of an additional seven taxa were subsequently published by MUSZER (1998). [Those identifications are, however, not confirmed herein.] Finally, a preliminary report with a list of recognised taxa, and some general stratigraphical and palaeogeographical suggestions, was recently published by the author (CHWIEDUK 1998).

The Upper Palaeozoic strata in Pomerania are entirely subsurface. Their recognition resulted from geophysical and geological oil and gas prospecting. The first drilling that reached the Carboniferous and/or Devonian rocks (Chojnice-2 borehole) was carried out in 1958 (TOKARSKI 1959). The Lower Carboniferous rocks were first reported from the Bobolice-1 borehole (ŻELICHOWSKI 1968). The Devonian and Carboniferous of Western Pomerania have so far been recognized in 119 boreholes (Oil and Gas Drilling Company data, Piła, 2000), mostly from the Koszalin-Chojnice (abbreviated as K-Ch) structural zone and from the Baltic Coast, west of Koszalin (Text-fig. 1).

The coral fauna analysed herein was derived from 39 boreholes (Text-figs 1, 2, Tabs 1a-d). It comprises 399 specimens (Tab. 1a-d) from the Upper Devonian and Lower Carboniferous strata; 58 from the Frasnian, 261 from the Famennian, and 80 from the Lower Carboniferous. Specimens, thin sections and some unpublished data of Professors Maria RÓŻKOWSKA and Jerzy FEDOROWSKI were additionally used.

The material is dominated by: ?*Campophyllum* sp. nov. A (9.0%), *Campophyllum flexuosum* (8.3%), *Conilophyllum priscum* (7.8%), *Bounophyllum pomeranicum* (5.3%), ?*Syringaxon* sp. nov. A (5.3%), *Cyathaxonia* (*C.*) *famenniana* (3.3%) and *Cyathaxonia* (*C.*) cf. *rozkowskae* (2.5%). The large representation (19.3%) of new (genera and species), most probably endemic taxa, is noteworthy.

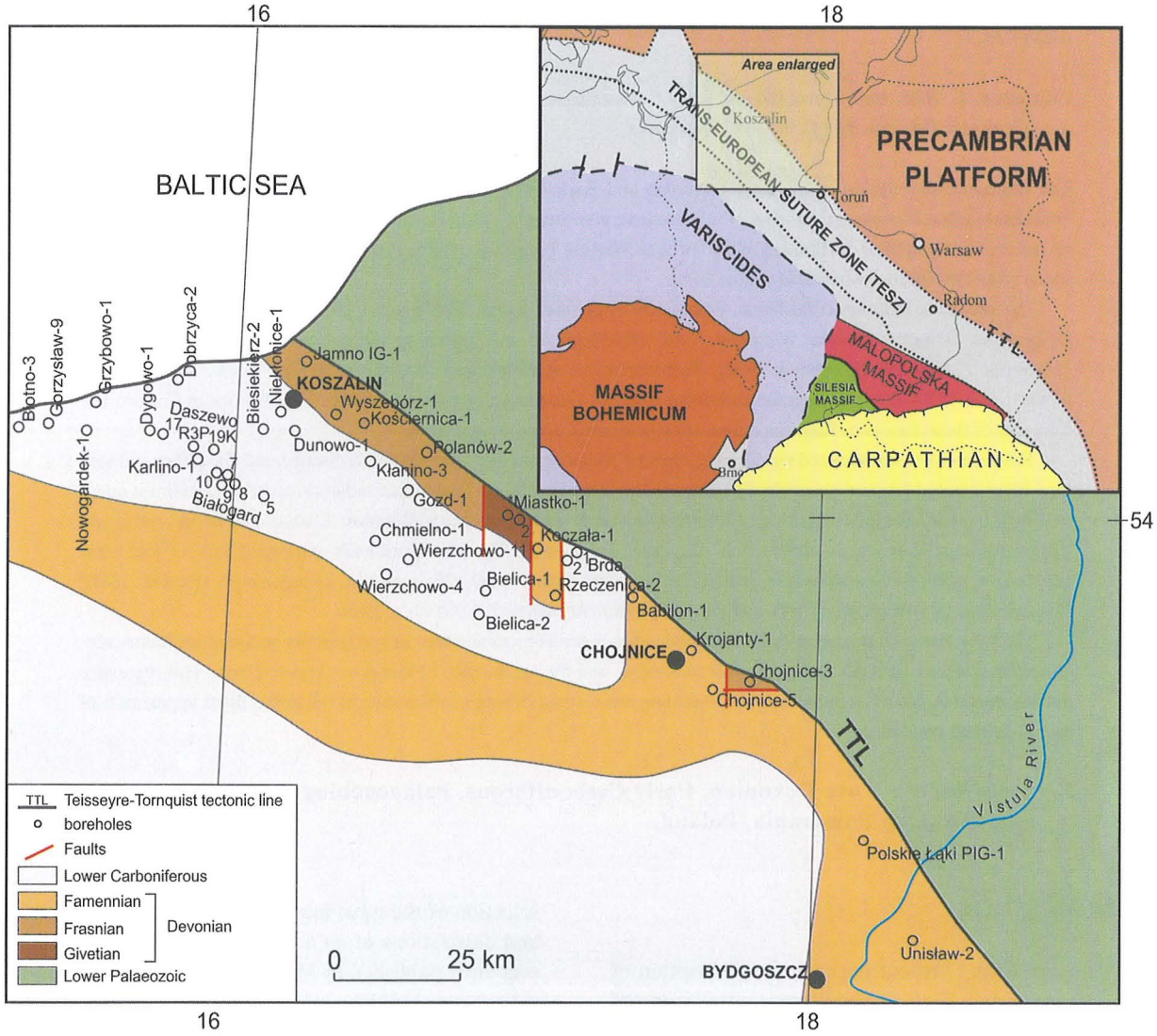


Fig. 1. Simplified geological map of Western Pomerania (after MATYJA 1998, slightly modified) excluding formations younger than Lower Carboniferous, including borehole locations with Upper Devonian and Lower Carboniferous rugose corals, against the background of the structural geological map of Poland (after BEŁKA 1998, slightly modified)

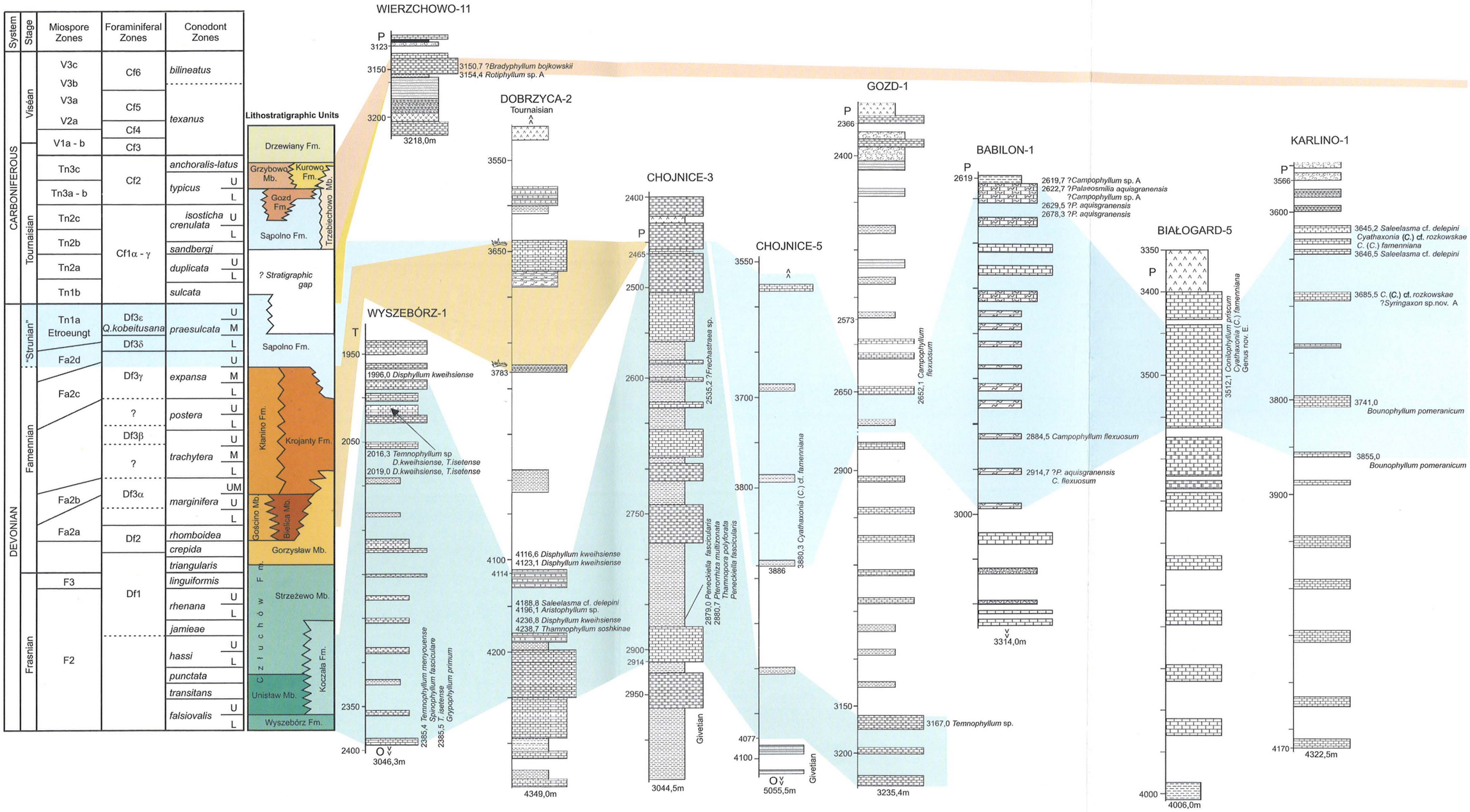


Fig. 2a. Stratigraphical correlation and distribution of the coral taxa of selected columns from Western Pomerania. Only those boreholes were selected where the recognized coral fauna changed the existing stratigraphic ranges or made them more precise (lithostratigraphical units of Upper Devonian according to MATYJA 1993 and 1998, Lower Carboniferous after LIPIEC in MATYJA & *al*. 2000; standard conodont division according to SANDBERG & *al*. 1978, LANE & *al*. 1980, ZIEGLER & SANDBERG 1990, WEDDIGE & *al*. 1996; Foraminifera and Miospore zones after CONIL & *al*. 1976 and 1990)

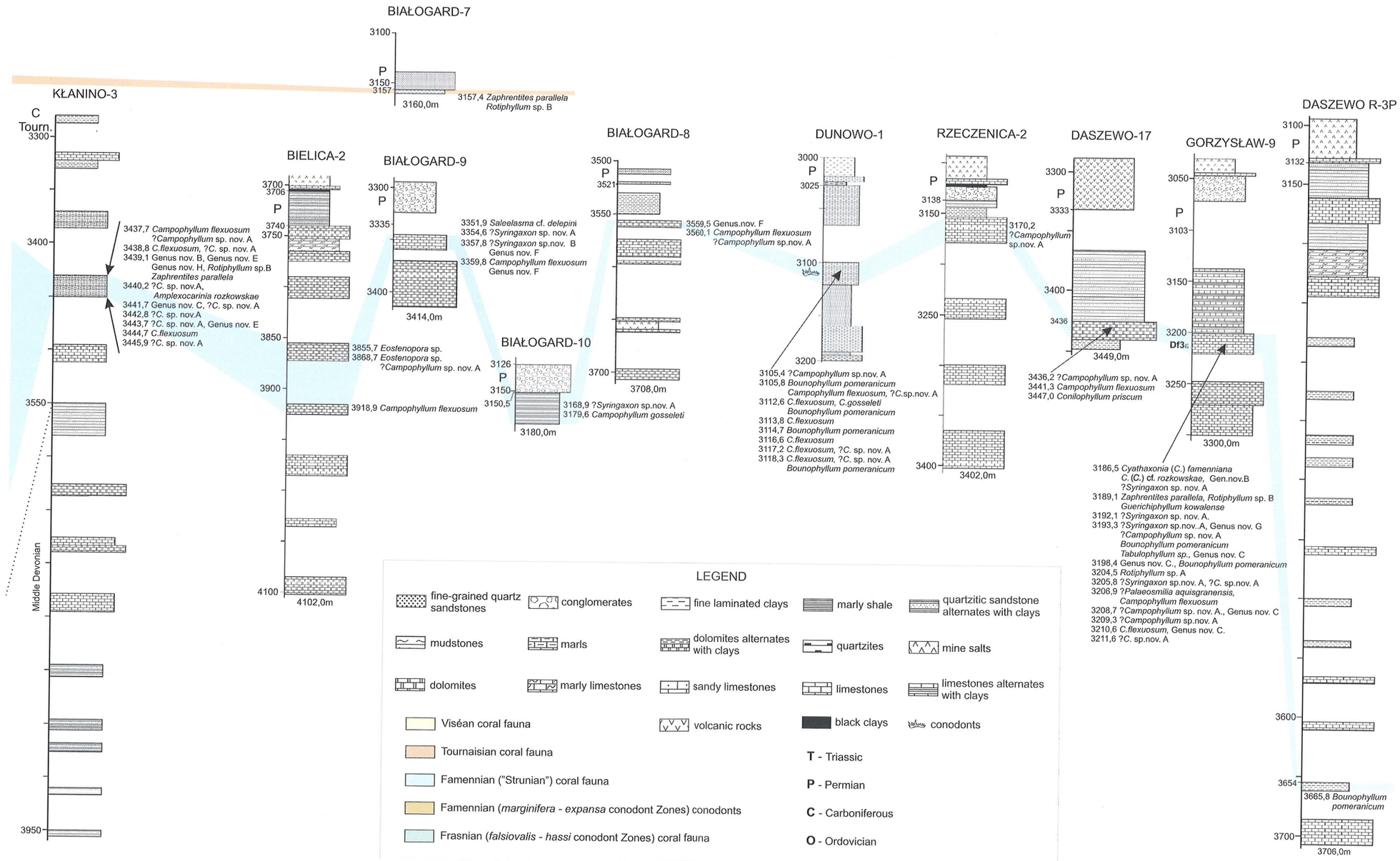


Fig. 2b. For explanation see Fig. 2a

GEOLOGICAL SETTING

Western Pomerania (Text-fig. 1) is located in the Trans-European Suture Zone (abbreviated as TESZ), which corresponds roughly to the tectonic Teisseyre-Tornquist Zone (TTZ), bounded to the NE by the East European Craton (EEC), along the Teisseyre-Tornquist Line (ZNOSKO 1969). The TTZ varies in width between 50 and 90 km and its crust thickness between 35 and 50 km (GŁAZEK 1994, GŁAZEK & al. 2000, GUTERCH & GRAD 2000). It separates two main structural areas of Central Europe: the stable Precambrian East European Craton (EEC) to the east, with crust 42-47 km thick, and the more mobile and thinner (with crust 30-36 km thick) craton of central and western Europe (CEP) of Variscan age (GŁAZEK 1994). In western Pomerania the basement of the craton is covered with sedimentary rocks ranging in thickness between 5 and 6 km (GUTERCH & *al.* 1986, GUTERCH & GRAD 2000, GŁAZEK 1994, GŁAZEK & *al.* 2000). This is demonstrated by the models showing the present top surface of the Devonian and/or Carboniferous (Text-figs 3, 4). The sub-Permian basement is formed of blocks delimited by NW-SE fault zones (DADLEZ 1978, 1980, 1982; POŻARYSKI 1982; MIŁACZEWSKI 1982; KARNKOWSKI 1983).

In the K-Ch Zone, the Devonian-Carboniferous strata do not form a continuous cover, and are strongly faulted, due to intensive block movements and subsequent erosion in the Late Carboniferous and Early Permian (MATYJA

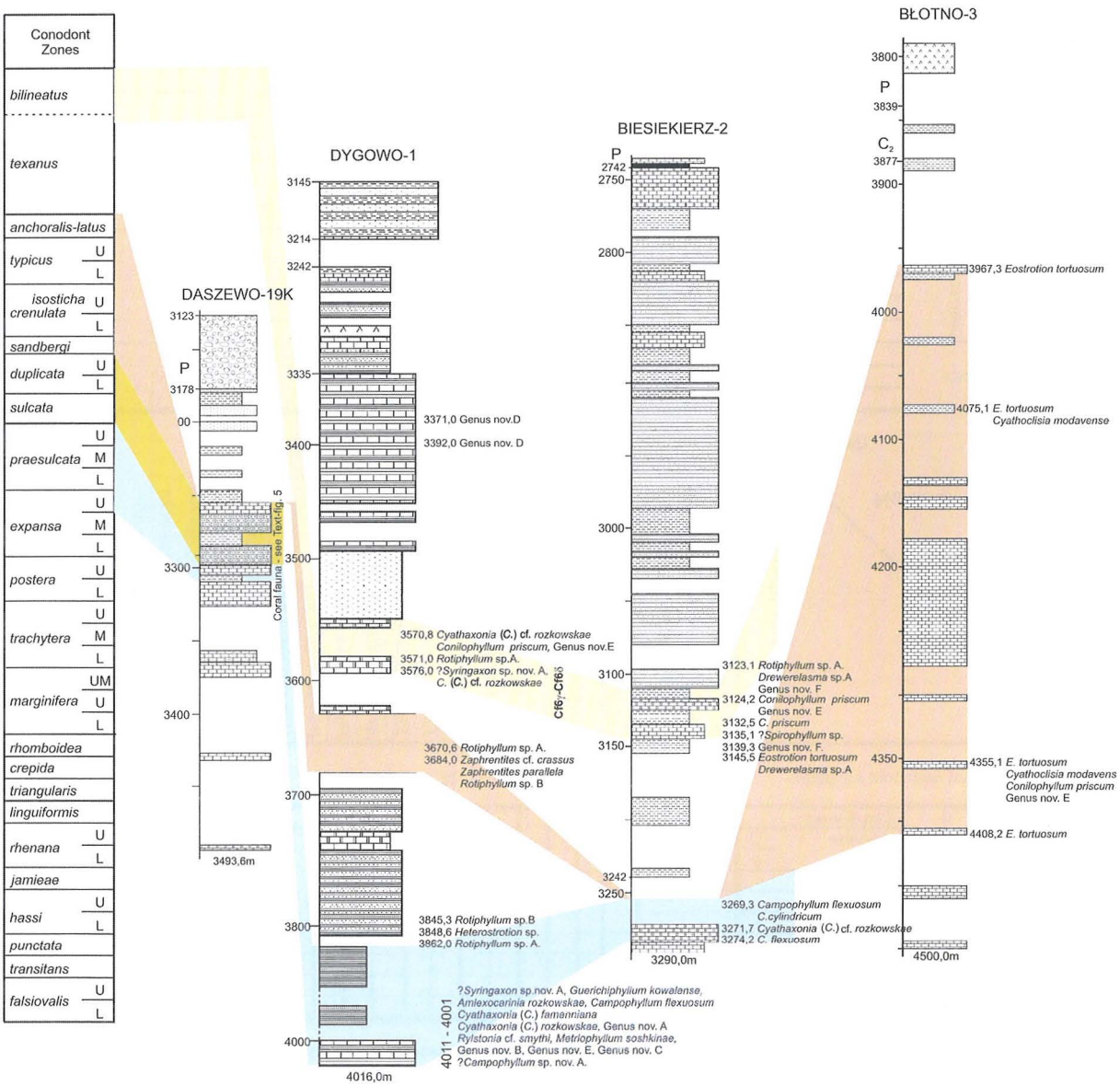
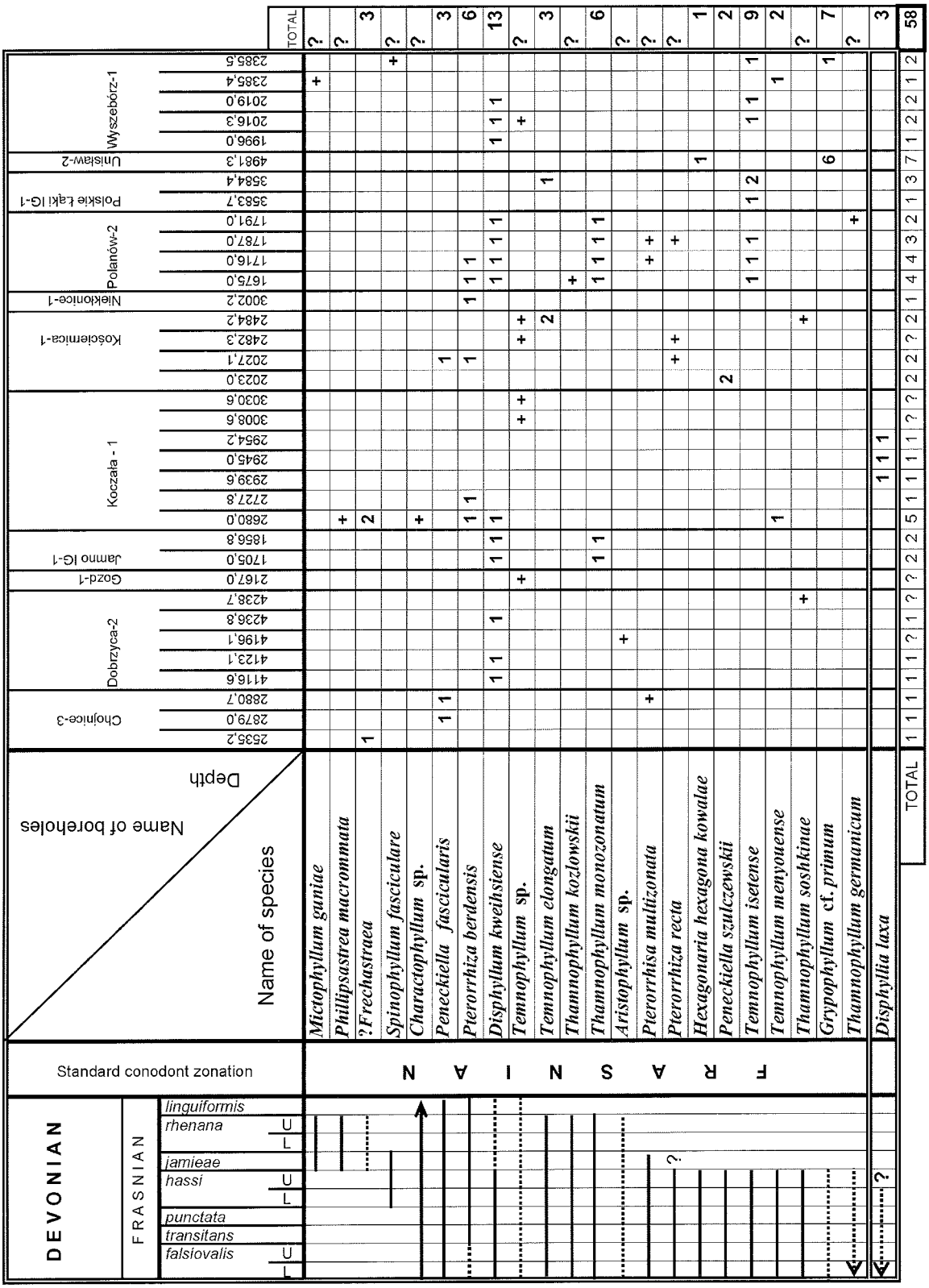


Fig. 2c. For explanation see Fig. 2a



Tab. 1a. Distribution, range chart and frequency of the Frasnian coral taxa studied in Western Pomerania. Standard conodont division according to ZIEGLER & SANDBERG (1990); corals stratigraphical ranges according to FEDOROWSKI (2001, 2003). 1, 2, ... – number of specimens; + – corals signed by Prof. M.RÓŻKOWSKA and/or Prof. J. FEDOROWSKI (archival data); some of them are listed in RÓŻKOWSKA (1979) and described in RÓŻKOWSKA & FEDOROWSKI (1972)

I A N

A N

expansa | praesulcata

M U L M U

Standard conodont zonation: F A M E N N I A N

Name of boreholes	Babilon-1						Białogard-5	Białogard-8	Białogard-9				Białogard-10		Bielica-2		Biesiekierz-2		
Name of species / Depth	2619,7	2622,7	2629,5	2678,3	2884,5	2914,7	3512,1	3560,1	3351,9	3354,6	3357,8	3359,8	3168,9	3179,6	3868,7	3918,9	3269,3	3271,7	3274,2
Bounophyllum pomeranicum sp.nov.																			
?Palaeosmilia aquisgranensis		1	1	1		1													
Campophyllum cylindricum																	1		
Campophyllum flexuosum					1	1		1				1				1	1		1
Campophyllum gosseleti														1					
Heterostrotion sp.																			
? Nervophyllum sp.																			
Campophyllum cf. ursinum																			
?Campophyllum sp. nov. A	2	1						1							1				
Saleelasma cf. delepini									1										
?Syringaxon sp. nov. A										1			1						
?Syringaxon sp. nov. B											1								
Cyathaxonia (C.) famenniana							1												
Guerichiphyllum kowalense																			
?Friedbergia sp.																			
Amplexocarinia rozkowskae																			
Metriophyllum soshkinae																			
Oligophylloides pachythecus																			
Cyathaxonia (C.) cf. rozkowskae																		1	
Tabulophyllum rozkowskae																			
Syringaxon cf. rozkowskae																			
Tabulophyllum sp.																			
TOTAL	2	2	1	1	1	2	1	2	1	1	1	1	1	1	1	1	2	1	1

Name of boreholes	Brda-1			Chmielno-1			Chojnice-5	Daszewo-17		Daszewo-19K														
Name of species / Depth	2959,0	3240,0	3250,0	4141,3	4349,3	4503,8	3880,3	3436,2	3441,3	3252,5	3278,1	3280,3	3282,8	3304,1	3305,1	3307,4	3309,3	3310,1	3312,9	3313,7	3314,5	3315,9	3317,3	3321,7
Bounophyllum pomeranicum sp.nov.																	1						3	
?Palaeosmilia aquisgranensis	1																		1					
Campophyllum cylindricum																			1					
Campophyllum flexuosum		1	1		1	1			1					2	1				1			1	1	2
Campophyllum gosseleti																2	1		1					
Heterostrotion sp.																								
? Nervophyllum sp.																								
Campophyllum cf. ursinum																			1				1	
?Campophyllum sp. nov. A								3								3	1	1	2			1	1	1
Saleelasma cf. delepini																								
?Syringaxon sp. nov. A												1	1		2	1	3		2					
?Syringaxon sp. nov. B																			2					
Cyathaxonia (C.) famenniana							1			1		1								1	2			1
Guerichiphyllum kowalense																1								
?Friedbergia sp.				1																				
Amplexocarinia rozkowskae																								
Metriophyllum soshkinae																								
Oligophylloides pachythecus											1												1	
Cyathaxonia (C.) cf. rozkowskae																								
Tabulophyllum rozkowskae																								
Syringaxon cf. rozkowskae												1		1					1					
Tabulophyllum sp.																								
TOTAL	1	1	1	1	1	1	1	3	1	1	1	3	1	3	3	7	6	1	12	1	2	2	7	4

Name of boreholes	Daszewo R-3P	Dobrzyca-2	Dygowo-1						Dunowo-1							Gorzysław-9									
Name of species / Depth	3665,8	4188,8	3570,8	3576,0	3848,6	4001-4007	4010,0	4011,0	3105,8	3112,6	3113,8	3114,7	3116,6	3117,2	3118,3	3186,5	3189,1	3192,1	3193,3	3198,4	3205,8	3206,9	3208,7	3209,3	3210,6
Bounophyllum pomeranicum sp.nov.	2								1	1		2			1				6	1					
?Palaeosmilia aquisgranensis																						1			
Campophyllum cylindricum																									
Campophyllum flexuosum						1			1	1	1		1	1	1							1			1
Campophyllum gosseleti										1															
Heterostrotion sp.					2																				
? Nervophyllum sp.																									
Campophyllum cf. ursinum																									
?Campophyllum sp. nov. A								1	2					1	1				1		1		1	1	
Saleelasma cf. delepini		1																							
?Syringaxon sp. nov. A				1		1										1		1	1		1				
?Syringaxon sp. nov. B																									
Cyathaxonia (C.) famenniana							1									2									
Guerichiphyllum kowalense						1	1	1									2								
?Friedbergia sp.																									
Amplexocarinia rozkowskae						1																			
Metriophyllum soshkinae								5																	
Oligophylloides pachythecus																									
Cyathaxonia (C.) cf. rozkowskae			2	1		2										2									
Tabulophyllum rozkowskae																									
Syringaxon cf. rozkowskae																									
Tabulophyllum sp.																			+						
TOTAL	2	1	2	2	2	6	2	7	4	3	1	2	1	2	3	5	2	1	8	1	2	2	1	1	1

Name of boreholes	Gozd-1	Karlino-1					Kłanino-3								Koczała - 1	Nowogardek-1	Rzeczenica-2	Wierzchowo-4			
Name of species / Depth	2652,1	3645,2	3646,5	3685,5	3741,0	3855,0	3437,7	3438,8	3440,2	3441,7	3442,8	3443,7	3444,7	3445,9	2949,5	2904,1	3170,2	4721,3	4730,0	4732,0	TOTAL
Bounophyllum pomeranicum sp.nov.					1	1												1			21
?Palaeosmilia aquisgranensis																					7
Campophyllum cylindricum																					2
Campophyllum flexuosum	1						1	1					1								33
Campophyllum gosseleti																					6
Heterostrotion sp.																					2
? Nervophyllum sp.																		1	1	1	3
Campophyllum cf. ursinum																					2
?Campophyllum sp. nov. A							1	1	2	1	1	1		1			1				36
Saleelasma cf. delepini		1	1													2					6
?Syringaxon sp. nov. A				2											1						21
?Syringaxon sp. nov. B																					3
Cyathaxonia (C.) famenniana		2																			13
Guerichiphyllum kowalense																					6
?Friedbergia sp.																					1
Amplexocarinia rozkowskae									1												2
Metriophyllum soshkinae																					5
Oligophylloides pachythecus																					2
Cyathaxonia (C.) cf. rozkowskae		1		1																	10
Tabulophyllum rozkowskae															+						?
Syringaxon cf. rozkowskae																					3
Tabulophyllum sp.																					?
TOTAL	1	4	1	3	1	1	2	2	3	1	1	1	1	1	1	2	1	2	1	1	184

Tab. 1b. Distribution, range chart and frequency of the Famennian coral taxa studied in Western Pomerania; see Tab. 1a for explanation

DEVONIAN — FAMENNIAN

Standard conodont zonation: *marginifera* (L, U, UM), *trachytera* (L, U), *postera* (L, U), *expansa* (L, M, U), *praesulcata* (L, M, U)

Name of boreholes / Depth / Name of species

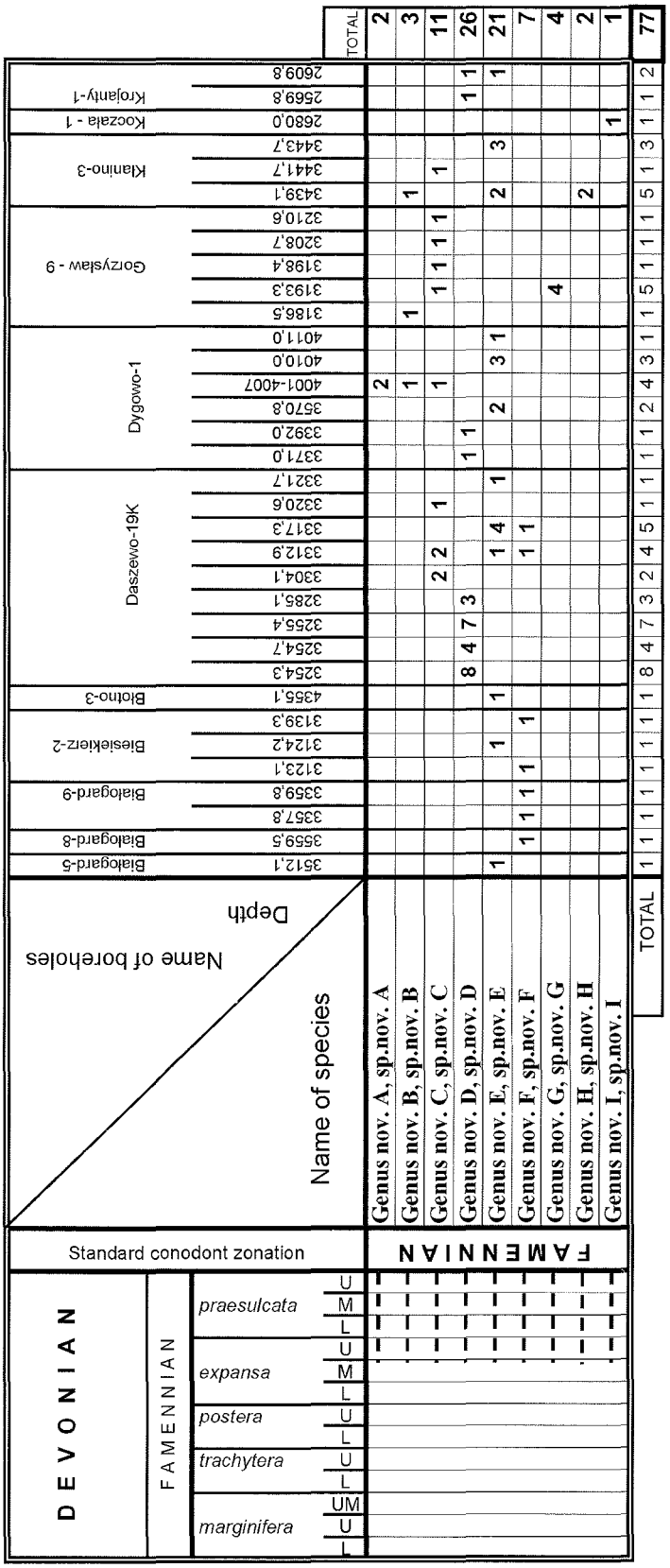
Name of species	Babilon-1						Białogard-5	Białogard-8	Białogard-9				Białogard-10		Bielica-2		Biesiekierz-2		
Depth	2619,7	2622,7	2629,5	2678,3	2884,5	2914,7	3512,1	3560,1	3351,9	3354,6	3357,8	3359,8	3168,9	3179,6	3868,7	3918,9	3269,3	3271,7	3274,2
Bounophyllum pomeranicum sp.nov.																			
?*Palaeosmilia aquisgranensis*		1	1	1		1													
Campophyllum cylindricum																	1		
Campophyllum flexuosum					1	1		1				1				1	1		1
Campophyllum gosseleti														1					
Heterostrotion sp.																			
? *Nervophyllum* sp.																			
Campophyllum cf. *ursinum*																			
?*Campophyllum* sp. nov. A	2	1						1							1				
Saleelasma cf. *delepini*									1										
?*Syringaxon* sp. nov. A										1			1						
?*Syringaxon* sp. nov. B											1								
Cyathaxonia (*C.*) *famenniana*							1												
Guerichiphyllum kowalense																			
?*Friedbergia* sp.																			
Amplexocarinia rozkowskae																			
Metriophyllum soshkinae																			
Oligophylloides pachythecus																			
Cyathaxonia (*C.*) cf. *rozkowskae*																		1	
Tabulophyllum rozkowskae																			
Syringaxon cf. *rozkowskae*																			
Tabulophyllum sp.																			
TOTAL	2	2	1	1	1	2	1	2	1	1	1	1	1	1	1	1	2	1	1

Name of species	Brda-1			Chmielno-1			Chojnice-5	Daszewo-17		Daszewo-19K														
Depth	2959,0	3240,0	3250,0	4141,3	4349,3	4503,8	3880,3	3436,2	3441,3	3252,5	3278,1	3280,3	3282,8	3304,1	3305,1	3307,4	3309,3	3310,1	3312,9	3313,7	3314,5	3315,9	3317,3	3321,7
Bounophyllum pomeranicum sp.nov.																	1						3	
?*Palaeosmilia aquisgranensis*	1																		1					
Campophyllum cylindricum																			1					
Campophyllum flexuosum		1	1		1	1			1					2	1				1			1	1	2
Campophyllum gosseleti																2	1		1					
Heterostrotion sp.																								
? *Nervophyllum* sp.																								
Campophyllum cf. *ursinum*																			1				1	
?*Campophyllum* sp. nov. A								3								3	1	1	2			1	1	1
Saleelasma cf. *delepini*																								
?*Syringaxon* sp. nov. A												1	1		2	1	3		2					
?*Syringaxon* sp. nov. B																			2					
Cyathaxonia (*C.*) *famenniana*							1			1		1								1	2			1
Guerichiphyllum kowalense																1								
?*Friedbergia* sp.				1																				
Amplexocarinia rozkowskae																								
Metriophyllum soshkinae																								
Oligophylloides pachythecus											1												1	
Cyathaxonia (*C.*) cf. *rozkowskae*																								
Tabulophyllum rozkowskae																								
Syringaxon cf. *rozkowskae*												1		1					1					
Tabulophyllum sp.																								
TOTAL	1	1	1	1	1	1	1	3	1	1	1	3	1	3	3	7	6	1	12	1	2	2	7	4

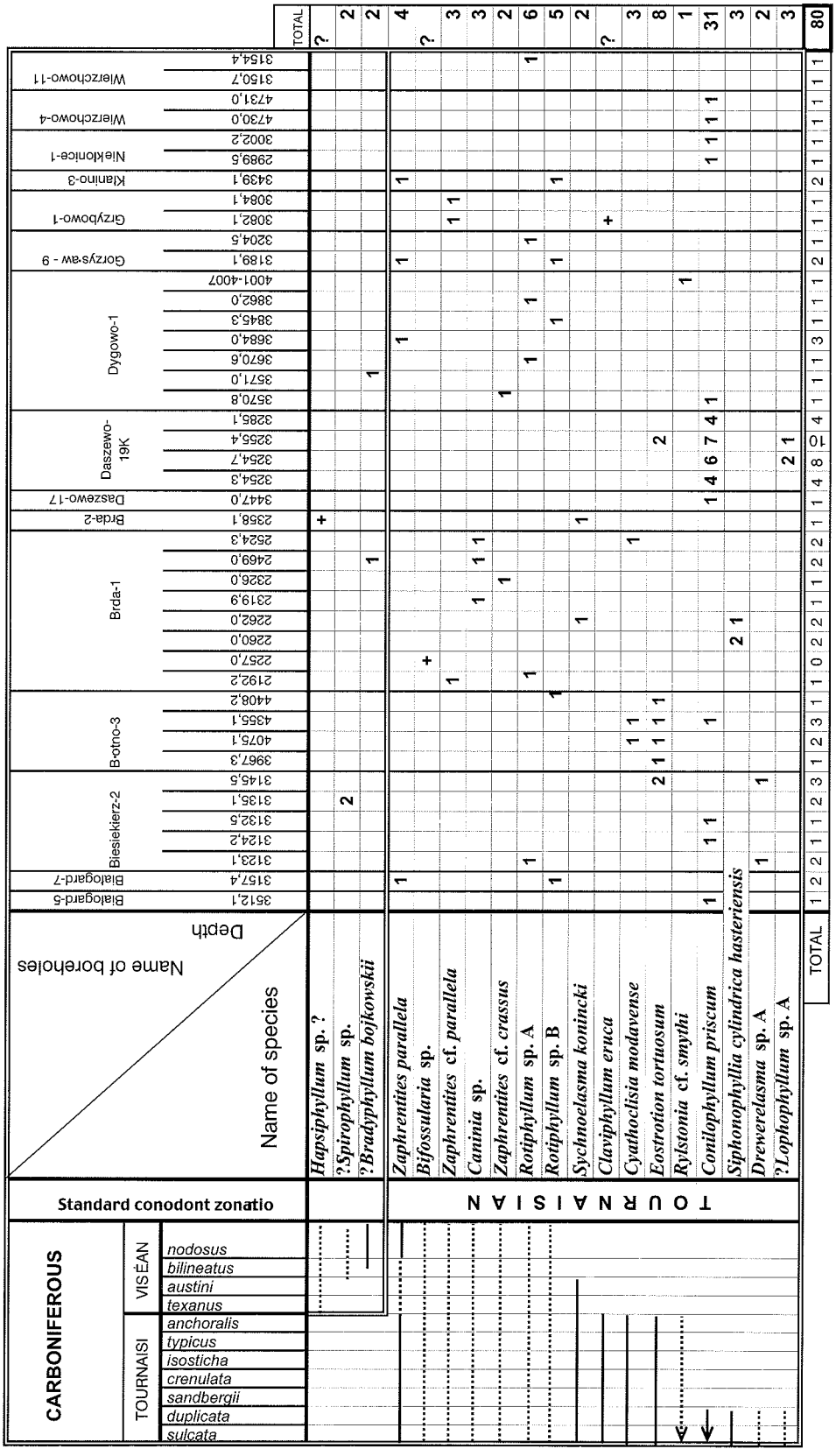
Name of species	Daszewo R-3P	Dobrzyca-2	Dygowo-1						Dunowo-1						
Depth	3665,8	4188,8	3570,8	3576,0	3848,6	4001-4007	4010,0	4011,0	3105,8	3112,6	3113,8	3114,7	3116,6	3117,2	3118,3
Bounophyllum pomeranicum sp.nov.	2								1	1		2			1
?*Palaeosmilia aquisgranensis*															
Campophyllum cylindricum															
Campophyllum flexuosum						1			1	1	1		1	1	1
Campophyllum gosseleti										1					
Heterostrotion sp.					2										
? *Nervophyllum* sp.															
Campophyllum cf. *ursinum*															
?*Campophyllum* sp. nov. A								1	2					1	1
Saleelasma cf. *delepini*		1													
?*Syringaxon* sp. nov. A				1		1									
?*Syringaxon* sp. nov. B															
Cyathaxonia (*C.*) *famenniana*							1								
Guerichiphyllum kowalense						1	1	1							
?*Friedbergia* sp.															
Amplexocarinia rozkowskae						1									
Metriophyllum soshkinae								5							
Oligophylloides pachythecus															
Cyathaxonia (*C.*) cf. *rozkowskae*			2	1		2									
Tabulophyllum rozkowskae															
Syringaxon cf. *rozkowskae*															
Tabulophyllum sp.															
TOTAL	2	1	2	2	2	6	2	7	4	3	1	2	1	2	3

Name of species	Gorzysław-9										Gozd-1	Karlino-1					Kłanino-3								Koczała - 1
Depth	3186,5	3189,1	3192,1	3193,3	3198,4	3205,8	3206,9	3208,7	3209,3	3210,6	2652,1	3645,2	3646,5	3685,5	3741,0	3855,0	3437,7	3438,8	3440,2	3441,7	3442,8	3443,7	3444,7	3445,9	2949,5
Bounophyllum pomeranicum sp.nov.				6	1										1	1									
?*Palaeosmilia aquisgranensis*							1																		
Campophyllum cylindricum																									
Campophyllum flexuosum							1			1	1						1	1					1		
Campophyllum gosseleti																									
Heterostrotion sp.																									
? *Nervophyllum* sp.																									
Campophyllum cf. *ursinum*																									
?*Campophyllum* sp. nov. A				1		1		1	1								1	1	2	1	1	1		1	
Saleelasma cf. *delepini*												1	1												
?*Syringaxon* sp. nov. A	1		1	1		1								2											1
?*Syringaxon* sp. nov. B																									
Cyathaxonia (*C.*) *famenniana*	2											2													
Guerichiphyllum kowalense		2																							
?*Friedbergia* sp.																									
Amplexocarinia rozkowskae																			1						
Metriophyllum soshkinae																									
Oligophylloides pachythecus																									
Cyathaxonia (*C.*) cf. *rozkowskae*	2											1		1											
Tabulophyllum rozkowskae																									+
Syringaxon cf. *rozkowskae*																									
Tabulophyllum sp.				+																					
TOTAL	5	2	1	8	1	2	2	1	1	1	1	4	1	3	1	1	2	2	3	1	1	1	1	1	1

Tab. 1b. Distribution, range chart and frequency of the Famennian coral taxa studied in Western Pomerania; see Tab. 1a for explanation



Tab. 1c. Distribution, range chart and frequency of the Famennian new genera and species studied in Western Pomerania; see Tab. 1a for explanation



Tab. 1d. Distribution, range chart and frequency of the Lower Carboniferous coral taxa studied in Western Pomerania; see Tab. 1a for explanation

1993). The blocky structure of the Late Palaeozoic was probably inherited from the Caledonian orogeny and reactivated subsequently during the Variscan and Alpine orogenic cycles (DADLEZ 1978; POŻARYSKI 1987; ŻELICHOWSKI 1971). The lithology and stratigraphy of the Devonian–Carboniferous of the K-Ch Zone have been intensively studied (DADLEZ 1976, 1978; ŁOBZA 1976; TURNAU 1979, 1995; MIŁACZEWSKI 1982, 1986; POŻARYSKI 1982; ŻELICHOWSKI 1982, 1987; LECH 1986; MATYJA 1976, 1993, 1998; MUSZYŃSKI & *al.* 1996; LIPIEC & MATYJA 1998).

During the Devonian and Early Carboniferous, the investigated area was part of a back-arc basin between the Mid-German High and the southern slope of the Old Red Continent represented by the Fennoscandian and Byelorussian Highs (ZIEGLER 1990), and is referred to as the Pomerania-Kujawy Basin (MATYJA 1998).

THE DEVONIAN–CARBONIFEROUS SUCCESSION

Devonian

The Devonian deposits in Pomerania belong mostly to the Frasnian and Famennian stages. Both stages are represented primarily by marlstones with intercalations of micritic limestone, commonly nodular. The Eifelian and Givetian stages are known sporadically (Chojnice-3, 5; Koczała-1; Kościernica-1; Miastko-1,2; Polskie Łąki PIG-1; Stobno-1; Wyszebórz-1). The Eifelian strata are represented by freshwater clastic deposits (TURNAU 1995). The transgression, dated as latest Eifelian, was related to the expansion of the sea towards the east, beyond the TTZ (NARKIEWICZ & *al.* 1998). The succeeding marine carbonate deposits are dated as Givetian. In the K-Ch Zone the Devonian transgressive sequence overlies folded Lower Palaeozoic basement with a distinct angular unconformity. The thickness of strata and tectonic deformation of the Devonian sequence increase toward the SW. It wedges out towards the NE.

The Devonian deposits are covered mostly by Lower and/or Upper Permian deposits. Remnants of Carboniferous deposits occur only locally. The lithostratigraphic framework for the Upper Devonian of the area (Text-fig. 2) was worked out by MATYJA (1993).

Facies analysis of the Devonian succession indicates that the Pomerania-Kujawy Basin was differentiated at that time into several zones. This differentiation resulted from synsedimentary small-scale block tectonics, with a variable record of the successive transgressive-regressive cycles on particular blocks (DADLEZ 1978; DADLEZ & DADLEZ 1986; MATYJA 1993, 1998; TURNAU 1979, 1995). MATYJA (1998), in her comprehensive study of this cyclicity, recognised seven transgressive-regressive cycles. She also documented lateral facies transition from deeper environments on the SW slope to shallower, clastic environment to the N and NE.

The coral fauna appeared first in the Givetian, during the second transgressive-regressive cycle of MATYJA (1998). Numerous solitary rugose corals continued into the Early Frasnian. Most corals disappeared before the end of the Frasnian and the carbonate platform was covered by argillaceous and marly deposits (the Strzeżewo Member). The rugose corals re-appeared in the latest Famennian in great abundance and diversity, and persisted until the Tournaisian (Text-figs 2, 5; Tabs 1b-d).

Carboniferous

The Lower Carboniferous (Tournaisian and Viséan) in Pomerania is represented by shallow-shelf clayey-marls and/or nodular, sandy and oolitic limestones (Text-fig. 5). The deeper facies existed probably farther to the southwest. The extensive lithological diversification of those strata is reflected in the numerous attempts at their lithostratigraphical and biostratigraphical subdivision (DADLEZ 1978; KOREJWO 1979, 1993; TURNAU 1979; ŻELICHOWSKI 1982, LECH 1986, MUSZYŃSKI & *al.* 1996; LIPIEC & MATYJA 1998; MATYJA & *al.* 2000). In general, the Lower Carboniferous is interpreted as representing a single, shallowing-upward regressive sequence (ŻELICHOWSKI 1979; MUSZYŃSKI & *al.* 1996; LIPIEC & MATYJA 1998; MATYJA & *al.* 2000). The Devonian–Carboniferous boundary is marked by a hiatus spanning the middle *praesulcata* to the lower *sandbergi* conodont Zones (MATYJA 1993).

DESCRIPTIVE TAXONOMY

The systematics of Rugosa and Heterocorallia is far from satisfactory. In the present paper the taxonomy of Upper Devonian corals is based on HILL's (1981) and FEDOROWSKI's (1991) classifications.

The following abbreviations are used for the measurable characters:

n – number of major septa; d – diameter of the coral; n/d – septal index; c – diameter of the axial tube; dt – diameter of the tabularium; ds – diameter of the axis structure; st – thickness of the stereotheca.

All specimens are housed in the Institute of Geology, Adam Mickiewicz University, Poznań (prefix UAM.IG). The individual numbers of coral specimens, consist of (1) the collection prefix; (2) Tc – tetracorals; (3) C. or R. – first letter of collector's name [C – CHWIEDUK; R – RÓŻKOWSKA]; (4) symbol of the borehole; (5) corallite number; and (6) sample depth (in metres). The collection prefix is omitted in the list within the text.

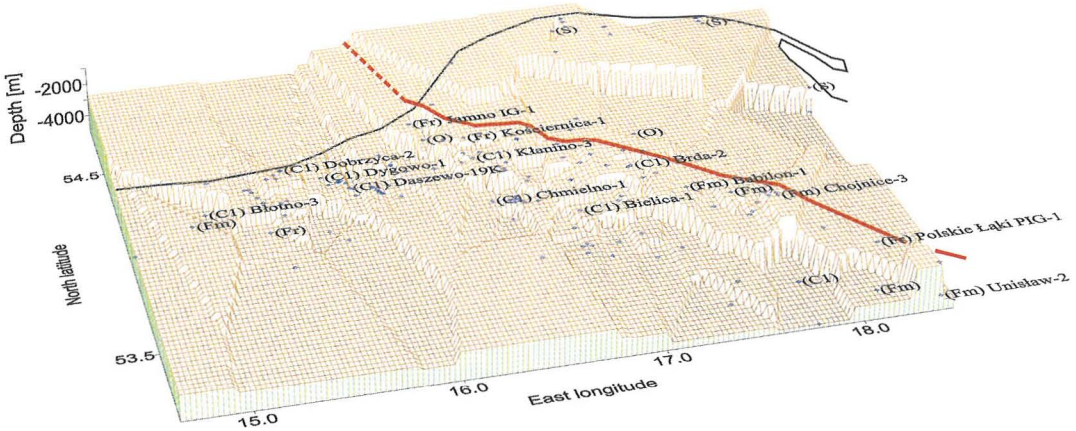


Fig. 3. Approximate depths of the occurrence of the Devonian and/or Carboniferous roofs in Western Pomerania including the location of selected boreholes (the model has been made on the basis of archived data provided by Oil and Gas Drilling Company in Piła). Red line – TTL, O – Ordovician, S – Silurian, Fr – Frasnian, Fm – Famennian, C1 – Lower Carboniferous. The model is drawn using programme SURFER 32 and data from 119 boreholes penetrated into the pre-Permian rocks. In order to achieve a more complete relief reconstruction, archival data of further 30 boreholes were used, in which directly beneath Permian base older formations were penetrated or basement is recognised only by geophysical logs, were bio- and lithostratigraphical divisions are not proven

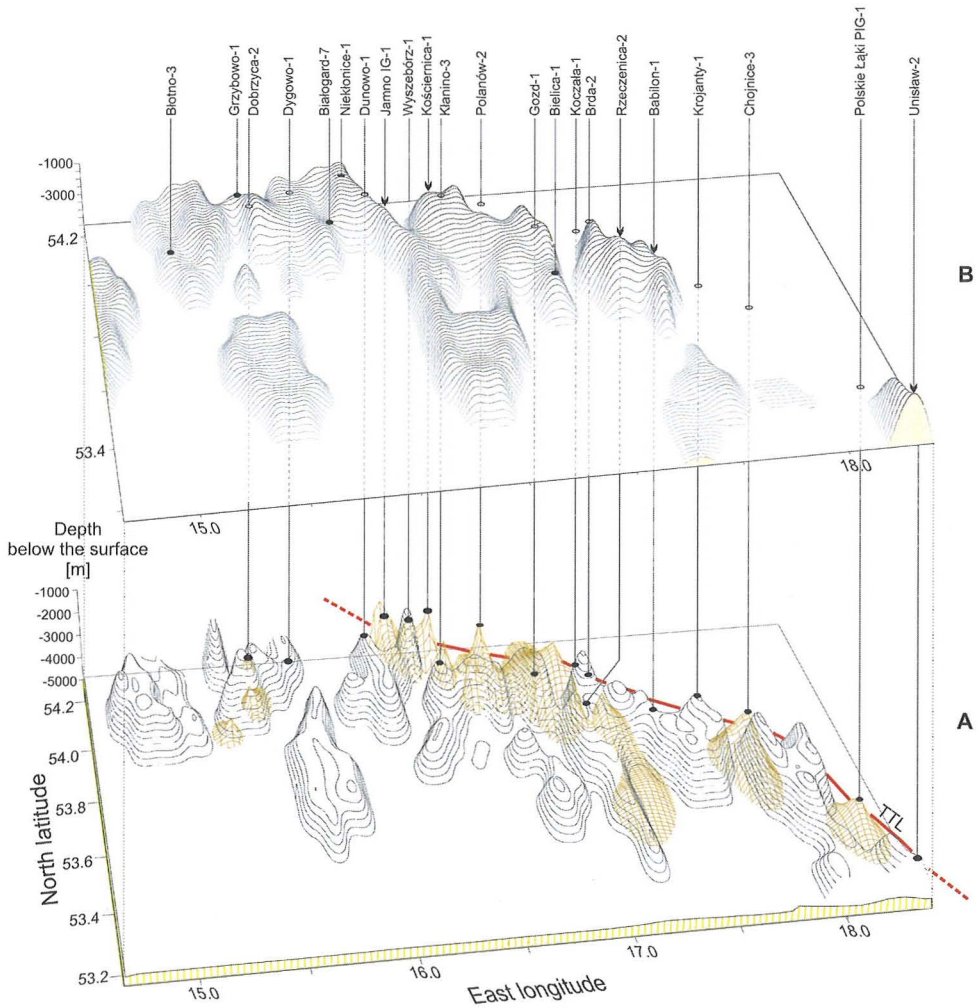


Fig. 4. Uncovered 3D topography of the depths of the occurrence the Frasnian, Famennian and Lower Carboniferous roofs with selected boreholes including coral fauna (the model has been made on the basis of archived data provided by Oil and Gas Drilling Company in Piła). A – Frasnian (brown grid), and Famennian (black isohypse); B – Lower Carboniferous

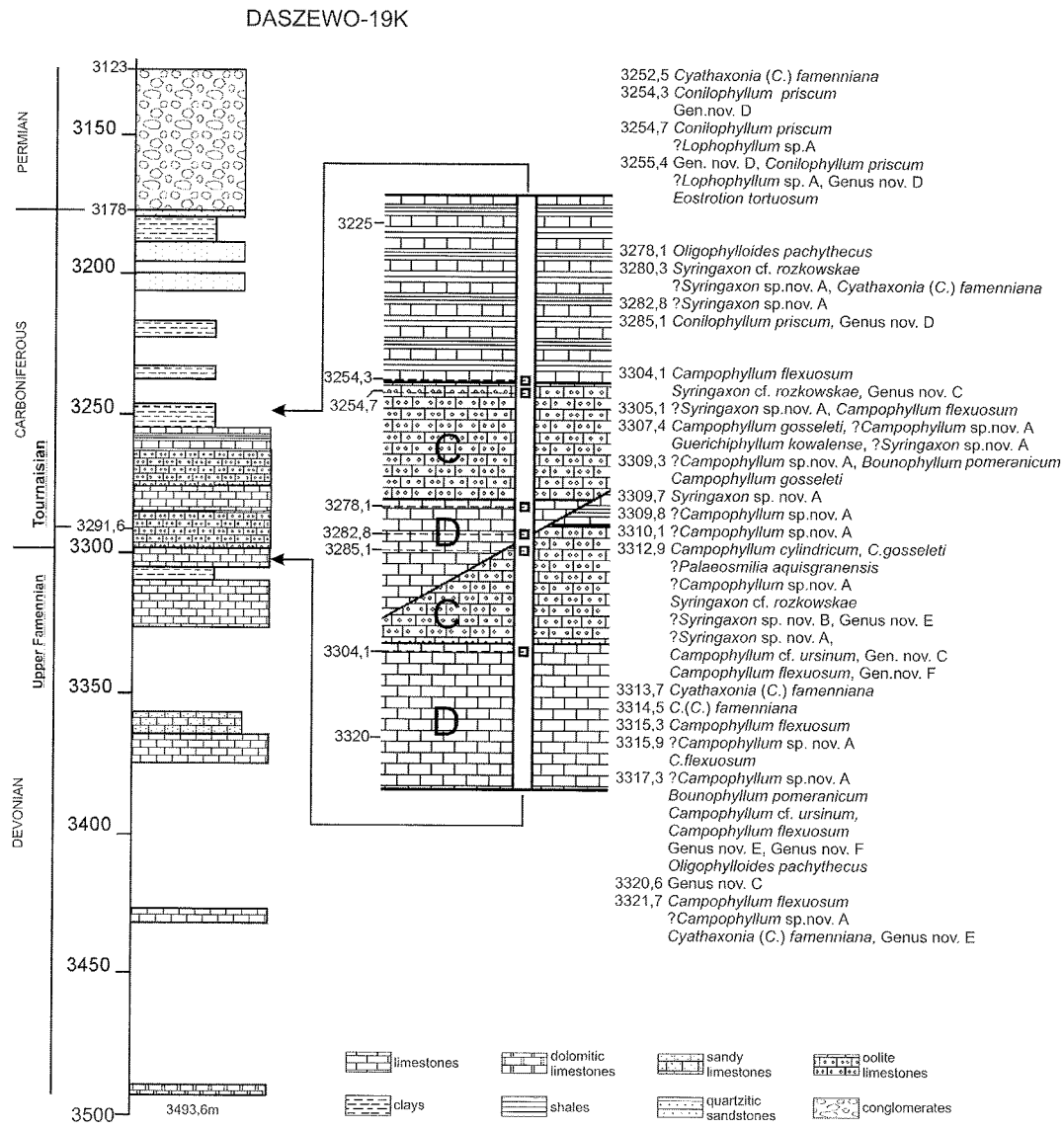


Fig. 5. Generalised lithological column of the Upper Devonian and Lower Carboniferous in the Daszewo-19K borehole. Stratigraphical ranges of the coral species shown. D – Devonian (Uppermost Famennian), C – Carboniferous (Lower Tournaisian)

Phylum Coelenterata FREY & LEUCKART, 1847
Class Anthozoa EHRENBERG, 1834
Subclass Rugosa MILNE-EDWARDS & HAIME, 1850
Order Stauriida VERRILL, 1865
Suborder Columnariina SOSHKINA, 1941
Family Disphyllidae HILL, 1939
Subfamily Disphyllinae HILL, 1939

Genus *Temnophyllum* WALTHER, 1928.

TYPE SPECIES: *Temnophyllum latum* WALTHER, 1928.

DIAGNOSIS: See HILL (1981, p. F269).

Temnophyllum isetense (SOSHKINA, 1951)
(Pl. 2, Fig. 1)

1951. *Neostringophyllum isetense* n.sp.; SOSHKINA, pp. 53-58, pl. 7, fig. 8; pl. 8, figs 1-5.
1979. *Temnophyllum isetense* (SOSHKINA, 1951); RÓŻKOWSKA, p. 31, pl. 4, figs 7-15; pl. 5, fig. 1.
2003. *Temnophyllum isetense* (SOSHKINA, 1951); FEDOROWSKI, pp. 96-97, pl. 42, figs 1-3.

DIAGNOSIS: See SOSHKINA (1951, pp. 53-54).

MATERIAL: Three specimens of RÓŻKOWSKA (1979)

from the Polanów-2 (Tc.R.POL-2/1675.0 and Tc.R.POL-2/1716.0) and Wyszebórz-1 (Tc.R.WBZ-1/2-2385.5) boreholes. Remaining specimens: (Tc.C.POL-2/1-1787.0 from Polanów-2; Tc.C.PLL-1/1-3583.7 and Tc.C.PLL-1/6, 7-3584.4 from Polskie Łąki IG-1; and Tc.C.WBZ-1/3-2016.3 and Tc.C.WBZ-1/4-2019.0 from Wyszebórz-1) collected by the author. Two specimens with calices preserved. All without proximal ends. Some re-crystallized, empty spaces between skeletal elements in the others may have been filled originally, probably with bitumens. Eleven thin sections and twelve acetate peels.

DESCRIPTION: Corallites solitary, cylindrical. Septal index n/d variable, ranging from 24/9.0 to 29/17.0. Major septa long, all nearly reaching corallite axis; weakly flexuous, thin in tabularium and only slightly dilated in dissepimentarium, with peripheral ends approximately 0.2 mm thick (Pl. 2, Fig. 1a). Minor septa thinner than major septa, straight or slightly flexuous, attaining up to 3/4 of length of major septa. Minor septa in dissepimentarium interrupted sometimes by second order transseptal dissepiments (sensu POTY 1981). Km septa longer than other minor septa. Tabulae incomplete, horizontal, convex or globose. Dissepimentarium 1/2 to 2/3 of corallite radius in width, dissepiments interseptal, globose, herringbone, pseudoherringbone and transseptal. External wall thin, slightly thicker at peripheral ends of septa (septostereotheca type). Septal microstructure finely trabecular (Pl. 2, Fig. 1b). Trabeculae up 0.03 mm in diameter.

REMARKS: By comparison to specimens of *Temnophyllum* described by SOSHKINA (1939, 1951), RÓŻKOWSKA (1979), HILL (1954), and HILL & JELL (1970), the specimens from Pomerania differ in possessing thicker axial and thinner peripheral ends of the major septa. The elongated Km septa of the Pomeranian specimens do not link with the opposite septum and thus do not form the triad that is characteristic of *Temnophyllum elongatum*. *Temnophyllum turbinatum* is distinguishable from *T. isetense* by its weakly developed minor septa. The remaining species of this genus have shortened major septa and a wide free axial area.

OCCURRENCE: Russia (The Central Urals) – Lower Frasnian; Poland (Holy Cross Mountains, Sudetes, Cracow Region, Lublin Region, Western Pomerania) – *falsiovalis–hassi* conodont zones.

Temnophyllum menyouense HILL & JELL, 1970
(Pl. 2, Fig. 8)

1970. *Temnophyllum menyouense* n.sp.; HILL & JELL, p. 60, pl. 15 figs 13-16.
1979. *Temnophyllum menyouense* HILL & JELL; RÓŻKOWSKA, p. 32, pl. 5 figs 2-4, 10.
1992. *Temnophyllum menyouense* HILL & JELL; WRZOŁEK, p. 234, text-fig. 11.
2003. *Temnophyllum menyouense* HILL & JELL; FEDOROWSKI, p. 97, pl. 42, figs 4-6.

DIAGNOSIS: See HILL & JELL (1970, p. 60).

MATERIAL: Two fragmentary corallites from Koczała-1 (Tc.C.KCA-1/8 - 2680.0) and Wyszebórz-1 (Tc.C.WBZ-1/1 - 2385.4). Two thin cross-sections and two acetate peels.

DESCRIPTION: Corallites cylindrical, straight or slightly bent. Septal index n/d = 28/14. Major septa thin, withdrawn from axis, with peripheral ends dilated. Minor septa barely penetrate outer tabularium. Dissepimentarium approximately 2/3 corallite radius in width, dissepiments mainly herringbone, pseudoherringbone or regular.

REMARKS: Corallites from Pomerania differ from the specimens described by HILL & JELL (1970) in their smaller dimensions. Mature stages of corallites from Canning Basin, Western Australia, have n/d = 30-33/22. Specimens from Pomerania are similar in that respect to those described by RÓŻKOWSKA (1979) and WRZOŁEK (1992 from the Holy Cross Mountains).

OCCURRENCE: Australia – Givetian-Frasnian; Poland: Holy Cross Mountains – Givetian-Frasnian (*disparilis – hassi* zones), Western Pomerania – Frasnian.

Temnophyllum elongatum RÓŻKOWSKA, 1979
(Pl. 2, Fig. 7)

1979. *Temnophyllum elongatum* n. sp., RÓŻKOWSKA, p. 31, pl. 4, fig. 6.
2003. *Temnophyllum elongatum* RÓŻKOWSKA; FEDOROWSKI, p. 96, pl. 41, fig. 7.

DIAGNOSIS: See RÓŻKOWSKA (1979, p. 31).

MATERIAL: Three specimens from Kościernica-1 (Tc.C.KSA-1/8 - 2484.2) and Polskie Łąki PIG-1 (Tc.C.PLL-1/5, 7 - 3584.4), partly dolomitized. Two transverse thin sections and two acetate peels.

DESCRIPTION: Septal index n/d = 28/13. Major septa thin, long, but not connected at corallite axis. Minor septa contratingent, approximately 1/4 length of major

septa. Dissepimentarium 1/5 corallite radius in width. Dissepiments interseptal, concentric. External wall 2.0 mm thick.

REMARKS: Specimens later included in *Temnophyllum elongatum* were first reported by RÓŻKOWSKA (1970, archive data) from the Kościernica-1 borehole. She then (RÓŻKOWSKA 1979) included them in the species discussed, based on the rich material from the Holy Cross Mountains. Both the Pomeranian and the Holy Cross Mountains specimens resemble *T. isetense*, which possesses long major septa and contratingent minor septa. *T. elongatum* differs from *T. isetense* primarily in its very thin major septa and wide tabularium.

OCCURRENCE: Poland (Holy Cross Mountains, Western Pomerania) – Lower and Middle Frasnian.

Genus *Disphyllum* DE FROMENTEL, 1861

TYPE SPECIES: *Cyathophyllum caespitosum* GOLDFUSS, 1826.

DIAGNOSIS: See RÓŻKOWSKA & FEDOROWSKI (1972, p. 296).

Disphyllum kweihsiense YOH, 1937
(Pl. 2, Figs 2, 6)

1937. *Disphyllum varium* var. *kweihsiense* n.var.; YOH, p. 61, pl. 7, figs 7a, 7b.
1970. *Disphyllum crassiseptatum* n.sp; TSIEN, p. 175, figs 10a-d.
1972. *Disphyllum kweihsiense* YOH; RÓŻKOWSKA & FEDOROWSKI, p. 308, pl. 5, figs 1-5; text-figs 17, 25.
2003. *Disphyllum kweihsiense* YOH; FEDOROWSKI, p. 90; pl. 37, figs 6, 7.

DIAGNOSIS: See RÓŻKOWSKA & FEDOROWSKI (1972, p. 309).

MATERIAL: Thirteen colony fragments from Dobrzyca-2 (Tc.C.DBA-2/3 - 4116.6; Tc.C.DBA-2/4 - 4123.1; Tc.C.DBA-2/5 – 4236.8), Jamno-1 (Tc.C.JMO-1/2 - 1705.0; Tc.C.JMO-1/1 - 1856.8), Koczała-1 (Tc.C.KCA-1 - 2680.0m), Polanów-2 (Tc.C.POL-2/8 - 1675.0; Tc.C.POL-2/9 - 1716.0; Tc.C.POL-2/10 - 1787.0; Tc.C.POL-2/11 - 1791.0), Wyszebórz-1 (Tc.C.WBZ-1/6 - 1996.0; Tc.C.WBZ-1/7 – 2016.3; Tc.C.WBZ-1/5 - 2019.0). Six acetate peels of transverse sections and one of a longitudinal section.

DESCRIPTION: Colonies subcerioid, mostly with corallites closely adjoining one another. Septal index n/d = 16-20/5-10. Major septa in neanic stage long, but not connected at axis. In adult stage major septa shortened, free axial area reaches 1/3 corallite diameter. Minor septa confined to dissepimentarium; in early growth up to 1/4, in mature growth approximately 1/2 length of major septa. Dissepimentarium 1/2 corallite radius in width; dissepiments interseptal, pseudoherringbone and herringbone. External wall 0.1 mm thick.

REMARKS: Specimens from Pomerania are very close to those from the Kowala (Holy Cross Mountains), described by RÓŻKOWSKA & FEDOROWSKI (1972), differing from them only in possessing a thinner external wall, 0.1 *versus* 0.4 mm.

OCCURRENCE: Belgium – Middle Frasnian; China – Givetian; Poland: Holy Cross Mountains – *falsiovalis–hassi* zones, Western Pomerania – Frasnian.

Subfamily Hexagonariinae BULVANKER, 1958
Genus *Hexagonaria* GÜRICH, 1896

TYPE SPECIES: *Cyathophyllum hexagonum* GOLDFUSS, 1826.

DIAGNOSIS: See HILL (1981, p. F275).

Hexagonaria hexagona kowalae WRZOŁEK, 1992
(Pl. 1, Fig. 3; Pl. 3, Fig. 4)

1992. *Hexagonaria hexagona kowalae* n.ssp.; WRZOŁEK, p. 237, figs 14A-C, 15A-C
2003. *Hexagonaria hexagona kowalae* WRZOŁEK; FEDOROWSKI, p. 100, pl. 43, fig. 4.

DIAGNOSIS: See WRZOŁEK (1992, p. 237).

MATERIAL: One fragment of colony from Unisław-2 (Tc.C.UNI-2/8 - 4981.3). Three acetate peels and one thin section.

DESCRIPTION: Colony cerioid with straight, thin intercorallite walls. Calices shallow, cup-shaped with sharp margins (Pl. 1, Fig. 3). Septal index n/d usually 18/12.0. Tabularium 4.0 mm wide. Major septa vary in length, carinated (Pl. 3, Fig. 4b); thin in axial area; closely approaching a corallite axis, when joining to form a weak axial structure; thick at tabularium margin. Minor septa carinated, short, mostly confined to dissepimentarium,

which contains herringbone, rarely concentric dissepiments. Tabulae numerous, incomplete. In longitudinal section (Pl. 3, Fig. 4c), tabular floors sub-horizontal to slightly depressed, commonly concave to subplanar. Axial tabellae almost flat; those at dissepimentarium-tabularium boundary vesicular, obliquely arranged.

REMARKS: The colony from Pomerania closely resembles the type from the Holy Cross Mountains described by WRZOŁEK (1992). However, in the Pomeranian specimen most of the major septa are connected in a corallite axis, whereas they are long and slightly curved, but axially free in the type material.

OCCURRENCE: Poland: Holy Cross Mountains (Kowala, Jaźwica), Western Pomerania – Frasnian.

Subfamily Spongonariinae CRICKMAY, 1962
Genus *Disphyllia* HE, 1978

TYPE SPECIES: *Disphyllum* (*Disphyllia*) *guanxianensis* HE, 1978

DIAGNOSIS: See HILL (1981, p. F277).

Disphyllia laxa (GÜRICH, 1896)
(Pl. 3. Figs 1-3)

1896. *Hexagonaria laxa* n.sp.; GÜRICH, p. 172, pl. 4, fig. 5.
1960. *Hexagonaria laxa* GÜRICH; RÓŻKOWSKA, p. 14, text-figs 9-16.
2003. *Hexagonaria laxa* GÜRICH; FEDOROWSKI, p. 102, pl. 46, figs 1, 2.

DIAGNOSIS: See RÓŻKOWSKA (1960, p. 14).

MATERIAL: Three specimens from RÓŻKOWSKA's collection (unpublished): Koczała-1 (Tc.R.KCA-1/1 - 2939.6; Tc.R.KCA-1/2 - 2945.0; Tc.R.KCA-1/3 - 2954.2). Three peels.

DESCRIPTION: Mean septal index n/d = 18/11x12. Major septa spindle-shaped, thickest at dissepimentarium-tabularium boundary. Free axial area exceeds 1/4 of corallite diameter. Minor septa short, wedge-shaped, usually reach 1/4 of dissepimentarium width. Septa of both cycles carinated (Pl. 3, Fig. 3). Dissepimentarium approximately 1/2 of a corallite radius in width; dissepiments mostly concentric and herringbone, some lonsdaleoid at most external part of corallites. Inner thick-walled dissepiments create an inner wall. Tabular floor concave. Tabulae commonly incomplete (Pl. 3, Fig. 2). External wall 0.1 mm thick.

REMARKS: The Upper Givetian specimens from Siewierz led RÓŻKOWSKA (1960) to accept the tendency of reduction in the number of major septa in *D. laxa*. This character was not observed in specimens from Pomerania, but they possess carinae, another very characteristic feature of this species established by RÓŻKOWSKA (1960).

OCCURRENCE: Poland: Siewierz (Dziewki Hill) – Givetian, Western Pomerania – Givetian.

Family Ptenophyllidae WEDEKIND, 1923
Subfamily Ptenophyllinae WEDEKIND, 1923
Genus *Grypophyllum* WEDEKIND, 1922

TYPE SPECIES: *Grypophyllum denckmanni* WEDEKIND, 1922.

DIAGNOSIS: See HILL (1981, p. F236).

Grypophyllum cf. *primum* (WEDEKIND, 1923)
(Pl. 2, Figs 3-5)

MATERIAL: Seven specimens; Unisław-2 (Tc.C.UNI-2/1-6 - 4981.3), Wyszebórz-1 (Tc.C.WBZ-1/8 - 2385.5); Fifteen transverse and two longitudinal sections with acetate peels.

DESCRIPTION: Corallites small, horn-shaped. Septal index n/d = 22-24/9-11. Major septa thin, slightly thickened towards periphery, almost equal in length during early growth (Pl. 2, Fig. 3). They vary in length in maturity (Pl. 2, Fig. 4) where some of them meet at corallite axis. Cardinal septum at that stage reaches 1/2 corallite diameter in length, intersecting distinct keyhole-like cardinal fossula. Minor septa in both growth stages almost straight, short, 1/4 corallite radius in length. Tabulae incomplete, tabellae convex, tabular floor slightly concave (Pl. 2, Fig. 5). Dissepimentarium 2/3 corallite radius in width. Dissepiments concentric and herringbone. External wall thin.

REMARKS: *Grypophyllum unduliseptatum* IVANIA, 1965, known from various localities in Poland (see RÓŻKOWSKA 1979), differs from *Grypophyllum* cf. *primum* in its distinctly concave tabular floor and poorly developed lonsdaleoid dissepiments. *Grypophyllum primum* from the Eifelian–Givetian of Germany

(BIRENHEIDE 1972) differs in possessing well-developed lonsdaleoid dissepiments. The material studied is inadequate either to confirm the occurrence of *G. primum* in Pomerania or to create a new species.

OCCURRENCE: Western Pomerania – Frasnian.

Family Phillipsastreidae HILL, 1954
Genus *Thamnophyllum* PENECKE, 1894

TYPE SPECIES: *Thamnophyllum stachei* LANG & SMITH, 1935.

DIAGNOSIS: See HILL (1981, p. F289).

Thamnophyllum monozonatum (SOSHKINA, 1939)
(Pl. 4, Figs 8-9)

1939. *Peneckiella monozonata* n.sp.; SOSHKINA, p. 25, pl. 10, figs 76-78.
1951. *Thamnophyllum monozonatum* (SOSHKINA); SOSHKINA, p. 78, pl. 13, fig. 7.
1953. *Thamnophyllum monozonatum* (SOSHKINA); RÓŻKOWSKA, p. 14, pl. 1, figs 8-10; text-fig. 5.
2003. *Thamnophyllum monozonatum* (SOSHKINA); FEDOROWSKI, p. 116, pl. 56, figs 1, 2.

DIAGNOSIS: See RÓŻKOWSKA (1953, p. 14).

MATERIAL: Six specimens, including three specimens from M. RÓŻKOWSKA's collection, from Jamno-1 (Tc.C.JMO-1/3 - 1705.0; Tc.C.JMO-1/4 - 1856.8) and Polanów-2 (Tc.C.POL-2/11 - 1675.0; Tc.C.POL-2/12 - 1716.0; Tc.C.POL-2/13 - 1787.0; Tc.C.POL-2/14 - 1791.0). Six transverse and two longitudinal sections with acetate peels.

DESCRIPTION: Colony dendroid. Corallites cylindrical. Septal index n/d = 17-19/6-8. Major septa noncarinate, in maturity spindle-shaped, not exceeding 1/2 of corallite radius in length; wedge-shaped in young stages, with very thin inner ends. Minor septa up to 1/2 the length of major septa; locally penetrating the tabularium. Dissepimentarium approximately 1/4 corallite radius in width, containing two rows of dissepiments. Outer row, almost horizontal, ladder-like in longitudinal section; inner row of thick-walled, horseshoe dissepiments (Pl. 4, Fig. 9b – lower right of the specimen). Tabular floor concave; tabulae commonly complete; locally vesicular tabellae at tabularium margin. External wall 0.05 mm thick.

REMARKS: The very restricted material derived from cores (only a few isolated branches were collected) does not allow the colonial character of those corals to be described in detail. The intracalicular offsetting suggests the formation of dendroid colonies similar to those described by RÓŻKOWSKA (1953) from the Holy Cross Mountains. With the exception of the septal carinae, which are missing, the Pomeranian specimens display all characteristic features of the species recognised by SHOSHKINA (1939) in its Uralian type material. It should perhaps be noted that the septal carinae were also missing in the specimens from the Holy Cross Mountains described by RÓŻKOWSKA (1953). The most characteristic features of typical *Thamnophyllum monozonatum* are the thickening of the interior and exterior walls of the monoserial dissepimentarium, and the morphology of the septa, which are thickest in the middle parts, slightly less thick in the peripheral parts and not thickened at all (with additionally curved ends) in the internal parts of the corallite.

OCCURRENCE: Belgium, Austria, Germany, Russia (the Urals) – Frasnian; Poland (Holy Cross Mountains, Cracow and Lublin Regions, Western Pomerania) – Frasnian (*falsiovalis–hassi* zones).

Genus *Pterorrhiza* EHRENBERG, 1834

TYPE SPECIES: *Cyathophyllum marginatum* GOLDFUSS, 1826.

DIAGNOSIS: See HILL (1981, p. F286).

Pterorrhiza berdensis (SOSHKINA, 1939)
(Pl. 3, Figs 5-8)

1939. *Macgeea berdensis* n.sp.; SOSHKINA, p. 18, pl. 3, figs 19-36; pl. 4, figs 37-38; pl. 13, figs 108-111.
1953. *Macgeea berdensis* SOSHKINA; RÓŻKOWSKA, p. 22, pl. 4, figs 7-11; text-fig. 11.
1969. *Pterorrhiza berdensis* (SOSHKINA); RÓŻKOWSKA, p. 148, text-fig. 61.
2003. *Pterorrhiza berdensis* (SOSHKINA); FEDOROWSKI, p. 108, pl. 51, figs 8, 9.

DIAGNOSIS: See RÓŻKOWSKA (1953, p. 22).

MATERIAL: Six corallites, including one from RÓŻKOWSKA's collection, from Koczała-1 (Tc.C.KCA-1/3 - 2680.0; Tc.C.KCA-1/4 - 2727.8), Kościernica-1 (Tc.C.KSA-1 - 2027.1), Niekłonice-1 (Tc.C.NCE-1 –

3002.2), and Polanów-2 (Tc.C.POL-2/1 - 1675.0; Tc.C.POL-2/2 - 1716.0). Two transverse and three longitudinal sections with acetate peels.

DESCRIPTION: Septal index n/d = 26/10. Major septa short; thinner in tabularium than in dissepimentarium; withdrawn from corallite axis, leaving free area 3.5-4.0 mm in diameter. Minor septa reach 1/4 length of major septa; commonly penetrating outermost tabularium. Dissepimentarium contains up to four rows of small, globose dissepiments, separated from tabularium by a distinct dissepitheca. Walls of horseshoe dissepiments adjacent to inner dissepimentarium markedly thickened (Pl. 3, Fig. 5). Tabular floor horizontal or slightly convex (Pl. 3, Fig. 7). Tabularium composed of tabellae and flat or slightly domed or saucer-shaped tabulae; tabellae may be vesicular, declined toward corallite axis.

REMARKS: The Pomeranian specimens exhibit a morphology intermediate between the holotype and the paratype illustrated by SOSHKINA (1939, Pl. 3, Figs 19, 20; Pl 4, Figs 37, 38 respectively). They possess short major septa, leaving a wide free axial area in transverse section, like in the holotype, but have numerous axial tabellae, like in the paratype, in longitudinal section. An absence of the thread-like thin inner ends of the major septa distinguishes the Pomeranian specimens from those of the Ural Mountains, Germany, and the Holy Cross Mountains. Also, the latter specimens possess horseshoe dissepiments separated from the wall by horizontal (in longitudinal section) interseptal dissepiments, absent from the Russian type specimens and from those described here.

OCCURRENCE: Russia (the Urals), Germany – Frasnian; Poland (Holy Cross Mountains, Cracov Region, Western Pomerania) – Frasnian (*transitans–rhenana* zones).

Genus *Peneckiella* SOSHKINA, 1939

TYPE SPECIES: *Diphyphyllum minus* ROEMER, 1855.

DIAGNOSIS: See HILL (1981, p. F289).

Peneckiella szulczewskii RÓŻKOWSKA, 1979
(Pl. 5, Figs 1, 2)

1979. *Peneckiella szulczewskii* n.sp.; RÓŻKOWSKA, p. 21; pl. 2, fig. 2.
2003. *Peneckiella szulczewskii* RÓŻKOWSKA; FEDOROWSKI, p. 107, pl. 51, fig. 1.

DIAGNOSIS: See RÓŻKOWSKA (1979, p. 21).

MATERIAL: Two fragments of a strongly dolomitized colony from the Kościernica-1 borehole (Tc.C.KSA-1/2, 3 - 2023.0). Two transverse thin sections, two polished surfaces, two acetate peels and one longitudinal polished surface.

DESCRIPTION: Colony phaceloid. Corallites cylindrical, with well-developed external wall. Septal index n/d = 18/6-7. Major septa spindle-like, thickest at dissepimentarium-tabularium boundary (Pl. 5, Fig. 2b); some reaching corallite axis. Minor septa mostly thin, developed only in narrow dissepimentarium consisting of 1-3 rows of globose (Pl. 5, Figs 1a, 1b) and peneckielloid (Pl. 5, Fig. 1b, see arrow) dissepiments. Tabulae horizontal, slightly convex or concave.

REMARKS: The Pomeranian specimens differ from the type specimen mostly in lacking septal carinae. This may be a primary character, but these small structural elements could have been destroyed by the subsequent dolomitization – an option accepted in the present paper.

OCCURRENCE: Poland: Holy Cross Mountains – *falsiovalis–hassi* zones, Western Pomerania – Frasnian.

Peneckiella fascicularis (SOSHKINA, 1952)
(Pl. 5, Figs 3, 4)

1952. *Schlüteria fascicularia* n.sp.; SOSHKINA, p. 100, pl. 40, fig. 1.
1954. *Schlüteria fascicularia* SOSHKINA; SOSHKINA, p. 44, pl. 9, figs 1-4.
1979. *Peneckiella fascicularis* (SOSHKINA, 1952); RÓŻKOWSKA, p. 21, pl. 2, figs 3-4.
2003. *Peneckiella fascicularis* (SOSHKINA); FEDOROWSKI, p. 106, pl. 50, figs 1, 2.

DIAGNOSIS: See SOSHKINA (1954, p. 44).

MATERIAL: Three specimens from Chojnice-3 (Tc.C.CHE-3/5 - 2879.0; Tc.C.CHE-3/6 - 2880.7) and Kościernica-1 (Tc.C.KSA-1/6 - 2027.1). Four transverse and one longitudinal section with acetate peels.

DESCRIPTION: Colony dendroid. Corallites cylindrical with septal index n/d = 22/7. Major septa mostly equal, reaching 25.0 mm in length; thin in tabularium (0.05 mm), thickest at dissepimentarium-tabularium boundary (up to 0.4 mm), reduced in thickness in

dissepimentarium to 0.2 mm. Minor septa equal in thickness to major septa, usually confined to dissepimentarium, locally penetrating outer tabularium. Dissepimentarium 1.0 to 1.5 mm wide, with up to three rows of small, globose dissepiments (Pl. 5, Fig. 3b). In longitudinal section, dissepiments of peneckielloid type accompany globose dissepiments. Slightly thickened innermost dissepiments form dissepitheca (Pl. 5, Figs 3a, 4). Tabularium composed mostly of short horizontal or adaxially elevated, flat and incomplete tabulae (Pl. 5, Fig. 3b). Tabellae flat at corallite axis, globose in outer tabularium and steeply inclined towards axis.

REMARKS: The specimen discussed closely resembles the corallites from Pomerania described by RÓŻKOWSKA (1979). It differs from the holotype in the smaller number of septa, smaller corallite diameter and the sporadic development of horseshoe dissepiments.

OCCURRENCE: Poland: Silesian-Cracow Region – *falsiovalis–hassi* zones, Western Pomerania – *rhenana–linguiformis* zones.

Family Petraiidae DE KONINCK, 1872
Genus *Guerichiphyllum* RÓŻKOWSKA, 1969

TYPE SPECIES: *Guerichiphyllum skalense* (GÜRICH, 1896).
DIAGNOSIS: See FEDOROWSKI (1965, p. 345)

Guerichiphyllum kowalense RÓŻKOWSKA, 1969
(Pl. 4, Figs 4-7)

1969. *Guerichiphyllum kowalense* n.sp.; RÓŻKOWSKA, p. 71, text-fig. 21.
2003. *Guerichiphyllum kowalense* RÓŻKOWSKA; FEDOROWSKI, p. 63; pl. 16, fig. 1.

DIAGNOSIS: See RÓŻKOWSKA (1969, p. 71).

MATERIAL: Six specimens from Daszewo-19K (Tc.C.DSO-19K/17 - 3307.5), Dygowo-1 (Tc.C.D-1/26 - 4001.2; Tc.C.D-1/28 - 4010.2; Tc.C.D-1/26(4) - 4011.0), and Gorzysław-9 (Tc.C.G-9/1, 6 - 3189.1). Two transverse thin sections and a dozen or so acetate peels.

DESCRIPTION: Septal index n/d = 24-28/10-11. In neanic stage, major septa shorter and thicker in counter quadrants than in cardinal quadrants, forming discontinuous half-aulos with their curved axial ends. All major septa in calice thin and free. Cardinal septum commonly as thin as remaining major septa of cardinal quadrants, may be rhopaloidally thickened in some corallites (Pl. 4, Fig. 6); only slightly shortened, located in a shallow, open cardinal fossula irrespective of its thickness. Minor septa vary in length, generally well developed. Dissepiments globose and lonsdaleoid at periphery of dissepimentarium, and interseptal near tabularium. External wall thin.

REMARKS: Short, thickened major septa, development of few lonsdaleoid dissepiments and weakly developed minor septa allow the Pomeranian specimens to be referred to *G. kowalense*. They differ from the type material in possessing a thick cardinal septum, equal to the remaining major septa, and in a larger number of major septa at the same corallite diameter (28/11 *versus* 21/11). See RÓŻKOWSKA (1969, p. 73) for further remarks.

OCCURRENCE: Poland: Holy Cross Mountains (*expansa* or *praesulcata* Zone), Western Pomerania (uppermost Famennian, *praesulcata* Zone).

Genus *Friedbergia* RÓŻKOWSKA, 1969

TYPE SPECIES: *Friedbergia bipartita* RÓŻKOWSKA, 1969

DIAGNOSIS: See RÓŻKOWSKA (1969, p. 78).

REMARKS: The monospecific genus *Friedbergia* shows many features in common with other genera (Tab. 2), the closest of which are: *Famennelasma* WEYER, 1973a, *Gorizdronia* RÓŻKOWSKA, 1969, *Amplexocarinia* SOSHKINA, 1928 and *Neaxon* KULLMANN, 1965. WEYER (1999) suggested a possible synonymy of *Friedbergia* with his genus *Famennelasma* WEYER 1973. Such a position cannot be accepted from a purely legal point of view. He also synonymized the subfamily Friedbergiinae with the family Petraiidae DE KONINCK 1872. The study by BERKOWSKI (2002) on the topotype material shows, however, that both the genus *Friedbergia* and the subfamily Friedbergiinae should be considered valid.

?*Friedbergia* sp.
(Pl. 4, Fig. 10)

MATERIAL: Single specimen from Chmielno-1 (Tc.C.CHO-1/1 - 4141.3). Three thin sections and one acetate peel of a transverse section.

DESCRIPTION: Coral horn-shaped, with well-developed talon like structure. Septal index n/d = 17/4. Major septa 1/2 corallite radius in length; inner ends either swell or bend toward each other to form aulos. Index dc/d = 1.2/4. Major septa in cardinal quadrants (on talon side in specimen discussed) 0.05 - 0.1 mm thick. Those in counter quadrants up to twice as thick. Cardinal and counter septum approximately equal in length to remaining major septa. Minor septa vary in length from low ridges on corallite wall to 0.3 mm long. External wall 0.3 mm thick, with fine growth wrinkles.

REMARKS: The specimen discussed resembles the Famennian species *Neaxon bulloides* RÓŻKOWSKA, 1969 from the Holy Cross Mountains, included by WEYER (1971) in *N. regulus*. An absence of a distinct aulos in the specimen discussed made it closer to *Friedbergia*, in which it was tentatively included. It resembles the type species of the latter genus in possessing major septa differentiated in thickness and an incomplete aulos, but differs from that species in having a thin cardinal septum equal to adjacent major septa in length, and in having a thickened counter septum. It is also characterized by thickening of the peripheral parts of major septa, an appearance of well developed minor septa next to the counter septum and in the adjacent loculi. All these characters distinguish the Pomeranian specimen from the holotype and topotypes examined by BERKOWSKI (2002).

OCCURRENCE: Poland: Western Pomerania (*expansa* Zone).

Family Laccophyllidae GRABAU, 1928
Genus *Amplexocarinia* SOSHKINA, 1928

TYPE SPECIES: *Amplexocarinia muralis* SOSHKINA, 1928, p. 379.

DIAGNOSIS: See FEDOROWSKI (1986b, p. 216).

Amplexocarinia rozkowskae FEDOROWSKI, 2003
(Pl. 5, Fig. 5)

1969. *Amplexocarinia muralis* SOSHKINA; RÓŻKOWSKA, p. 82, text-figs 26-29; pl. 3, figs 5, 8, 9; pl. 8, fig. 6.
2003. *Amplexocarinia rozkowskae* n. sp.; FEDOROWSKI, p. 66, pl. 18, figs 8-10.

DIAGNOSIS: According to FEDOROWSKI (2003, p. 66) – *Amplexocarinia* with thin major septa up to 1/2 corallite radius in length; minor septa very short, incomplete; weakly developed aulos may disappear near calice floor; index of septa 13-16/6.0-8.0.

MATERIAL: Two corallites; from Dygowo-1 (Tc.C.D-1/26 - 4001.2m) and Kłanino-3 (Tc.C.KŁO-3/8 -

GENUS	MAJOR SEPTA	MINOR SEPTA	CARDINAL SEPTUM	COUNTER SEPTUM	AULOS	TABULAE
Famennelasma Weyer, 1973a	long, not reach axis	very short	shortened, in fossula	as long as major septa	discontinuous, formed by swelling ends of major septa	slope towards fossula
Gorizdronia Różkowska, 1969	amplexoid	reduced	not distinct		present only in early growth stages, formed by tabellae	complete and incomplete, some with concave at axis
Friedbergia Różkowska, 1969	within cardinal quadrants thick, in counter ones thin	reduced	short, thick, in open fossula; in oldest stages long and thin	as major septa	with axial ends of septa which bent towards each other	no data
Amplexocarinia Soshkina, 1928	in young stages reach axis; in old stages shortened	very short	short in weakly marked fossula	as major septa	in old stages formed with axial ends of septa which bent towards each other	rare, horizontal in axis
Neaxon Kullmann, 1965	in young stages join at axis	very short	may be longer than other major septa		formed by swelling axial ends of major septa	horizontal in axis, periaxial tabellae are bend down
Corallite from Pomerania	do not reach the axis	from very short to 1/4 length of major septa	not distinct		formed by swelling axial ends of septa bent towards each other	horizontal in axis, periaxial tabellae are bend down

Tab. 2. Comparison of morphological characters of genera in the family Laccophyllidae GRABAU, 1928

3440.2). Three thin transverse sections and two acetate peels.

DESCRIPTION: Septal index n/d = 13/3.2. Major septa thin, slightly shorter than 1/2 of corallite radius, with dilated peripheral margins; most connected near axis to form aulos. Minor septa incomplete, up to 0.2 mm in length. In neanic stage (n/d = 8/1.3), protosepta fused axially (Pl. 5, Figs 5a-c); in further growth (Pl. 5, Fig. 5d), with n/d = 12/2.8, all inner ends of major septa bent and joined to each other to form aulos. Minor septa form low ridges on the corallite wall. External wall approximately 0.2 mm thick.

REMARKS: Specimens from Pomerania are much smaller than the type from the Holy Cross Mountains, but possess a similar number of septa. *A. obliqua* from the Famennian of the Holy Cross Mountains, described by RÓŻKOWSKA (1969), differs from the specimens studied in their shorter major septa, better developed minor septa and thicker skeletal elements.

OCCURRENCE: Poland: Holy Cross Mountains (*marginifera–expansa* zones), Western Pomerania (uppermost Famennian, probably *praesulcata* Zone).

Genus *Syringaxon* LINDSTRÖM, 1882

TYPE SPECIES: *Cyathaxonia siluriensis* MCCOY, 1850.

DIAGNOSIS: See HILL (1981, p. F195).

REMARKS: Specimens temporarily included here in the genus *Syringaxon* bear several similarities to the genus *Thuriantha* WEYER 1981 from the Lower Tournaisian *Gattendorfia* Zone of Thuringia, Germany and may be ancestral to *T. muelleri* WEYER 1981. This question cannot be resolved on the basis of the material now available for study and is the subject of a separate paper.

Syringaxon cf. *rozkowskae* FEDOROWSKI 2003
(Pl. 5, Figs 6, 7)

MATERIAL: Three specimens, all from Daszewo-19K (Tc.C.DSO-19K/43 - 3280.3; Tc.C.DSO-19K/44 - 3304.1; Tc.C.DSO-19K/54 - 3312.9); Three transverse sections with acetate peels.

DESCRIPTION: In early growth stages (indexes n/d/dc = 14-17/3-4/0.5-0.8), contratingent minor septa extend up to 3/4 length of major septa. Km septa, almost equal to latter in length, form triad with counter septum. External wall bears well preserved septal furrows. At index n/d/dc = 17/5/0.9 (Pl. 5, Figs 6c, 6d), minor septa reach up to 4/5 length of major septa. Counter septum slightly elongated and strongly rhopaloid, penetrating aulos slightly, whereas cardinal septum shortened a little (Pl. 5, Fig. 6d). Peripheral tabellae thin, slightly convex, declined towards aulos. Axial tabellae thick, flat, horizontal, 2 in one mm (Pl. 5, Fig. 7).

REMARKS: The specimens discussed resemble *Laccophyllum cyathoxoniaeformis* GORSKY 1932 in the widened peripheral margins of the major septa and the long minor septa. The re-study by J. FEDOROWSKI (oral information, July 2005) of the Kirghizstan type material proves the presence of strong *Duncanella*-like carinae, which are absent from the Pomeranian corals. They most closely resemble specimens from the Holy Cross Mountains (Kadzielnia and the Besówka Hill) described by RÓŻKOWSKA (1969) as *Syringaxon* aff. *cyathaxoniaeformis* and renamed *S. rozkowskae* sp. nov. by FEDOROWSKI (2003), but differ from them in septal index (10-12/4.0-5.0 *versus* 14-17/5.0-8.0) and in the thinner peripheral ends of the septa.

OCCURRENCE: Poland: Western Pomerania (upper *expansa–praesulcata* zones).

?*Syringaxon* sp. nov. A
(Pl. 6, Figs 1-4)

MATERIAL: Twenty-one corallites from various boreholes; Białogard-9 (UAM.IG.Tc.C.BGD-9/2 - 3354.6), Białogard-10 (UAM.IG.Tc.C.BGD-10/1 - 3168.9m), Daszewo-19K (UAM.IG.Tc.C.DSO-19K/168 - 3280.3; UAM.IG.Tc.C.DSO-19K/47 - 3282.8; UAM.IG.Tc.C.DSO-19K/62, 108 - 3305.1; UAM.IG.Tc.C.DSO-19K/3 - 3307.4; UAM.IG.Tc.C.DSO-19K/15-17 - 3309.7; UAM.IG.Tc.C.DSO-19K/61, 130 - 3312.9), Dygowo-1 (UAM.IG.Tc.C.D-1/10 - 3576.0; UAM.IG.Tc.C.D-1/11 - 4001.0), Gorzysław-9 (UAM.IG.Tc.C.G-9/21 - 3186.5; UAM.IG.Tc.C.G-9/11a -3192.1; UAM.IG.Tc.C.G-9/11a(7) - 3193.3; UAM.IG.Tc.C.G-9/22 - 3205.8), Karlino-1 (UAM.IG.Tc.C.KRL-1/20, 21 - 3685.5), Koczała-1 (UAM.IG.Tc.C.KCA-1/7 - 2949.5). A dozen or so transverse and longitudinal thin sections.

DESCRIPTION: The best preserved, almost complete specimens (Pl. 6, Figs 1, 4) up to 12.0 mm in length and 2.5 - 4.2 mm in diameter of circular transverse sections. Septotheca thick, formed by triangular, swollen bases of major and minor septa. Axial ends of major septa rhopaloid, forming thick stereotheca. Lumen of aulos

changes relatively quickly in ontogeny. It equals 0.3 mm at 2.5 mm corallite diameter (Pl. 6, Fig. 4d), with stereotheca 0.2 mm thick, and reaches 0.6 mm at 3.0 mm corallite diameter (Pl. 6, Fig. 4e), with stereotheca remaining 0.2 mm thick. Cardinal and counter septa equal in length to other major septa. Contratingent minor septa reach 1/2 to 2/3 length of major septa. Km septa longer than other minor septa, may reach length of major septa (Pl. 6, Fig. 3c-b, 4f). Tabulae loosely packed (6 in 3.0 mm); complete, horizontal or slightly concave within aulos (Pl. 6, Figs 2, 4g). Peripheral parts of tabulae declined towards external wall (Pl. 6, Fig. 2). Calice deep, with steep rim. External wall in proximal part strongly sinuous, indicating presence of septal furrows; in distal part smooth in outline, indicating absence of septal furrows.

In early growth stages, most septa meet at corallite axis to form the pseudocolumella, which persisted up to the stage with 12 septa at 2.5 mm corallite diameter. In this stage septa Km are already long, forming a triad (Pl. 6, Figs 1c, 3a). The aulos begins to form after the appearance of minor septa, and disappears gradually just above the calice floor.

REMARKS: The early growth (up to n/d = 12/2.5) of *Syringaxon* sp. nov. A closely resembles that of *S. bohemica* illustrated by FEDOROWSKI (2003). In the subsequent growth, however, those taxa differ significantly. The aulos in the Pomeranian specimens follows the appearance of minor septa, whereas in *S. bohemica* it preceded them, appearing as a narrow, oval tube at corallite index n/d = 12/2.

The new species A closely resembles *S. rozkowskae* in all qualitative characters. Thus, the close relationship of those two taxa seems indisputable. The distinguishing features of the new species A are: the cardinal septum equal in length to the remaining major septa up to the calice floor inclusive (Pl. 6, Fig. 1e), the slightly shorter minor septa and the thicker external wall with more clearly accentuated septal wrinkles.

It also resembles *Laccophyllum cyathoxoniaeformis* GORSKY 1932 from the Lower Tournaisian of Kirghizia. The main characters of the latter were mentioned above with the discussion on *S. rozkowskae*. It therefore suffices here to point out that the similarity of those two species is only apparent and that they are unrelated. *S. turbinatum* GORSKY, 1932, from the Tournaisian of Kirghizia with n/d ratio 18/7 possesses major septa thickened axially in the early growth to form an aulos which disappears in later ontogeny (GORSKY 1932, pl. 1, figs 14, 15; text-figs 2a, b).

Syringaxon beruinensis POTY, 1981 and *Syringaxon*? sp. of WEBB 1990, two other Carboniferous taxa included in that genus, are either inadequately known (the latter) or differ from *Syringaxon* sp. nov. A in possessing strongly thickened structural elements, short minor septa, a smooth external wall and a very narrow aulos tube (POTY 1981, pl. 1, fig. 2a).

OCCURRENCE: Poland: Pomerania, Upper Famennian.

?*Syringaxon* sp. nov. B
(Pl. 6, Fig. 5)

MATERIAL: Three corallites from Białogard-9 (Tc.C.BGD-9/9 - 3357.8) and Daszewo-19K (Tc.C.DSO-19K/60, 61 - 3312.9). Six transverse sections with acetate peels.

DESCRIPTION: Septal index n/d = 14/3.5. In early growth stage thickened inner margins of major septa united axially (Pl. 6, Figs 5a-b). Major septa rhopaloid in maturity. Their laterally contiguous inner margins form thick stereotheca (Pl. 6, Figs 5c-d), which form aulos at least 0.1 mm in diameter. Minor septa contratingent, 1/2 to 3/4 length of major septa. Km septa equal to other minor septa in length. External wall bears distinct septal furrows.

REMARKS: ?*Syringaxon* sp. nov. B resembles ?*S.* sp. nov. A in thickness and morphology of the external wall, length of most minor septa and similar n:d ratio. The main differences between the two taxa are the much shorter Km septa than the major septa, and the broad axial structure. The strongly thickened aulos in *Syringaxon* sp. nov. B is similar to that in *S. beruinensis* from the lowermost Viséan (Cf4α foraminiferal Subzone) of Belgium. It differs from the Belgian species in smaller dimensions (n/d 14/3.5 *versus* 18/12) and in much longer Km septa.

OCCURRENCE: Poland: Pomerania, Upper Famennian.

Family Campophyllidae WEDEKIND, 1921
Genus *Campophyllum* MILNE-EDWARDS & HAIME, 1850

TYPE SPECIES: *Cyathophyllum flexuosum* GOLDFUSS, 1826.

DIAGNOSIS: See HILL (1981, p. F306).

REMARKS: The type species came from the Late Famennian deposits of the Stollberg area near Aachen (GOLDFUSS 1826). The history of investigation of *Campophyllum* thus goes back to the first half of the nineteenth Century. This may have resulted in many,

sometimes insecurely based, identifications despite it being the single known genus in the family. The true morphology of the lectotype of the genus remained unknown until the revision by HILL & JULL (1965). Unfortunately, the incomplete and poor state of preservation of the lectotype allowed various interpretations since that publication. Such crucial characters as the ontogeny and the microstructure of septa were not investigated whereas the cardinal and the counter septa were described as not being "of distinctive length" and the major septa are thickened in the tabularium but thin and flexuous in the narrow dissepimentarium. POTY (1984, pl. 2, fig. 2) illustrated one transverse section with a long counter septum, and another transverse section (POTY 1984, pl. 2, fig. 3) showing a shortened cardinal septum, and major septa strongly dilated in the tabularium but thin in the rather wide dissepimentarium. The longest of those major septa meet in the corallite axis.

Morphological variations of the *Campophyllum* material described from Europe (GOLDFUSS 1826, MILNE-EDWARDS & HAIME 1850, SCHINDEWOLF 1932, POTY 1984, WEYER 1997, BERKOWSKI 2002), Asia (POTY & ONOPRIENKO 1984) and North America (SORAUF 1992) point at the high taxonomic variability of the genus. In addition, specimens from Pomerania document its large ontogenetic variation. Characters diagnostic of the lectotype can be mixed with distinct ones, such as elongated cardinal and counter septa or a shortened cardinal septum, with the counter septum either elongated or equal in length to the adjacent major septa (Pl. 7, Fig. 1). In a single transverse section the minor septa may be free, contrajunct or contratingent (Pl. 7, Fig. 1g). In addition, both major and minor septa can be carinated (Pl. 7, Figs 1g, 2). The latter character was here accepted as a supplementary diagnostic character of *C. flexuosum*.

Specimens possessing very thick major septa approaching a corallite axis in early growth, with the cardinal septum clearly shortened and the counter septum elongated in mature growth, with contratingent minor septa as thick as the major septa and with a regular dissepimentarium that appeared late in ontogeny were tentatively classified as ?*Campophyllum* sp. nov. A.

The original diagnoses of *C. cylindricum* and *C. gosseleti* can be complemented in the context of the large morphological variability. Specimens bearing thin major septa, a short cardinal septum located in a distinct cardinal fossula, an elongated counter septum (*sensu* POTY & ONOPRIENKO 1984), contraclined or contratingent minor septa and both lonsdaleoid and interseptal dissepiments, represent *C. cylindricum*. Specimens possessing minor septa other than contratingent, almost equally thin major and minor septa, an only slightly shortened cardinal septum, and exclusively interseptal dissepiments belong in *C. ursinum*. The main diagnostic characters of *C. gosseleti* are splitting of the septa in a dissepimentarium comprising both regular and herring-bone dissepiments, in addition to a shortened cardinal septum and an elongated counter septum.

All the above proposals are tentative. The revision of the genus based on the abundant fauna from the Ardennes, announced years ago by Professor E. POTY, should bring substantial clarification of this problem.

Campophyllum flexuosum (GOLDFUSS, 1826)
(Pl. 1, Fig. 8; Pl. 7, Figs 1-3)

1826. *Cyathophyllum flexuosum* nov. nomen.; GOLDFUSS, p. 57, pl. 17, figs 3a-b.
1850. *Campophyllum flexuosum* (GOLDFUSS); MILNE-EDWARDS & HAIME, pl. 18.
1932. *Caninia flexuosa* (GOLDFUSS); SCHINDEWOLF, p. 471, text-fig. 3.
1965. *Campophyllum flexuosum* (GOLDFUSS); HILL & JULL, p. 207, pl. 7, figs 1-3.
1984. *Campophyllum flexuosum* (GOLDFUSS); POTY, pl. 2, figs 1-3

DIAGNOSIS: See HILL (1981, p. 306).

MATERIAL: Thirty-three corallites from various localities, including one specimen from M.RÓŻKOWSKA's collection: Babilon-1 (Tc.C.BAB-1/5 - 2884.5; Tc.C.BAB-1/7 - 2914.7), Bielica-2 (Tc.C.BLC-2 - 3918.9), Biesiekierz-2 (Tc.C.BKZ-2/25 - 3269.3; Tc.C.BKZ-2/28 - 3274.2), Brda-1 (Tc.C.BRD-1/1 - 3240.0; Tc.C.BRD-1/2 - 3250.0), Chmielno-1 (Tc.C.CHO-1/11 - 4349.3; Tc.C.CHO-1/12 - 4503.8), Daszewo-17 (Tc.C.DSO-17/4 - 3441.35m), Daszewo-19K (Tc.C.DSO-19K/18, 19 - 3304.1; Tc.C.DSO-19K/156 - 3305.1; Tc.C.DSO-19K/117 - 3312.9; Tc.C.DSO-19K/5 - 3315.3; Tc.C.DSO-19K/6 - 3316.0; Tc.C.DSO-19K/123 - 3317.3; Tc.C.DSO-19K/1, 10, 120 - 3321.7), Dunowo-1 (Tc.C.DUN-1/4, 11 - 3116.6; Tc.C.DUN-1/7 - 3105.6; Tc.C.DUN-1/12 - 3117.2; Tc.C.DUN-1/13 - 3112.6; Tc.C.DUN-1/13 - 3113.8; Tc.C.DUN-1/18 - 3118.3), Dygowo-1 (Tc.C.D-1/28 - 4007.5), Gorzysław-9 (Tc.C.G-9/22 - 3206.9; Tc.C.G-9/31 - 3210.6), Gozd-1 (Tc.C.GZD-1/2 - 2652.1), Kłanino-3 (Tc.C.KŁO-3/4 - 3437.7-3438.8; Tc.C.KŁO-3/15 - 3444.7). A few dozen acetate peels and a dozen or so thin sections mainly from transverse sections.

DESCRIPTION: Septal index = 32-55/10-15. Major septa amplexoid, reaching 3.0 mm in length, weakly flexuous, slightly thinner in dissepimentarium. Cardinal septum may be slightly shortened. Counter septum usually

reaches a corallite axis. Minor septa contratingent and contrajunct, up to 1/2 length of major septa and up to 2.0 mm in length. Septa of both cycles may be carinated within dissepimentarium (Pl. 7, Fig. 2). Dissepimentarium composed of 1-3 ranks of small, unequal dissepiments. External wall 0.2 mm thick.

In the early growth (Pl. 7, Fig. 1a) with n/d = 14/3, major septa approach the corallite axis. The longest joined axially. Minor septa incomplete; varying in length from low crests on a corallite wall to 0.5 mm; contratingent when adequately long. Dissepiments absent. Wall 0.2 mm thick. In the subsequent stage (Pl. 7, Fig. 1b) with n/d = 24/5.5, major septa differentiated in length. The cardinal, counter and some metasepta remain connected at the axis; other septa become slightly shortened. Minor septa well developed, 1.0 mm long, contrajunct or contratingent. No dissepiments.

Major septa in two subsequent transverse sections (Pl. 7, Figs 1c-d) became shortened to 1/2-1/3 corallite radius, closely resembling the non-contratingent minor septa. Rare dissepiments appear in the first of these transverse sections, but constitute a distinct, continuous row in the second one (Pl. 7, Figs 1c, d respectively).

In further growth (two millimetres above the preceding one) with n/d = 30/8, major septa thickened in all quadrants (Pl. 7, Figs 1e-f) and elongated up to 3/4 of corallite radius in length. Cardinal and counter septa equal in length to the adjacent major septa. Minor septa reach a quarter of length of major septa, with some being equal to them in length (Pl. 7, Fig. 1f). Strong elongation of minor septa may due to their amplexoid character. Below calice floor (Pl. 7, Fig 1g), i.e. 10 mm above the section illustrated in Pl. 7, Fig. 1f, all septa are thin. Major septa up to 3/4 of corallite radius in length. Minor septa up to 1/2 of length of major septa, free, contrajunct or contratingent; both cycles of septa carinated (Pl. 7, Fig. 2). Dissepimentarium narrow at this growth stage, composed of 3 rows of dissepiments. Immediately below calice (Pl. 7, Fig. 1h) major septa thicker in tabularium than in dissepimentarium, may reach corallite axis. Periaxial parts of major septa commonly thin. Contratingent minor septa up to 1/2 length of major septa. Counter septum as long as other major septa. Cardinal septum shortened, 3/4 length of major septa, located in narrow cardinal fossula. Dissepimentarium composed of 4 ranks of small dissepiments.

REMARKS: Most characters of the mature morphology of small specimens from Pomerania (n/d = 32/10) closely resemble those of the lectotype described by HILL & JULL (1965). Carinae present in the Pomeranian specimens but absent from the lectotype form the most important difference at that stage. In most specimens the dissepimentarium is narrow, all septa are thin and it is difficult to distinguish between the major and the minor septa (Pl. 7, Figs 1c-d). Corallites with those characters closely resemble the syntype 197b of HILL & JULL (1965). Some differences are noticed in early stages: in the Pomeranian specimens the major septa can reach the corallite axis, the cardinal and counter septa are united at that stage, and the dissepimentarium consists of both interseptal and locally lonsdaleoid dissepiments. Major septa thickened in the tabularium appear in the Pomeranian specimens already at 8.0 mm diameter, and not 18.0 mm as observed by HILL & JULL (1965) in the type material.

OCCURRENCE: Belgium, Northern France, Germany – Upper Famennian (Etroeungt Formation ~Tn1a Zone); Poland: Holy Cross Mountains, Cracow Region – *P. expansa* or *S. praesulcata* Zone, Western Pomerania – uppermost Famennian (Df3ε Subzone).

Campophyllum cylindricum (ONOPRIENKO 1979)
(Pl. 6, Figs 6, 7)

1979a. *Protocaninia cylindrica* n.sp.; ONOPRIENKO, p. 25, pl. 3, figs 4-11.

1979b. *Protocaninia parva* n.sp.; ONOPRIENKO, p. 27, pl. 4, figs 1-4.

1984. *Campophyllum cylindricum* (ONOPRIENKO); POTY & ONOPRIENKO, p. 202, pl. 30, figs 1-3.

EMENDED DIAGNOSIS: *Campophyllum* with major septa 3/4 of corallite radius in length; cardinal septum shortened, in narrow fossula; counter septum elongated, reaching corallite axis; minor septa from very short to 2/3 length of major septa, contratingent; dissepimentarium of 2 to 6 rows of fine interseptal, locally lonsdaleoid dissepiments, up to 1/6 corallite radius in width; tabulae complete, with downturned peripheral parts and horizontal axial parts.

MATERIAL: Two corallites; from Biesiekierz-2 (Tc.C.BKZ-2/4 - 3269.3) and Daszewo-19K (Tc.C.DSO-19K/109 - 3312.9). Five transverse sections with acetate peels.

DESCRIPTION: Corallites cylindrical. Septal index n/d = ?40/9.5. Major septa thin in dissepimentarium, slightly thickened in tabularium; differentiated in length, reaching 2/3 of a corallite radius, except for amplexoid elongations just above tabulae. Some major septa and almost always counter and alar septa join each other at corallite axis on tabular floors and immediately above. Cardinal septum shortened. Minor septa 1.5 to 2.2 mm

long, contratingent. Km septa commonly longer than other minor septa, contrajunct; in adult stage commonly separated from counter septum. Dissepimentarium 1.0 mm wide, with up to 6 rows of small, globose and lonsdaleoid dissepiments. The latter may compose entire dissepimentarium in adult stage. External wall approximately 0.1 mm thick. Tabularium biform. Tabulae subhorizontal to gently domed, with downturned edges.

REMARKS: Specimens from Pomerania differ from the types mainly in the septal index n/d: 56-74/15-20 in the types *versus* ?40/9.5 in the specimens described in the present paper. Besides, the Pomeranian specimens differ from the topotypes in larger lonsdaleoid dissepiments, longer and thinner major septa, the longest of which meet each other in the corallite axis of young specimens. They also differ in having longer minor septa, i.e., 3/4 to 1/2 length of the major septa *versus* 1/4 to 1/2 length of the major septa in the topotypes.

C. cylindricum differs from *C. flexuosum* and *C. gosseleti* in possessing a narrow dissepimentarium composed almost entirely of lonsdaleoid dissepiments in the mature stage and clearly separated from the tabularium by thickened dissepiments (so-called dissepitheca), and in the septal index n/d.

OCCURRENCE: Russia (Omolon Massif) – Upper Famennian; Poland (Western Pomerania) – uppermost Famennian.

Campophyllum gosseleti WEYER, 1997
(Pl. 7, Figs 4-6)

1997. *Campophyllum gosseleti* n.sp.; WEYER, p. 44; pl. 2, figs 1-3.

DIAGNOSIS: See WEYER (1997, p. 45).

MATERIAL: Six specimens; from Białogard-10 (Tc.C.BGD-10/2 - 3179.6), Daszewo-19K (Tc.C.DSO-19K/117 - 3309.3; Tc.C.DSO-19K/121, 121A - 3307.4; Tc.C.DSO-19K/152 -3312.2), Dunowo-1 (Tc.C.DUN-1/20 - 3112.6). Nine transverse section with acetate peels.

DESCRIPTION: Septal index n/d = 40-50/16 – 61/21. Major septa vary in length, with longest reaching a corallite axis; wedge-shaped in tabularium (up to 0.45 mm at tabularium-dissepimentarium boundary); thin (0.05 to 0.2 mm), bifurcated and carinated in dissepimentarium (Pl. 7, Figs 4, 6b-c). Counter septum as long as other major septa. Cardinal septum shortened, 1/2 corallite radius in length, located in deep cardinal fossula surrounded by major septa of cardinal quadrants. Minor septa thin and carinated, confined to dissepimentarium, approximately 1/3 corallite radius in width, composed of concentric interseptal and pseudoherringbone dissepiments.

REMARKS: The Pomeranian specimens differ from corallites from Avesnois, France (WEYER 1997) in larger dimensions and well developed carinae on both major and minor septa (Pl. 7, Fig. 6c). The remaining specimens with septal index 40-50/16 resemble those of French specimens (48/16.6).

OCCURRENCE: Northern France (Avesnois) – Etroeungt Formation (Tn1a Zone); Germany (Rhenish Mountains) – uppermost Famennian; Poland (Western Pomerania) – uppermost Famennian.

Campophyllum cf. *ursinum* SORAUF, 1992
(Pl. 6, Fig. 8)

MATERIAL: Two specimens, both from Daszewo-19K (Tc.C.DSO-19K/19 - 3312.9; Tc.C.DSO-19K/125 - 3317.3). Nine transverse sections with acetate peels.

DESCRIPTION: Septal index n/d = 28-38/7-16. Major septa 0.1 mm thick at tabularium/dissepimentarium boundary and approximately 2.5 mm long. Minor septa 1/2 to 3/4 length of major septa; mostly contraclined and contrajunct in early growth, free at maturity (Pl. 6, Figs 8a, 8c respectively). Cardinal septum becomes distinctly shortened only in mature stage, i.e., when dissepimentarium complete. Counter septum as long as other major septa. Dissepimentarium narrow, composed of 1-2 rows of small, interseptal dissepiments. External wall 0.1 mm thick.

REMARKS: Major septa that are only slightly diversified in length are characteristic of this species. The Pomeranian corallites differ from the New Mexican type specimens of SORAUF (1992) in longer minor septa that locally reach the length of the major septa in the mature stage whereas the minor septa in the American specimens are very thin and only one-quarter the length of the major septa. They resemble *C. cylindricum* in possessing thin major and minor septa and a narrow dissepimentarium. However, an absence of lonsdaleoid dissepiments, a slightly shortened cardinal septum and a counter septum equal in length to adjacent major septa preclude their identification as *C. cylindricum*.

OCCURRENCE: USA, New Mexico – Famennian; Poland, Western Pomerania – uppermost Famennian.

?*Campophyllum* sp. nov. A
(Pl. 8, Figs 1-8)

MATERIAL: Thirty-six specimens from various localities: Babilon-1 (Tc.C.BAB-1/2 - 2619.7; Tc.C.BAB-1/1 - 2622.7), Białogard-8 (Tc.C.BGD-8/2 - 3560.1), Bielica-2 (Tc.C.BLC-2/1 - 3868.7), Daszewo-17 (Tc.C.DSO-17/1-3 - 3436.2), Daszewo-19K (Tc.C.DSO-19K/83, 155, 156 - 3307.4; Tc.C.DSO-19K/153 - 3309.3; Tc.C.DSO-19K/50 - 3310.1; Tc.C.DSO-19K/122, 154 - 3312.9; Tc.C.DSO-19K/175 - 3316.0-3317.3; Tc.C.DSO-19K/132 - 3321.7), Dunowo-1 (Tc.C.DUN-1/16-17 - 3105.8; Tc.C.DUN-1/19 - 3117.2; Tc.C.DUN-1/21 - 3118.3), Dygowo-1 (Tc.C.D-1/26 - 4011.0), Gorzysław-9 (Tc.C.G-9/20 - 3193.3; Tc.C.G-9/21 - 3205.8; Tc.C.G-9/26 - 3208.7; Tc.C.G-9/26A-3209.3, Tc.C.G-9/28a - 3211,6), Kłanino-3 (Tc.C.KŁO-3/3 - 3437.7; Tc.C.KŁO-3/4 - 3438.8; Tc.C.KŁO-3/6 - 3445.9; Tc.C.KŁO-3/11 - 3441.7; Tc.C.KŁO-3/12-13 - 3440.2; Tc.C.KŁO-3/14, 23 - 3442.8; Tc.C.KŁO-3/24 - 3443.7), Rzeczenica-2 (Tc.C.RCA-2/1 - 3170.2). A few dozen transverse thin sections and acetate peels and two longitudinal thin sections.

DESCRIPTION: Solitary corals, oval or circular in outline. Septal index n/d = 25-38/5.3-13. Major septa vary in length, thick, leaving very narrow free interseptal spaces. Longest major septa and axial tabellae join at a corallite axis to form an open axial structure exposed up to a calice floor. Minor septa appeared late in ontogeny as short spines, but in mature growth may reach 1/4 length of major septa, being always thick and contratingent, confined to narrow dissepimentarium. Dissepiments become evident only in the mature stage when interseptal loculi are large and minor septa well developed. Counter septum elongated behind a corallite axis. Cardinal septum beneath calice floor reaches up to 3.0 mm in length (n/d = 34/12), but is reduced to 1.3 mm above it. Cardinal fossula elongated, attaining a corallite axis. Tabulae mostly incomplete, composed of domed tabellae, elevated at the tabularium margin (Pl. 8, Fig. 4). External wall 0.3 - 0.7 mm thick.

In the earliest stage investigated (Pl. 8, Fig. 1a, b), the major septa are wedge-shaped, 0.6 mm thick near the external wall. The cardinal and counter septa joined at the corallite axis and form an axial septum. Other major septa, arranged pinnately in counter quadrants and radially in cardinal quadrants, vary in length. The longest major septa joined the axial septum. Minor septa not yet developed.

During further corallite growth with n/d = 32/9x6 (Pl. 8, Fig. 1d), some major septa withdraw slightly from the axial area, whereas the other major septa remain extended to the corallite axis, forming a weak axial structure consisting of their sinuous inner margins and a discontinuous series of linked axial tabellae (Pl. 8, Figs 1e, 2, 5a-b, 8a-b). Minor septa strongly underdeveloped, forming low crests on a corallite wall. They are better recognizable, but still short and thick, at 8.0 mm corallite diameter and 36 major septa. Immediately below and above the calice floor (Pl. 8, Figs 1e, 2, 3, 5b, 6) the minor septa elongate a little and become contratingent. Complete dissepimentarium developed immediately below the calice floor (Pl. 8, Fig. 5b). The external wall is 0.3 mm thick.

REMARKS: The strongly thickened septa, formation of the long-lasting axial septum replaced by a weak, open axial structure and a very late development of the dissepimentarium, are unique within the genus *Campophyllum*. Thus, further discussion is unnecessary to prove the taxonomic distinction of ?*Campophyllum* sp. nov. A from the remaining species of the genus *Campophyllum*. It probably represents a new genus.

Suborder Caniniina WANG, 1950
Family Cyathopsidae DYBOWSKI, 1873
Genus *Siphonophyllia* SCOULER *in* GRIFFITH, 1842

TYPE SPECIES: *Siphonophyllia cylindrica* SCOULER *in* GRIFFITH, 1842

DIAGNOSIS: See POTY & BOLAND (1996, p. 208).

Siphonophyllia cylindrica hasteriensis (SALÉE, 1913)
(Pl. 1, Fig. 10; Pl. 9, Fig. 4)

1913. *Caninia cylindrica* mut. *hasteriensis* SALÉE, p. 42, pl. A, figs 1-2.
1913. *Caninia dorlodoti* n.sp.; SALÉE, p. 44, pl. B, figs 1a-c; pl. C, figs 1a-b.
1996. *Siphonophyllia cylindrica hasteriensis* (SALÉE, 1913); POTY & BOLAND, p. 208, pl. 4, fig. 4; pl. 5, fig. 1.

DIAGNOSIS: See BOLAND (1997, p. 74).

MATERIAL: Three specimens, all from Brda-1 (Tc.C.BRD-1/3 - 2262.0; Tc.C.BRD-1/4-5 - 2260.0). Three transverse sections with acetate peels.

DESCRIPTION: Septal index n/d = 51/25. Major septa up to 10.0 mm long, 1.0 mm thick in cardinal quadrants and 0.3 to 0.5 mm thick in counter quadrants. Cardinal septum thick, shortened to 1/2 length of major septa. Counter septum equal in length to other major septa in counter quadrants. Minor septa free, 2.5 mm long.

Dissepimentarium narrow, with interseptal and lonsdaleoid dissepiments.

REMARKS: The pronounced thickening of the major septa in the cardinal quadrants of the Pomeranian specimens distinguish them from the Irish Lower Viséan *Siphonophyllia cylindrica*, making them at the same time closely comparable to Belgian specimens of this species, described by SALÉE (1913) as *Caninia cylindrica* mutation *hasteriensis*. This "mutation" was subsequently elevated by POTY & BOLAND (1996) to subspecies level as *Siphonophyllia cylindrica hasteriensis*, a position accepted in the present paper.

OCCURRENCE: Belgium – Tournaisian (from near the base of the Hastarian Stage, Cf1α foraminifer Subzone to the lower part of the Ivorian Stage, Cf1γ foraminifer Subzone); Poland (Western Pomerania) – Tournaisian.

Genus *Caninia* MICHELIN in GERVAIS, 1840

TYPE SPECIES *Caninia cornucopiae* MICHELIN in GERVAIS, 1840.

DIAGNOSIS: See HILL (1981, p. F339).

Caninia sp.
(Pl. 1, Fig. 7; Pl. 9, Figs 5, 6)

MATERIAL: Three specimens; from Brda-1 (Tc.C.BRD-1/2 - 2319.9; Tc.C.BRD-1/8 - 2469.0; Tc.C.BRD-1/14 - 2524.3). Three thin section and four acetate peels from transverse sections.

DESCRIPTION: Septal index n/d = 31/11. Major septa thickened to 0.6 mm at bases, attaining 2/3-3/4 corallite radius in length. Cardinal septum shortened to 3/4 length of major septa, in open cardinal fossula. Minor septa thick, penetrating peripheral tabularium. Dissepimentarium narrow, consisting mainly of interseptal, concentric and irregular dissepiments. External wall 0.3 mm thick.

REMARKS: The few incompletely preserved specimens from Pomerania do not allow a firm identification.

OCCURRENCE: Poland (Western Pomerania) – Upper Tournaisian–?Viséan.

Family Lophophyllidae GRABAU, 1928
Genus *Lophophyllum* MILNE-EDWARDS & HAIM, 1850

TYPE SPECIES: *Lophophyllum koninckı* MILNE-EDWARDS & HAIME, 1850

DIAGNOSIS: See HILL (1981, p. F333).

?*Lophophyllum* sp. A
(Pl. 9, Figs 1-3)

MATERIAL: Three well preserved specimens from Daszewo-19K (Tc.C.DSO-19K/38-39 - 3254.7; Tc.C.DSO -19K/23 - 3255.4). Two transverse thin sections and eight acetate peels.

DESCRIPTION: Corallites solitary, horn-shaped. Septal index n/d = 22/5. Major septa vary in length. Several join oval columella united with cardinal and counter septa. Cardinal fossula indistinct or absent. Minor septa mostly contrajunct, some contratingent, reaching 1/4 length of major septa. Tabularium biform. No dissepiments. Shortening of major septa in ontogenetically youngest preserved part of the specimen (n/d = 11/1.0, Pl. 9, Fig.1a) resulted perhaps from diagenetic alteration and not considered as taxonomically important. Major septa zaphrentoidally arranged in the further corallite growth with septal index (n/d = 13-15/2-2.5 (Pl. 9, Figs 1b-d). A slight shortening of cardinal septum in that part of corallite growth may be apparent and may have resulted from diagenesis. Cardinal septum long in subsequent growth (Pl. 9, Figs 1e-g). Columella appears at a diameter of 2.8 mm and 16 major septa (Pl. 9, Fig. 1f). Ontogenetically most advanced corallite shows formation of loose axial structure consisting of inner ends of longest major septa and some axial tabellae (Pl. 9, Fig. 3c).

REMARKS: The specimens discussed are well preserved, but cannot be firmly included in any of the existing genera. Unfortunately, the limited number of specimens does not suffice to establish a new genus. They were therefore temporarily included in the genus *Lophophyllum* and left in open nomenclature, until more material is collected.

OCCURRENCE: Poland, Pomerania – Lower Tournaisian.

Suborder Metriophyllina SPASSKY, 1965
Family Metriophyllidae HILL, 1939
Genus *Metriophyllum* MILNE-EDWARDS & HAIME, 1850

TYPE SPECIES: *Metriophyllum bouchardi* MILNE-EDWARDS & HAIME, 1850.

DIAGNOSIS: See WEYER (1970, p. 57).

Metriophyllum soshkinae RÓŻKOWSKA, 1969
(Pl. 10, Figs 1, 2)

1969. *Metriophyllum soshkinae* n. sp.; RÓŻKOWSKA, p. 34, pl. 2, figs 1,2; text-figs 8A-I.
2003. *Metriophyllum soshkinae* RÓŻKOWSKA; FEDOROWSKI, p. 71; pl. 24, figs 11-13.

DIAGNOSIS: See RÓŻKOWSKA (1969, p. 34).

MATERIAL: Five corallites, all from Dygowo-1 (Tc.C.D-1/28(1-5) - 4011.0); without calices and proximal ends; seven acetate peels and two thin sections.

DESCRIPTION: Corallites round, 3.6 mm in diameter. Septal index n/d = 14/3.6. Major septa thick, radially arranged, slightly wavy. Inner margins of elongate major septa joined at corallite axis. Carinae strong, hook-like or developed as short crests, alternately arranged with carinae of neighbouring septa. Hook-like carinae directed either towards corallite axis or towards wall (Pl. 10, Figs 1, 2). External corallite wall smooth and thick.

REMARKS: Pomeranian specimens are similar in structure to the Famennian forms from Besówka (Holy Cross Mountains, central Poland), described by RÓŻKOWSKA (1969, p. 34), from which they differ in slightly smaller dimensions and in septal index. Specimens from Besówka have septal index n/d = 14/4.5.

OCCURRENCE: Poland: Holy Cross Mountains (*marginifera–expansa* zones), Western Pomerania (uppermost Famennian, *praesulcata* Zone), Russia: Eastern Urals (Lower Permian).

Family Cyathaxoniidae MILNE-EDWARDS & HAIM, 1850
Genus *Cyathaxonia* MICHELIN, 1847

TYPE SPECIES: *Cyathaxonia cornu* MICHELIN, 1847.

DIAGNOSIS: See SANDO (1977, p. 53).

Cyathaxonia (*Cyathocarinia*) *famenniana* FEDOROWSKI, 2003
(Pl. 10, Figs 7-9)

1969. *Cyathaxonia (Cyathocarinia) tuberculata* SOSHKINA; RÓŻKOWSKA, p. 56, pl. 3, figs 3, 4; text-figs 15, 16.
2003. *Cyathaxonia (Cyathocarinia) famenniana* n. sp.; FEDOROWSKI, p. 60, pl. 14, fig. 3.

DIAGNOSIS: See FEDOROWSKI (2003, p. 61).

MATERIAL: Thirteen corallites, from various localities: Białogard-5 (Tc.C.BGD-5/1 - 3512.1), Chojnice-5 (Tc.C.CHO-5/2 - 3880.3), Daszewo-19K (Tc.C.DSO-19K/51 - 3252.5; Tc.C.DSO-19K/168 - 3280.3; Tc.C.DSO-19K/110 - 3313.7; Tc.C.DSO-19K/114-115A - 3314.5; Tc.C.DSO-19K/169 - 3321.7), Dygowo-1 (Tc.C.D-1/26 - 4010.0), Gorzysław-9 (Tc.C.G-9/2(1)-3 - 3186.5), Karlino-1 (Tc.C.KRL-1/2 - 3645.2); a few dozen acetate peels and thin sections from transverse section.

DESCRIPTION: Corallites solitary, subcylindrical, slightly bent. Columella oval or irregular, narrow (the ds+st/d index reaches 0.3+0.1/3.2), thickened by stereotheca adhering to it with concentric lines. In young stages, columella irregular (Pl. 10, Figs 9a-c). Septal index n/d mostly = 11-18/1.7-3.2. Septal arrangement corresponds to that of *Cyathaxonia cornu* MICHELIN, 1847. Major septa slightly rotated, rhopaloid, strongly thickened at periphery, up to triangular in calice (Pl. 10, Fig. 9d), forming a septotheca (Pl. 10, Fig. 8b). Minor septa contratingent, slightly thinner and shorter than major septa. All septa covered by rounded knobs carinae. External corallite walls approximately 0.3 mm thick, smooth in outline, indicating absence of septal furrows.

REMARKS: Representatives of *C.* (*C.*) *famenniana* are morphologically very close to the Permian species *C.* (*Cyathocarinia*) *tuberculata*, described from the Central Urals by SOSHKINA (1928), to which they were formerly referred e.g. by RÓŻKOWSKA (1969), based on the material from the Holy Cross Mountains. FEDOROWSKI (2003) considered this similarity homeomorphic, an interpretation that is followed herein. The occurrence of thick major and minor septa and their slight rotation in the corallite axis were decisive for the *C.* (*C.*) *famenniana* identification.

In Pomerania, *Cyathaxonia* occurs in both Upper Devonian and Lower Carboniferous strata. Famennian corallites from the Gorzysław-9 borehole as well Tournaisian corallites from the Daszewo-19K borehole, differ from the Holy Cross Mountains specimens in the larger number of septa and smaller diameters. The septal index of the Holy Cross corallites is 13/4 whereas the Famennian specimens from Pomerania possess a n/d ratio 12/2.8 to 16/3.2 (Pl. 10, Fig. 9), and Tournaisian specimens (Pl. 10, Fig. 8), from the Daszewo-19K borehole have a mean n/d ratio 18/3. In respect of the septal index, the Pomeranian specimens resemble the North

American Mississippian specimens referred to *C. tantilla* (MILLER, 1891), in which carinae can be present or absent, even within the same specimen. The carinae appear mostly beneath the calice floor and disappear immediately above.

The specimens described herein come most probably from the Tournaisian, extending significantly the stratigraphical range of the species.

OCCURRENCE: Poland: Holy Cross Mountains (*trachytera–expansa* zones), Western Pomerania (*expansa–sulcata* zones).

Cyathaxonia (*Cyathaxonia*) cf. *rozkowskae* FEDOROWSKI, 2003
(Pl. 11, Figs 1-2)

MATERIAL: Ten, short fragments with calice only partially preserved, without proximal ends, including one from RÓŻKOWSKA's collection (unpublished data); from Biesiekierz-2 (Tc.C.BKZ-2/12 - 3271.7), Dygowo-1 (Tc.C.D-1/9(9, 10) - 3570.8; Tc.C.D-1 - 3576.0; Tc.C.D-1/26a - 4005.5; Tc.C.D-1/26b - 4007.5), Karlino-1 (Tc.C.KRL-1/3 - 3645.2; Tc.C.KRL-1/4 - 3685.5) and Gorzysław-9 (.Tc.C.G-9/22-23 - 3186.5); eight acetate peels and four thin sections from transverse sections.

DESCRIPTION: Corals cylindrical, oval or circular in transverse sections. Diameter of oval corals approximately 3.0 mm/5.0 mm - 3.7 mm/4.8 mm; circular from 1.7 mm to 4.0 mm in diameter. Preserved corallites reach from 3.0 mm to 7.0 mm in length. Septal index, n/d from 12/2.0 mm to 18/4.0 mm. Septal arrangement corresponds to that of *Cyathaxonia cornu*. All septa nodulous and thickened at periphery to form septotheca; periaxial ends of most major septa in lateral contact, but not truly rhopaloid. Columella oval or round, occupying about 1/3 of corallite diameter. Minor septa sporadically thinner and shorter than major septa, contratingent. Km septa longer than other minor septa, forming a characteristic triad with counter septum. Swollen distal ends of septa form ring around columella. Cardinal septum slightly longer then other major septa, in narrow fossula bordered by two major septa. Nodes small. Index dc+st/d reaches 0.5+0.3/3.2. Tabulae elevated adaxially (Pl. 11, Fig. 2a). External corallite walls approximately 0.3 mm wide.

REMARKS: Pomeranian specimens are similar in structure and septal index to Belgian corals from the Viséan (POTY 1981), as well as to Lower Permian specimens from the Urals (DOBROLYUBOVA 1936), referred previously to *Cyathaxonia* (*Cyathocarinia*) *rushiana* VAUGHAN, 1906. The specimens described herein come from the uppermost Famennian and Tournaisian, significantly extending the stratigraphical range of the species. Famennian specimens from Pomerania closely resemble those from the Holy Cross Mountains in morphology, but possess much larger numbers of septa at similar diameters (20/4 *versus* 14/4) and thin, straight septa that are carinated like in *C.* (*Cyathocarinia*) *famenniana*. Carinae are unknown from the type specimens of *C.* (*Cyathaxonia*) *rozkowskae*; however, the otherwise similar morphology of the Pomeranian specimens to the latter species, and the cylindrical columella, which is twice the size of that in *C.* (*C.*) *famenniana*, resulted in the identification proposed.

SANDO (1977) and POTY (1981) questioned the diagnostic value of carinae in *Cyathaxonia* and did not acknowledge *Cyathocarinia*. They considered the development of carinae unrelated either to morphology or to position in the stratigraphical column. Both kinds of septa co-exist in the same species.

OCCURRENCE: Poland, Western Pomerania – probably *praesulcata–sulcata* Zones.

Suborder Aulophyllina HILL, 1981
Family Aulophyllidae DYBOWSKI, 1873
Subfamily Aulophyllinae DYBOWSKI, 1873
Genus *Nervophyllum* VASILYUK, 1959

TYPE SPECIES: *Nervophyllum besheviensis* VASILYUK, 1959.

DIAGNOSIS: See FEDOROWSKI (1971, p. 114).

?*Nervophyllum* sp.
(Pl. 11, Figs 3, 4)

MATERIAL: Three specimens, all from Wierzchowo-4 (Tc.C.WHO-4/4 - 4721.3; Tc.C.WHO-4/2 - 4730.0; Tc.C.WHO-4/8 - 4732.0); six acetate peels from transverse sections.

DESCRIPTION: Solitary corals with external corallite wall 0.1-0.2 mm thick. Septal index n/d = 28-31/8-11. Major septa wedge-shaped, reaching 4.0 mm in length, with proximal ends 0.5 mm thick, and axial ends 0.05 mm thick. Axial structure complex, with a median lamella, septal lamellae, few lamellae of minor septa included (Pl. 11, Fig. 4b – enlarged fragment Fig. 4c, see arrow), and several rows of axial tabellae (Pl. 11, Figs 3b, 4a-b). Axial

structure 4.0x3.0 mm wide, based on elongated cardinal septum, which reaches axis and initially forms median lamella (Pl. 11, Fig. 3a). Cardinal septum slightly shortened in more advanced growth stages, losing its connection to axial structure (Pl. 11, Fig. 4c). Counter septum equal in length to other major septa, permanently connected to median lamella. Minor septa straight, 0.5 to 1.0 mm in length. Dissepimentarium narrow, consisting of 2–3 ranks of interseptal dissepiments. Axial structure in youngest growth stage investigated (Pl. 11, Fig. 3a) comprises a distinct median lamella, seven septal lamellae and few sections of axial tabellae. Tabulae incomplete, sigmoidal. Tabellae in periaxial part concave; at external wall, bulbous, steeply elevated, resembling dissepiments; in corallite axis elevated less steeply than at periphery, meeting distinct median lamella.

REMARKS: Specimens from Pomerania, tentatively included in *Nervophyllum*, resemble that genus in possessing few septal lamellae corresponding to minor septa. They differ from the type and other species included in that genus so far in having the cardinal septum hardly distinguishable from other major septa during most growth stages and being only slightly shortened in maturity. It also differs in the sigmoidal shape of the incomplete tabulae and in lacking an axial column in the longitudinal section. The small diameters and numbers of septa and a narrow dissepimentarium are less important distinguishing characters. Among all known species of *Nervophyllum* only *N. intermedium* FEDOROWSKI, 1971, from the Upper Viséan of the Holy Cross Mountains has the axial structure poorly developed, but it possesses a few more lamellae corresponding to minor septa.

OCCURRENCE: The co-appearance of the Pomeranian specimens with the "*Dibunophyllum*" fauna, indicates their latest Famennian age.

Subfamily Dibunophyllinae WANG, 1950
Genus *Bounophyllum* gen. nov.

TYPE SPECIES: *Bounophyllum pomeranicum* sp. nov.

DERIVATION OF NAME: Gr. *βουνοσ* - hill, *φιλλον* – leaf after hemispherical shape of the tabularium with a distinct axial column absent from the longitudinal section.

DIAGNOSIS: Solitary dissepimental corals; axial structure irregular; median lamella indistinct, interrupted, in early growth connected to cardinal and counter septa; major septa twisted axially, may be thickened in tabularium; cardinal septum slightly shortened; cardinal fossula shallow with parallel walls; counter septum equal to other major septa; minor septa well developed; dissepimentarium interseptal; tabulae incomplete, hemispherical.

REMARKS: The mature morphology of specimens assigned here to the new genus *Bounophyllum* resembles that of the Upper Famennian *Clisiophyllum* (*Dibunophyllum*) *praecursor* FRECH, 1885 from the Stollberg area near Aachen. POTY (1984) mentioned that species as "*Dibunophyllum*" *praecursor.* Similar specimens were described as "*Dibunophyllum*" or ?*Dibunophyllum* from Pomerania (Northern Poland; CHWIEDUK 1998) and from the Sudetes (Southern Poland; BERKOWSKI 2002).

Detailed studies on the Pomeranian specimens suggest that the advanced features of "Strunian" *Dibunophyllum*-like corals cannot be accepted as ancestor for a phylogenetic lineage leading towards the Viséan *Dibunophyllum*. The distinctive characters listed in the diagnosis are adequate for the creation of a new genus that is convergent to the Viséan *Dibunophyllum* but most probably not related to it.

The stratigraphically oldest taxa of the "*Dibunophyllum*" *praecursor* species group differ from the Viséan representatives of *Dibunophyllum* proper, revised by HILL (1938-1941), in a less complex axial structure in transverse sections, with a weakly developed median lamella, and in the absence of an axial column in the longitudinal sections. Their narrow dissepimentaria and distinct minor septa are less important characters (see THOMSON & NICHOLSON 1878, pl. 25, fig. 3b and HILL 1938-1941, pl. 1, figs 15-21 *versus* FRECH 1885, pl. 7, fig. 1; POTY 1984, pl. 1, fig. 1, and BERKOWSKI 2002, pl. 11, fig. 2, and pl. 13, figs 1-4 in this paper). The Pomeranian specimens differ from POTY's (1984) and BERKOWSKI's (2002) Upper Famennian ("Strunian") specimens mainly in the absence of the distinct median lamella that is present in FRECH's (1885, pl. 7, fig. 1) specimen, a distinct thickening of the major septa in the tabularium (pl. 12, figs 5, 6; pl. 13, figs 2d, 3, 4c), more distinctly twisting inner parts of the major septa and septal lamellae within an axial structure, a biform tabularium and a trabecular septal microstructure (Pl. 12, Fig. 4).

Bounophyllum pomeranicum sp. nov.
(Pl. 12, Figs 4-7; Pl. 13, Figs 1-4; Text-Fig. 6)

1998. „*Dibunophyllum*" *praecursor* FRECH, 1885, CHWIEDUK, p. 95.

HOLOTYPE: UAM.IG.Tc.C.G-9/11a/7 (three thin sections, five acetate peels), from the Gorzysław-9 borehole.

TYPE LOCALITY: Poland, Western Pomerania, Gorzysław-9 borehole, 3193m below surface (Text-figs 1, 2).

TYPE HORIZON: Sąpolno Formation, uppermost Famennian (Text-fig. 2).

ETYMOLOGY: Named for its occurrence in Pomerania (Poland).

MATERIAL: Twenty one specimens from various localities: Daszewo-19K (Tc.C.DSO-19K/9 - 3309.3; Tc.C.DSO-19K/11, 48, 141 - 3317.3), Daszewo R3-P (Tc.C.D-R3P/1, 1A - 3665.8), Dunowo-1 (Tc.C.DUN-1/1 - 3105.8; Tc.C.DUN-1/8 - 3112.6; Tc.C.DUN-1/9, 17 - 3114.7; Tc.C.DUN-1/16A - 3118.3), Gorzysław-9 (Tc.C.G-9/11a, 1, 6, 7, 16, 17, 18 - 3193.3-3198.4), Karlino-1 (Tc.C.KRL-1/5 - 3855.0; Tc.C.KRL-1/10 - 3741.0 – this specimen from M.RÓŻKOWSKA'S collection), Wierzchowo-4 (Tc.C.WHO-4/6 - 4721.3); twenty acetate peels and nine thin sections, most from transverse sections.

DIAGNOSIS: *Bounophyllum* with maximum n/d ratio 33/15; irregular axial structure occupies 1/2 of corallite radius; major septa up to 1/2 corallite radius in width; minor septa up to 1/2 the length of majors, may be thickened in tabularium; dissepimentarium composed of 2–3 ranks of small globose dissepiments.

DESCRIPTION: Solitary, cylindrical corals. Septal index n/d usually between 22-32/6 and 14.0 mm (Text-Fig. 6); in section made partly above calice floor mostly 31/11.0 mm. Major septa vary in length and thickness; commonly thickest at tabularium-dissepimentarium boundary; some major septa slightly swollen axially; together with tabulae form axial structure characteristic of *Dibunophyllum*. Axial structure broad (ds/d generally 6/14.0 mm). Septa thin in dissepimentarium, wedge-shaped in tabularium, with thin inner ends. Minor septa short, forming low ridges on corallite wall up to 1/2 the length of major septa, thickened in tabularium. Dissepimentarium narrow, with up to 5 ranks of small, globose dissepiments. Tabularium biform; tabulae slightly elevated at axis, declined towards wall. Inclination angle reaches 45° (Pl. 13, Fig. 4d).

ONTOGENY: Ontogeny has been studied in the holotype (specimen UAM.IG.Tc.C.G-9/11a/7). In the youngest identified ontogenetic stages (Pl. 13, Figs 1a-b), the septal index n/d is 7-8/1.5x2.3-2.0x2.3. The cardinal and counter septa join at the corallite axis. Three metasepta, which are already present at this stage, are connected with the protosepta halfway along their length. All the septa are slightly swollen. The wall is 0.2 mm thick.

At the next stage of growth (Pl. 13, Fig. 1c) there are 16 major septa and the corallite diameter is 3.0 mm. The major septa vary in length and are partly free and withdrawn from the axial area. The cardinal, counter and counterlateral septa remain united at the corallite axis. The axial structure, composed of an axial septum, a few septal lamellae and axial tabellae (Pl. 13, Figs 1d-e)

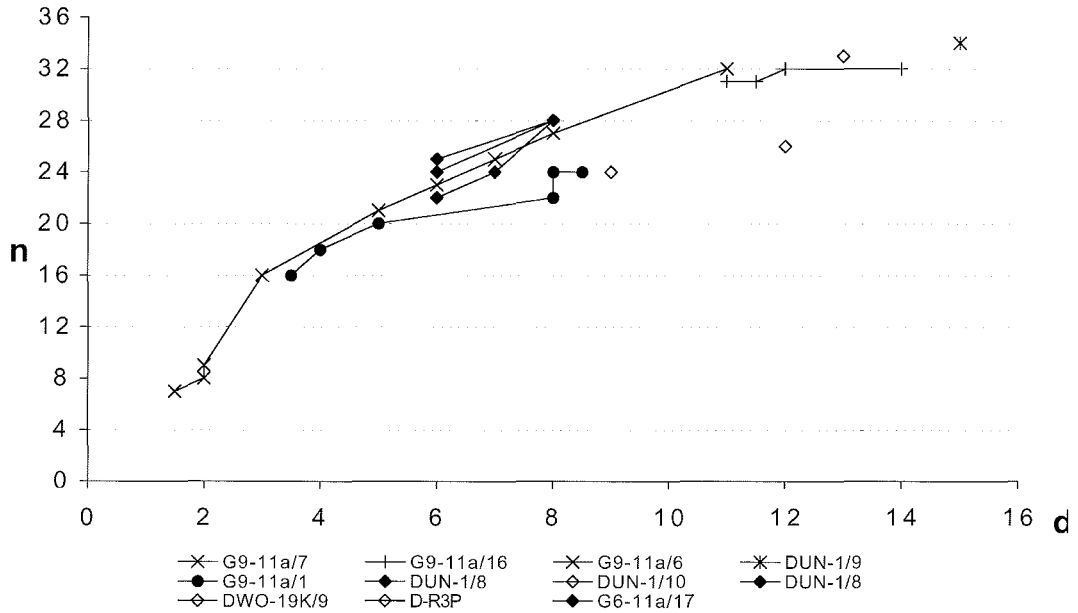


Fig. 6. Number of major septa *v.* diameter for specimens placed in *Bounophyllum pomeranicum* sp. nov.; n – number of major septa, d – diameter (mm); symbols joined by lines represent values taken from individual specimens.

appears at n/d = 21/4.5 mm. The major septa are thin, varying in length, with the shortest not extending 1/3 of the corallite radius and the longest 2–3 septa reaching the corallite axis and joining the axial septum. This growth stage differs from the juvenile stage in the rearrangement of the major septa into an almost pinnate pattern. The connection of counter and cardinal septa with the axial septum emphasises the bilateral symmetry. In the transverse section at n/d index = 20/4.5x5 (Pl. 13, Fig. 1e). The minor septa are usually missing or rudimentary. The major diversification of morphological structure took place at n/d = 22/5.5x8.5 (Pl. 13, Fig. 1f). At this growth stage, the first dissepiments appeared between some major septa and the axial structure is already well developed (ds/d = 2x3.5/5.5x8.5): it is composed of a sigmoid, initial lamella, which is connected with the cardinal and counter septa, dispersed septal lamellae, corresponding approximately to the major septa, and numerous axial tabulae; the major septa are thin and can reach 1/3 of corallite radius. The thickening of septa within the tabularium appears along the first dissepiments (Pl. 13, Figs 1f-g). The incomplete dissepimentarium is composed of 1–2 ranks of concentric dissepiments. The minor septa are short, forming low ridges on the corallite wall. The complete dissepimentarium, with 3–4 ranks of dissepiments, appears in a transverse section when n/d amounts to 30/8.0 mm. In the lower part of the calice the septal index n/d is 32/9 (Pl. 13, Fig. 1h), major septa reach up to 2.5 mm in length; the minor septa reach 1/2 the length of the major septa and are free or contrajunct, barely penetrating the outer tabularium. The dissepimentarium is regular, occupying 1/4 of the corallite radius, and composed of 4-5 ranks of concentric dissepiments. The axial structure gradually decreases. In half of the calice length the ds/d index amounts to 4/9.5 mm. The microstructure of the septa is trabecular (Pl. 12, Fig. 4).

OCCURRENCE: Poland, Western Pomerania – uppermost Famennian.

Genus *Spirophyllum* FEDOROWSKI, 1970

TYPE SPECIES: *Spirophyllum sanctaecrucense* FEDOROWSKI, 1970.

DIAGNOSIS: See FEDOROWSKI (1970, p. 571).

REMARKS: Differences between the genera: *Spirophyllum*, *Carruthersella* and *Amygdalophyllum* concern the construction of the axial structure, which can be with free or closely spaced septal lamellae (dependent on the genus), and in the dissepimentarium, which, apart from interseptal dissepiments, can also include lonsdaleoid dissepiments.

POTY (1981) believed that the generally smaller dimensions of specimens of *Carruthersella* were more diagnostic than the presence of lonsdaleoid dissepiments, which can also occur in *Amygdalophyllum*. Because of the lack of lonsdaleoid dissepiments in Pomeranian specimens, and in view of their general similarity to *Carruthersella* and *Amygdalophyllum* (resulting from their affinity – FEDOROWSKI 1970, SEMENOFF-TIAN-CHANSKY 1974), I decided to place them in *Spirophyllum*. Amygdalomorphic corallites from the Lower Viséan of the Isle of Man, UK, described by POTY (1981) as *Carruthersella compacta*, do not include lonsdaleoid dissepiments either; they differ from the Pomeranian specimens in their axial structure, which is connected to the major septa.

Because of the poor and fragmentary preservation of the research material, it was not possible to trace, on the Pomeranian specimens, the feature of axial structure complexity that differentiate *Amygdalophyllum* from *Spirophyllum* (with a more complicated axial structure); the axial structure tends to become simplified to a degree in which it appears identical to that of *Amygdalophyllum*. However, as in *Spirophyllum*, the connection of major septa with the axial structure in the late growth stage was not observed in the Pomeranian specimens. It is often observed in the Australian species of the genus *Amygdalophyllum*. The connection of major septa and the axial structure is also present in *Carruthersella compacta*.

?*Spirophyllum* sp.
(Pl. 11, Fig. 5)

MATERIAL: Two corallites, both from Biesiekierz-2 (Tc.C.BKZ-2/10, 11 - 3135.1); four thin sections and two acetate peels from transverse section.

DESCRIPTION: Solitary corals with massive columella composed of closely connected septal lamellae (Pl. 11, Fig. 5c). Major septa thick, straight, reaching up to 3.0 mm in length; in young stages connected with axial structure, which includes distinct main lamella *sensu* FEDOROWSKI (1970). Septal index n/d = 29/9. Minor septa reach 1/2 to 2/3 length of major septa, commonly penetrating outer tabularium. Dissepimentarium with interseptal dissepiments, up to 1/5 corallite radius in width.

REMARKS: A thick amygdalophylloid columella and axially rotating inner margins of the major septa are the main characters that the Pomeranian specimens have in

common with the genus *Spirophyllum*. The remaining diagnostic features of the latter genus are absent from the specimens discussed, resulting in its questionable identification.

Famennian *Spirophyllum*? sp. from the Holy Cross Mountains, described by BERKOWSKI (2002), was considered by that author a homeomorph of the Upper Viséan representatives of that genus. It differs from the Pomeranian specimens in an underdeveloped dissepimentarium, very short minor septa and a wide, complex axial structure.

OCCURRENCE: Tournaisian (tentative dating in *sulcata–duplicata* zones).

Genus *Eostrotion* VAUGHAN, 1915

TYPE SPECIES: *Cyathaxonia tortuosa* MICHELIN, 1846.

DIAGNOSIS: See HILL (1981, p. F365).

REMARKS: CARRUTHERS (1913) synonymized *Cyathaxonia tortuosa* with *Lophophyllum konincki* MILNE-EDWARDS & HAIME, 1850 – the type species of *Lophophyllum* MILNE-EDWARDS & HAIME, 1850. VAUGHAN (1915) did not agree with CARRUTHERS's (1913) classification and restored the previous concept of *Lophophyllum* and, at the same time, designated *"Lophophyllum" tortuosum* (MICHELIN, 1846), a species preserved by CARRUTHERS (1913), as the type species of his new genus *Eostrotion*. On the basis of L. DE KONINCK's original specimens received from the Royal Institute of Natural Science from Belgium, LECOMPTE (1955) described them in detail (in LECOMPTE's opinion, type specimens of *Cyathaxonia tortuosa* do not exist); however, although they are similar to the specimens from *Eostrotion*, he classified them as *"Lophophyllum" tortuosum*. HILL (1981) stood by VAUGHAN's (1915) opinion and named corallites from KONINCK's collection, which possess dissepiments, as *Eostrotion*, while corallites without dissepiments she named *Lophophyllum*. The present author complies with HILL (1981) classification for the Pomeranian specimens and uses the name *Eostrotion*.

Eostrotion tortuosum (MICHELIN, 1846)
(Pl. 1, Fig. 4; Pl. 12, Fig. 1)

1846. *Cyathaxonia tortuosa* nov. sp.; MICHELIN, p. 258, Pl. 59
1851. *Cyathaxonia tortuosa* MICHELIN; MILNE-EDWARDS & HAIME, p. 322.
1913. *Lophophyllum tortuosum* (MICHELIN); CARRUTHERS, pp. 50-53, Pl. 3, Fig. 1.
1915. *Eostrotion* (*"Lophophyllum"*) *tortuosum* (MICHELIN); VAUGHAN, pp. 39-40.
1955. *"Lophophyllum" tortuosum* (MICHELIN); LECOMPTE, p. 411, Pl. B, Figs 1-4.

DIAGNOSIS: Based on the specimens from L. DE KONINCK's collection, collected in 1872 year, described by LECOMPTE (1955). Solitary corals up to 40.0 mm in length; calice deep with protruded columella; septal index n/d = 23-26/12-22; major septa, except cardinal and counter septa, do not reach corallite axis; in young stages cardinal and counter septa united with oval pseudocolumella; in older stages, cardinal and counter septa withdrawn from axis to leave narrow axial structure; cardinal fossula distinct; minor septa free; reach 1/4 length of major septa; dissepimentarium broad up to 3.5 mm wide with small interseptal dissepiments (up to 8.0 mm in corallite diameter dissepiments absent).

MATERIAL: Eight specimens, from various localities: Biesiekierz-2 (Tc.C.BKZ-2/10C, 10D - 3145.5), Błotno-3 (Tc.C.BŁT-3/1 - 3967.3; Tc.C.BŁT-3/2 - 4075.1; Tc.C.BŁT-3/6 - 4355.5; Tc.C.BŁT-3/9 - 4408.2), Daszewo-19K (Tc.C.DSO-19K/71 - 3255.4); three thin sections and six acetate peels from transverse sections.

DESCRIPTION: Solitary corals, 8 mm long with deep calice occupying 1/2 corallite length. Septal index n/d = 33/11.0 mm. Major septa reach up to 3/4 corallite radius in length, some connected with pseudocolumella. Cardinal and counter septa beneath calice floor (Pl. 12, Fig. 1e), always united with elongated (2.0x0.7 mm) pseudocolumella. In lower part of calice (Pl. 12, Fig. 1f), cardinal and counter septa withdrawn from axis to leave narrow pseudocolumella. Minor septa free, 1.0 mm in length. Dissepimentarium composed of 2-3 ranks of small globose, locally herringbone dissepiments. Tabulae incomplete. Tabellae steeply declined towards axial structure External corallite wall 0.15 mm thick.

In the ontogenetically earliest growth available for the study (Pl. 12, Figs 1a-d) major septa vaviable in length, and connected to the inner margins of the longest ones at their various parts. The longest reach the lens-shaped columella. Minor septa appear on the inner surface of the external wall as low protuberances. Dissepiments are absent.

REMARKS: The horn shape of the corallite, its deep calice (Pl. 11, Fig. 1g), a distinct bilateral symmetry, emphasized by connection of the cardinal and counter

septa with the lens-shaped columella and n/d ratio (31/11 *versus* 32/10-13) are characters in common with *Lophophyllum konincki*. However, the latter genus is non-dissepimental. The horn-shaped type specimen of *E. tortuosum* resembles Pomeranian specimens in its comparatively wide dissepimentarium, lens-shaped columella connected in early growth with the cardinal and counter septa, long major septa, mostly approaching the columella and slightly twisted axially and short minor septa. The main differences are restricted to the n/d ratio (26/22 for Belgian specimens), and late (on the calice floor) disconnection of the cardinal and counter septa from the columella (Pl.12, Fig. 1f), whereas the counter septum may join the columella in the DE KONINCK originals, and the cardinal septum may be shortened to 2/3 the length of the adjacent major septa as documented by LECOMPTE (1955). Also other features characterising the Belgian material and known from the Pomeranian specimens suggest that they are conspecific. Differences listed above are treated as within the range of intra specific variability.

OCCURRENCE: Belgium, Great Britain – Tournaisian; Poland (Western Pomerania) – Tournaisian.

Subfamily Amygdalophyllinae GRABAU, 1935
Genus *Rylstonia* HUDSON & PLATT, 1927

TYPE SPECIES: *Rylstonia benecompacta* Hudson & Platt, 1927.

DIAGNOSIS: See HUDSON & PLATT (1927, pp. 39-44). According to HUDSON (1943, p. 139) "dissepiments and minor septa appear in advanced species".

Rylstonia cf. *smythi* WEYER, 1975
(Pl. 12, Fig. 3)

MATERIAL: Single specimen from Dygowo-1 (Tc.C.D-1/9a - 4005.5); five acetate peels and two thin sections.

DESCRIPTION: In transverse section made partly above calice floor, round, 6.7 mm in diameter. Septal index n/d = ?24/6.7. Major septa, together with cardinal septum, in lower part of calice united at axis with pear-shaped axial structure (β type *sensu* HUDSON & PLATT 1927). Major septa in cardinal quadrants thicker and more rhopaloid than in counter quadrants. Alar septa sporadically shorter than other major septa, in weakly marked fossula. Cardinal septum short, 0.9 mm in length, in well developed, deep fossula bordered by two major septa. Minor septa and dissepiments absent. Major septa in upper part of calice shortened, reaching 1.7 mm in length (Pl. 12, Fig. 3b); axial structure broad, united with counter septum.

REMARKS: This specimen is morphologically similar to Upper Tournaisian specimens from Rügen (Tab. 3); however, it also shows some resemblance to stratigraphically younger species. The corallite dimensions, lack of rhopaloid septa, dissepiments, complex axial structure

Name of species	Major septa	Minor septa	Dissepimentarium	Axial structure
R. benecompacta Hudson & Platt, 1927	n/d=28/17, in dissepimentarium discontinuous	short	narrow	broad, β type
R. contorta (Vaughan, 1906)	40	none	none	β type
R. brevisepta Hudson, 1942	n/d=26/18, in dissepimentarium continuous	none or rudimentary	narrow	β type
R. kusbassica Dobrolyubova, 1966	n/d=42/20	42, up to 1/3 length of major septa	broad, 1/3 corallite radius in length	broad, compact
R. smythi Weyer, 1975	n/d=23/9.5-10	fine in rim of calice	narrow, only in upper part of calice.	α/β type
R. stirtonensis Hudson, 1943	n/d=6/12	none or form low ridges	none	oval, lamellae radially arranged (α)
R. tenuicolumna Smyth, 1930	n/d=30/10,	short	narrow	δ type
R. cystea Keller, 1959	n/d=21/10	21	interseptal, lonsdaleoid	no data
Pomeranian specimen	n/d=24/6,7	none	none	β type

Tab. 3. Morphological similarity of species of the genus *Rylstonia*

composed of pseudocolumella and radially arranged major septa, all indicate that it is a juvenile stage of *R. smythi*. Juvenile stages of *R. benecompacta,* differ from those of *R. smythi* in the presence of distinct septal furrows and a columella that occupies up to 1/8 of the corallite diameter.

OCCURRENCE: Poland, Western Pomerania – Upper Famennian.

Subfamily Clisiophyllinae NICHOLSON, 1889
Genus *Cyathoclisia* DINGWALL, 1926

TYPE SPECIES: *Cyathoclisia tabernaculum*, DINGWALL, 1926.

DIAGNOSIS: See HILL (1981, p. F360).

Cyathoclisia modavensis (SALÉE, 1913)
(Pl. 12, Fig. 2)

1913. *Clisiophyllum modavense* n.sp.; SALÉE, p. 206, pl. 5, fig. 3.
1960. *Cyathoclisia modavensis* (SALÉE); SOSHKINA, p. 282, pl. 1, figs 1-7; text-figs 6-7.
1966. *Cyathoclisia modavense* (SALÉE); DOBROLYUBOVA & al., p. 42, pl. 2, fig. 1.
1981. *Cyathoclisia modavensis* (SALÉE); POTY, p. 44, pl. 19, figs 1-5.
1984. *Cyathoclisia modavensis* (SALÉE); POTY & ONOPRIENKO, p. 210, pl. 34, fig. 7.

DIAGNOSIS: See POTY (1981, p. 44).

MATERIAL: Three specimens; from Błotno-3 (Tc.C.BŁT-3/3 - 4075.1; Tc.C.BŁT-3/2 - 4355.1) and Brda-1 (Tc.C.BRD-1/7 - 2524.3); four acetate peels from transverse sections.

DESCRIPTION: Solitary, conical. Septal index n/d = 19-22/4.4-6.5. Major septa thin, straight, joined with spindle-like columella, with peripheral ends slightly dilated. Cardinal septum disconnected from columella immediately below calice. Counter septum and a few major septa join axial structure. Only counter septum joins axial structure on calice floor. Minor septa straight, up to 0.4 mm in length. Columella 1.3 x 0.4 mm wide; median lamella (*sensu* FEDOROWSKI 1970) distinct. In young stages columella regular, thickened by rhopaloid ends of major septa; in later growth stages irregular, connected to counter and cardinal septa and other long major septa. Tabulae incomplete, declined to columella in corallite axis and inclined towards external wall, composed of sigmoidal and bulbose tabellae (Pl. 12, Fig. 2e). Dissepimentarium absent, but individual dissepiments already present (Pl. 12, Fig. 2e). External corallite wall 0.2 mm thick.

REMARKS: A complete description of the successive growth stages and ontogenetic changes of *Cyathoclisia modavense* was presented by SOSHKINA (1960). Specific determination of the Pomeranian material, represented by young stages only (lack of dissepimentarium, smaller diameter and smaller number of septa) is based largely on SOSHKINA's material (1960, pl. 1, fig. 1) from the Peczora River, Russia, which includes a number of juveniles. All specimens have similar septal index, elliptical axial structure and arrangement of major and minor septa. According to SOSHKINA (1960) dissepiments appear only in mature growth stages, at septal index n/d = 60/22.0 mm.

OCCURRENCE: Western Europe – Upper Tournaisian – lowermost Viséan (Cf4α foraminiferal Subzone); Russia: East-European Platform, Donetsk Basin, the Urals, Kuznetsk – Tournaisian; Poland, Western Pomerania – Tournaisian.

Family Palaeosmiliidae HILL, 1940
Genus ?*Palaeosmilia* MILNE-EDWARDS & HAIME, 1848

TYPE SPECIES: *Palaeosmilia murchisoni* MILNE-EDWARDS & HAIME, 1848.

DIAGNOSIS: See HILL (1981, p. F374).

REMARKS: The general appearance and most of the morphological elements of the Pomeranian specimens make them similar to those of the Viséan *Palaeosmilia*. The Famennian species was first described as *Cyathophyllum aquisgranense* by FRECH (1885), later CONIL (1961) synonymized it with *Palaeosmilia*. The difference between Viséan and Famennian species of *Palaeosmilia* are difficult to trace (see BERKOWSKI 2002). *Palaeosmilia* also resembles another genus, namely *Campophyllum* MILNE-EDWARDS & HAIME, 1850, which is characterised by horizontal tabulae, slightly shortened major septa, a narrow dissepimentarium, and a weakly marked, broad, short fossula. The latter is clearly different from the *Palaeosmilia*-type of cardinal fossula (key-hole-shaped). Some of the Pomeranian specimens also resemble representatives of the genus *Molophyllum* ONOPRIENKO, 1979, particularly its mature stages, with flat domed tabulae with a slightly concave central part

and downturned edges, which are thus of the *Palaeosmilia* type; young stages have complete tabulae that are horizontal at the axis and thus of tabulophylloid type. The shape of the fossula in *Molophyllum* does not resemble the characteristic *Palaeosmilia* "keyhole" cardinal fossula at any growth stage.

Some Tournaisian representatives of *Palaeosmilia* (KABAKOVITCH 1952) from the Kuznetsk Basin [*Cyathophyllum* (*Strephodes*) sp. FOMITCHEV, 1939; *Palaeosmilia tshumyshensis* DOBROLYUBOVA, 1966], can show that the similarity between Upper Famennian, Tournaisian and Viséan corallites of this genus is the result of phyletic or phylogenetic changes. According to SEMENOFF-TIAN-CHANSKY (1974), some corallites placed by STUCKENBERG (1895) among *Strephodes* (now in synonymy of *Palaeosmilia*) can increase the set of Tournaisian *Palaeosmilia* known from Asia. However, there is a distinct gap in the occurrence of *Palaeosmilia* within the Tournaisian in Western Europe and Poland. As in the case of the Famennian Clisiophyllidae (i.e., "*Dibunophyllum*", "*Clisiophyllum*" and ?*Spirophyllum*), ?*Palaeosmilia* seems to be a homeomorph of the Carboniferous species.

?*Palaeosmilia aquisgranensis* (FRECH, 1885)
(Pl. 1, Fig. 9; Pl. 14, Figs 1-3)

MATERIAL: Seven specimens (including specimens from M. RÓŻKOWSKA's collection), about 40.0 mm long, without proximal ends and upper part of calice; from Babilon-1 (Tc.C.BAB-1/4 - 2622.7; Tc.C.BAB-1/5A - 2629.5 – archival data, signed by RÓŻKOWSKA 1968; Tc.C.BAB-1/3 - 2678.3; Tc.C.BAB-1/8 - 2914.7), Brda-1 (UAM.IG.Tc.C.BRD-1/7 - 2959.0), Daszewo-19K (UAM.IG.Tc.C.DSO-19K/152 - 3312.9) and Gorzysław-9 (UAM.IG.Tc.C.G-9/23 - 3206.9); eight acetate peels and ten thin sections from transverse sections and two from longitudinal section.

DESCRIPTION: Corals included here in ?*Palaeosmilia aquisgranensis* can be divided into two groups: the first group, with major septa strongly dilated in tabularium and long minor septa with their tabulariar parts dilated (Pl. 14, Fig. 3); the second group, with both cycles of septa thin, and with minor septa restricted to dissepimentarium (Pl. 14, Figs 1, 2).

Specimens possessing septal index n/d = 54/22 belong to the first group. Major septa long, varying slightly in length, generally withdrawn from axial area, to leave wide area 4.0-5.0 mm in diameter; septa straight, thicker in tabularium (up to 0.3 mm), thinner in dissepimentarium (about 0.1 mm); equal in length and thickness at calice floor; cardinal septum shorter than other major septa, 7.0 mm in length, in distinct fossula, as long as major septa and with narrow, nearly parallel walls; counter septum longer than other major septa; minor septa reach 3/4 length of major septa; dissepimentarium 2.5-3.0 mm wide, with globose, interseptal dissepiments, rarely herringbone and locally, at periphery, lonsdaleoid dissepiments; inner row of dissepiments thickened (Pl. 14, Figs 3b-c); tabulae flat or slightly concave axially with their peripheral parts downturned; bulbose tabellae at border with the dissepimentarium.

Specimens included in the second group are nearly equal in diameters with those of the first group, possessing septal index n/d = 52/19.0 mm. Major septa amplexoid, 8.7 mm long at most, approaching corallite axis on tabulae floors; generally straight, locally flexuous; in cardinal quadrants thickened in outer tabularium, thin near axis. Cardinal septum (7.3 mm long) shorter than other major septa, in narrow cardinal fossula, with almost parallel walls. Counter septum longest, reaching corallite axis. Minor septa 4.5 - 5.0 mm in length, contratingent and contrajuncted, locally slightly penetrating tabularium. Km septa longer then other minor septa. In dissepimentarium major and minor septa always carinate (Pl. 14, Fig. 1c), in tabularium carinae occur only in few major septa. Septal microstructure trabecular. Dissepimentarium occupying 1/2 of corallite radius in width, with mainly interseptal, sporadically lonsdaleoid dissepiments. Tabularium biform, tabulae flat or slightly sagging in corallite axis, with peripheral edges downturned. Peripheral tabellae dissepiment-like. External corallite wall approximately 0.1 mm thick, smooth in outline.

REMARKS: The Pomeranian specimens are similar morphologically to those from the Upper Famennian of the Aachen region, described by FRECH (1885) as *Cyathophyllum aquisgranense*. POTY (1984) referred this species to the genus *Palaeosmilia* (however, the oldest, unquestionable species of this genus – *Palaeosmilia murchisoni* MILNE-EDWARDS & HAIME, 1848 – appears in Europe in the Early Viséan – Cf4α foraminiferal Subzone). By comparison to German specimens, those from Pomerania possess shorter major septa. Only few of them may approach a corallite axis. Their microstructure is trabecular.

The radially arranged, trabecular septa dilated in the tabularium and a hat-shaped, incomplete tabulae were observed in specimens from the Holy Cross Mountains (BERKOWSKI 2002). The latter possess the keyhole cardinal fossula, long major septa, shorter minor septa and alar fossulae developed in some corallites, but lack the dissepitheca and carinae. Carinate septa occur in the

Viséan representatives of *Palaeosmilia fraternum* (REED, 1927) with the septal index n/d = 47/25.0 mm. This species also has long minor septa (up to 2/3 the length of major septa) and a long, narrow cardinal fossula. In addition to typical *Palaeosmilia*-like tabulae, they have horizontal tabulae, numbering 16-20 at 5.0 mm in the axial parts.

OCCURRENCE: France, Belgium (Etroeungt Formation, Df3ε foraminiferal Subzone), Germany: Aachen (uppermost Famennian), Poland: The Holy Cross Mountains, Western Pomerania (uppermost Famennian: Upper *expansa–praesulcata* zones).

Suborder Stereolasmatina HILL, 1981
Family Stereolasmatidae FOMITCHEV, 1953
Genus *Saleelasma* WEYER, 1970

TYPE SPECIES: *Zaphrentis delepini* VAUGHAN, 1915

DIAGNOSIS: See WEYER (1970, p. 59).

Saleelasma cf. *delepini* (VAUGHAN, 1915)
(Pl. 10, Figs 3-6)

MATERIAL: Six damaged specimens and one well-preserved specimen 10.0 mm long; from: Białogard-9 (Tc.C.BGD-9/4 - 3351.9); Dobrzyca-2 (Tc.C.DBA-2/1 - 4188.8); Karlino-1 (Tc.C.KRL-1/2 - 3645.2; Tc.C.KRL-1/2A - 3646.5), and Nowogardek-1 (Tc.C.NWG-1/1-2 - 2904.1); four thin sections and ten acetate peels.

DESCRIPTION: Calice deep, reaching 2/3 length of corallite, widely open. In transverse section round. Septal index n/d = 13-16/3-3.3 and 22/4.7 (in upper part of calice = 24/6.0). Major septa differentiated in length, thickened at periphery and at corallite axis; with metriophylloid septal flanges; inner margins of major septa joined axially. Cardinal septum long, wavy, alone in long, narrow fossula, which reaches corallite axis. Counter septum as long as other long major septa. Carinae strong, some short, hook-like, others long, septa-like. In section made partly above calice floor (Pl. 10, Fig. 5a), some major septa joined axially. In upper part of calice (Pl. 10, Fig. 5b) only a few septa of counter quadrants still joined. Minor septa strongly reduced, forming low ridges on corallite wall. Km septa form triad with counter septum, reaching counter septum at half its length in early growth (Pl. 10, Figs 3, 6a-b), but becoming almost equal in length to it in maturity (Pl. 10, Fig. 4). Wall 0.3 mm thick, nearly smooth, with weakly developed septal furrows.

REMARKS: The specimens studied are morphologically similar to *M. bouchardi* and *M.* aff. *bouchardi*, described by RÓŻKOWSKA (1969) from the Frasnian and the Late Famennian deposits of the Holy Cross Mountains respectively, from which they differ in a slightly larger septal index, joined major septa in a corallite axis, distinct cardinal fossula in maturity and a triad. Those characters are typical of the Middle Tournaisian *Saleelasma delepini* (VAUGHAN, 1915). The Pomeranian specimens differ from the type of that species in lacking a distinct cardinal fossula in early growth.

OCCURRENCE: Poland; Pomerania, uppermost Famennian.

Family Antiphyllidae ILINA, 1970
Subfamily Antiphyllinae ILINA, 1970
Genus *Bradyphyllum* GRABAU, 1928

TYPE SPECIES: *Bradyphyllum bellicostatum* GRABAU, 1928.

DIAGNOSIS: See FEDOROWSKI (1987, p. 42).

?*Bradyphyllum bojkowskii* FEDOROWSKI, 1968
(Pl. 14, Fig. 4)

1968. *Bradyphyllum bojkowskii* n. sp.; FEDOROWSKI, pp. 205-207, pl. 1,fig. 1.
2001. *Bradyphyllum bojkowskii* FEDOROWSKI; FEDOROWSKI, pp. 100, pl. 28, fig. 3, pl. 29, fig. 1.

DIAGNOSIS: See FEDOROWSKI (1968, p. 205).

MATERIAL: Two, almost complete specimens; from Brda-1 (Tc.C.BRD-1/9 - 2469.0) and Wierzchowo-11 (Tc.C.WHO-11/3 - 3150.7); Eight acetate peels and three thin sections from transverse sections, and one thin section from a longitudinal section.

DESCRIPTION: Solitary corals. Septal index n/d = 30/13. Major septa in early maturity (Pl. 14, Figs 4a-d), slightly thickened and elongated; cardinal septum and elongated counter septum dominant. Remaining major septa differentiated in length. In mature stage (Pl. 14, Figs 4e-g), major septa almost equal, up to 4.0 mm in length. Free axial area occupies about 1/3 of corallite diameter. Cardinal septum and counter septum do not differ from other major septa in length. Minor septa straight, from 0.2 mm to 0.8 mm in length. Tabularium

biform, tabulae complete, in corallite axis strongly depressed (Pl. 14, Fig. 4h). External corallite wall 1.0 mm thick, with distinct septal furrows.

REMARKS: The Pomeranian specimens bear some similarity to the Upper Viséan *B. bojkowskii*, known from the Lublin region, but differ from the latter in having thin major septa, the cardinal septum not shortened, and in both the morphology and strong biformity of the tabularium. Non-rhopaloid, thin septa and a different septal index also distinguish the Pomeranian specimens from another *Bradyphyllum* species known from Poland (Holy Cross Mountains), namely *B. differentiatum* FEDOROWSKI, 1973 – the stratigraphically oldest species of *Bradyphyllum*, occurring most probably in the *praesulcata - sulcata* Zones (FEDOROWSKI 2001).

OCCURRENCE: Poland, Pomerania – the ages that have been suggested for ?*Bradyphyllum* sp., based on the associated coral species (*Caninia cornucopiae, Zaphrentites parallela, Siphonophyllia cylindrica hasteriensis, Sychnoelasma konincki*), range from Tournaisian to Viséan.

Genus *Rotiphyllum* HUDSON, 1942

TYPE SPECIES: *Densiphyllum rushianum* VAUGHAN, 1908.

DIAGNOSIS: See FEDOROWSKI (1989, p. 298).

Rotiphyllum sp. A
(Pl. 1, Fig. 5; Pl. 15, Fig. 4)

MATERIAL: Six specimens from various localities: Biesiekierz-2 (Tc.C.BKZ-2/7 - 3123.1), Dygowo-1 (Tc.C.D-1/8 - 3571.0; Tc.C.D-1/18 - 3670.6; Tc.C.D-1/9 - 3862.0), Gorzysław-9 (Tc.C.G-9/19 - 3204.5), Wierzchowo-11 (Tc.C.WHO-11/2 - 3154.4); three thin sections and five acetate peels, all from transverse sections.

DESCRIPTION: Corallites conical, with a flat external corallite wall on one side near proximal end. Calice 8.5 mm - 12.0 mm in diameter. Septal index n/d = 26/12. Major septa, except CL4 septum, up to 3.5 mm in length; in zaphrentoid arrangement. Stereocolumella distinct in young stages. Cardinal and counter septa long; cardinal septum remains long on calice floor (Pl. 15, Fig. 4b). Major septa, except for short cardinal septum, equal in length in calice. Minor septa appear as short crests in upper part of calice. Alar fossulae distinct; counter fossula commonly recognizable. External corallite wall thin.

REMARKS: The Pomeranian specimens exhibit some similarity to *R. diutinum* FEDOROWSKI 1990, from which it differs in the septal index (for *R. diutinum* n/d = 18/4.5) and in long, straight and non-rhopaloid major septa adjacent to the cardinal septum. Also, migration of that species between the Western Interior Province in the USA and Pomerania seems most unlikely (FEDOROWSKI, personal communication).

OCCURRENCE: Poland, Pomerania, Tournaisian.

Rotiphyllum sp. B
(Pl. 15, Figs 1-2)

MATERIAL: One specimen with upper part of calice from Dygowo-1 (Tc.C.D-1/22 - 3845.3), and four specimens with broken proximal ends and without upper parts of calice; from various localities: Białogard-7 (Tc.C.BGD-7/1 - 3157.4), Dygowo-1 (Tc.C.D-1/13 - 3684.0), Gorzysław-9 (Tc.C.G-9/6 - 3189.1), Kłanino-3 (Tc.C.KŁO-3/7 - 3439.1); seven acetate peels and five thin sections from transverse sections.

DESCRIPTION: The specimen from Dygowo-1 (Pl. 15, Fig. 1) possesses septal index n/d = 22/8. Cardinal and counter septa equal in length to other major septa on calice floor (Pl. 15, Fig. 1a). In upper part of calice, major septa withdrawn from axis, leaving a free area 1.5 mm in diameter; counter septum as long as major septa; cardinal septum shorter, reaching 1.0 mm in length (Pl. 15, Fig. 1b). Cardinal and counter fossulae distinct. Minor septa absent or forming low ridges on corallite wall. External corallite wall approximately 0.4-0.5 mm thick.

The septal index n/d of specimens from the remaining cores = 21/5.0. Major septa vary in length, clustered in four fascicles; longest major septa joined at corallite axis, thicker in cardinal quadrants than in counter quadrants. Major septa in mature growth shortened and free (Pl. 15, Fig. 2c). Cardinal septum in early growth stage long and thick, reaching corallite axis; still long in section made partly above calice floor (Pl. 15, Fig. 2b); reduced in upper part of calice to 0.5 mm (Pl. 15, Fig. 2c). Cardinal fossula distinct, approximately 2.5 mm long; in young stage widened in periaxial area and bordered by M3 septa, inner parts of M2, M1 and alar septa next to corallite axis. It broadens axially in lower part of calice.

REMARKS: The Pomeranian specimens described above belong to the stratigraphically oldest representa-

tives of the genus *Rotiphyllum*. Their incomplete preservation precluded a more comprehensive comparison to remaining species of the genus.

OCCURRENCE: Poland, Pomerania, Tournaisian.

Genus *Drewerelasma* WEYER, 1973b

TYPE SPECIES: *Drewerelasma schindewolfi* WEYER, 1973b.

DIAGNOSIS: See WEYER (1973b, p. 975).

Drewerelasma sp. A
(Pl. 1, Fig. 1; Pl. 15, Fig. 3)

MATERIAL: Two specimens without proximal ends; from Biesiekierz-2 (Tc.C.BKZ-2/3 - 3123.1; Tc.C.BKZ-2/18B - 3145.5); 8 thin sections and six acetate peels from transverse section.

DESCRIPTION: Corallites round in transverse section, 11.0 mm in diameter at calice floor. Septal index n/d = 26/6x8. Major septa thick, varying in length approaching corallite axis; longest ones enclose inner part of fossula at corallite axis. Cardinal septum long, in well developed fossula, localized in convex side of corallites. Alar fossulae distinct. Minor septa very short and/or appearing as short crests, locally absent. Km septa approaching axial area and forming characteristic triad with counter septum. External corallite wall 0.5 mm thick. Septal microstructure trabecular (Pl. 15, Fig. 3e).

In lower part of calice, major septa reach 1/2 corallite radius in length – first withdrawn major septa in counter quadrants; initially zaphrentoid arrangement of septa changes into radial pattern; cardinal septum shortened up to 1/2 length of major septa.

REMARKS: The lack of carinae on the septa distinguishes the Pomeranian specimens from the other described species of this genus. However, distinct carinae occur exclusively in *D. schindewolfi* WEYER 1973 from the Lower Tournaisian of the Rhenish Mountains (WEYER 1973, p. 977, figs 1, 2). In addition to the lack of carinae, Pomeranian specimens differ from that species in septal index (26/6x8 *versus* 20/7.5). *Drewerelasma* n. sp. A of WEYER (1993, pl. 2, figs 1-11), from the Isle of Rügen is morphologically much closer to the Pomeranian specimens. Carinae in that species are recognizable only in a single transverse section out of eleven illustrated by WEYER (1993, pl. 2, fig. 7), suggesting an extreme rarity in their occurrence. It may well be that such rare carinae occur in the Pomeranian specimens, but were omitted from the sections. All characters of the Pomeranian specimens, except for the development of carinae, are nearly identical to those of the specimens from Rügen.

If the idea by SANDO (1977) and POTY (1981) is accepted, the absence or presence of carinae is not a diagnostic character and should be reduced to intraspecific or ecological variation. Thus, the Pomeranian specimens may be conspecific with those from Rügen, but not with *D. schindewolfi*, from which it differs in several characters that are more important than carinae.

OCCURRENCE: Poland, Pomerania, Tournaisian.

Subfamily Hapsiphyllinae GRABAU, 1928
Genus *Zaphrentites* HUDSON, 1941

TYPE SPECIES: *Zaphrentites parallela* CARRUTHERS, 1910.

DIAGNOSIS: See HILL (1981, p. F316).

Zaphrentites parallela (CARRUTHERS, 1910)
(Pl. 15, Fig. 6)

1910. *Zaphrentis parallela* sp. nov.; CARRUTHERS, p. 533, pl. 37, fig. 4.
1941. *Zaphrentis parallela* CARRUTHERS; HUDSON, p. 292.
1966. *Zaphrentites parallelus* (CARRUTHERS); DOBROLYUBOVA & *al.*, p. 26, pl. 1, figs 4-7.

DIAGNOSIS: See HUDSON (1941, p. 292).

MATERIAL: Four specimens with broken proximal ends and without upper parts of calice; from various localities: Białogard-7 (Tc.C.BGD-7/1 - 3157.4), Dygowo-1 (Tc.C.D-1/22(1) - 3684.0), Gorzysław-9 (Tc.C.G-9/6 - 3189.1), Kłanino-3 (Tc.C.KŁO-3/7 - 3439.1); five acetate peels and five thin sections.

DESCRIPTION: Longest corallite 15.0 mm long, cylindrical in transverse section, 4.5 mm in diameter in lower part and 7.0 mm in diameter in upper part. Septal index n/d = 25/6.0-7.0. Major septa vary in length, clustered in four fascicles; longest joined at corallite axis. In mature growth stages some major septa shortened and free. Cardinal septum in early growth stage long and thin, reaching corallite axis (Pl. 15, Fig. 6a), in later growth stages thin and short; at calice floor (Pl. 15, Fig. 6b)

reaching 1/2 corallite radius in length. Cardinal fossula distinct, approximately 2.5 mm long, in early growth narrowed adaxially, reaching corallite axis (Pl. 15, Fig. 6a). In more advanced growth bordered by two nearly parallel or parallel major septa, this character being retained up to middle part of calice (Pl. 15, Figs 6b-d).

REMARKS: Characteristic features for this species are the parallel walls of the fossula and the shortened cardinal septum. The preserved parts of corallites from Pomerania do not differ from the corallites from the Tournaisian of Scotland, described by CARRUTHERS (1910) and from the Kuznetsk Basin, described by DOBROLYUBOVA & *al.* (1966).

OCCURRENCE: Western Europe, Tournaisian, Upper Viséan; Russia (Eastern European Platform, the Urals, Kuznetsk, Donbas), Upper Tournaisian, Upper Viséan; Poland (Western Pomerania), Tournaisian.

Zaphrentites cf. *parallela* (CARRUTHERS, 1910)
(Pl. 1, Fig. 6; Pl. 15, Fig. 5)

MATERIAL: Three specimens: one from Brda-1 (Tc.C.BRD-1/2 - 2192.2) and two from Grzybowo-1 (Tc.C.GRB-1/1 - 3082.1; Tc.R.GRB-1/2A - 3084.1 - from M.RÓŻKOWSKA's collection); five acetate peels from transverse sections.

DESCRIPTION: Septal index n/d = 17/5.0 mm. Zaphrentoid arrangement of major septa in all growth stages. Minor septa commonly appear as short crests on corallite wall. Major septa of counter quadrants, including counter septum, shorter than major septa in cardinal quadrants. Cardinal septum long up to calice floor (Pl. 15, Figs 5a-b). Cardinal fossula narrow, closed, triangular in early growth (Pl. 15, Fig. 5a), parallel-walled in maturity (Pl. 15, Fig. 5b), where it is bordered by two major septa. At calice floor (Pl. 15, Fig. 5c) it narrows adaxially at periphery, but possesses parallel walls in periaxial area. Cardinal septum shortened in calice to 1/4 length of major septa. Arrangement and length of major septa at calice floor similar to those below calice.

REMARKS: The morphology of the cardinal fossula, different septal index (17-20/4.5-7.0 in *Zaphrentites parallela*) and the long-lasting elongation of the cardinal septum in the Pomeranian specimens prevent their indisputable identification as *Zaphrentites parallela*.

OCCURRENCE: Poland, Western Pomerania – Tournaisian.

Zaphrentites cf. *crassus* (HUDSON, 1944)
(Pl. 1, Fig. 2; Pl. 16, Fig. 2)

MATERIAL: Two fragmentarily and poorly preserved specimens, from Brda-1 (Tc.C.BRD-1/10 - 2326.0) and Dygowo-1 (Tc.C.D-1/13 - 3684.0); three acetate peels and four thin sections from transverse sections.

DESCRIPTION: The preserved fragments reach 10.0 mm in length; in transverse section round, 5.5 mm in diameter in lower part of fragments and 6.5 mm in diameter in calice rim. Septal index n/d = 21/5.5 mm in lower part of calice. Major septa vary in length, reaching 3/4 corallite radius; nearly radially arranged, joined periaxially. Cardinal septum reaches 1/2 length of neighbouring major septa; cardinal fossula keyhole, deep and elongated, attaining a corallite axis; thick near corallite wall, tapering toward axis. Cardinal septum in lower part of calice shortened up to 1/4 length of major septa. In calice rim all septa very short. Septal formula: C, CL3-4, A, KL5, K at corallite diameter over 5.0 mm. Alar fossulae well expressed.

REMARKS: Diagnosis of most of the species of the genus *Zaphrentites* requires sections from their young stages in order to follow the ontogenetic changes in the shape of the fossula [although this view is questioned sometimes (e.g. CARRUTHERS 1910)]. The impossibility of studying this feature in the Pomeranian corallites is the reason why these specimens are left here in open nomenclature, referred to *Z.* cf. *crassus*, which is characterised by a V-shaped fossula in its young stages (HUDSON 1944, text-fig. 1; pl. 1, figs 1b, 1c). Of the other species with a similar fossula shape to that in the Pomeranian specimens, *Z. pseudoparallela* HUDSON, 1941, *Z. disjuncta* CARRUTHERS, 1910, and *Z. brevisepta* HUDSON, 1941 differ in the longer cardinal septum and/or longer counter septum, or a lack of stereoplasm; *Z. subcarruthersi* VASILYUK, 1960, has twice as many septa in the counter quadrants than in the cardinal quadrants.

OCCURRENCE: Poland, Pomerania, Tournaisian.

Family Zaphrentoididae SCHINDEWOLF, 1938
Subfamily Zaphrentoidinae SCHINDEWOLF, 1938
Genus *Sychnoelasma* LANG, SMITH & THOMAS, 1940

TYPE SPECIES: *Verneuilia urbanowitschi* STUCKENBERG, 1895.

DIAGNOSIS: See HILL (1981, p. F318).

Sychnoelasma konincki (MILNE-EDWARDS & HAIME, 1851)
(Pl. 16, Fig. 1)

1851. *Zaphrentis konincki* n.sp.; MILNE-EDWARDS & HAIME, p. 331, pl. 5, fig. 5.
1908. *Zaphrentis konincki* M-EDW. & HAIME; CARRUTHERS, p. 67, pl. 5, figs 1-4.
1910. *Zaphrentis konincki* M-EDW. & HAIME; SALÉE, pl. 9, figs 2a-e.
1931. *Zaphrentis konincki* M-EDW. & HAIME; FOMITCHEV, p. 16, pl. 1, fig. 4.
1938. *Zaphrentis konincki* M-EDW. & HAIME; GORSKY, p. 18, pl. 2, fig. 4.
1960. *Zaphrentis konincki* M-EDW. & HAIME; SOSHKINA, p. 278, fig. 2.
1960. *Verneuilites konincki* var. *calmisia* (LISSITZIN); VASILYUK, p. 48, pl. 12, fig. 2.
1962. *Sychnoelasma konincki* M-EDW. & HAIME; DOBROLYUBOVA & KABAKOVITCH, pl. 13, fig. 2.
1966. *Sychnoelasma konincki* M-EDW. & HAIME; DOBROLYUBOVA, KABAKOVITCH & SAYUTINA, p. 36-40, pl. 1, fig. 14-16.
1967. *Sychnoelasma konincki* (M-EDW. & HAIME); IVANOVSKY, p. 43, pl. 2, figs 5-6.
1972. *Sychnoelasma* nov. sp. aff. *konincki* (M-EDW. & HAIME); WEYER, pl. 2, fig. 1.
1984. *Sychnoelasma konincki* (M-EDW. & HAIME); POTY & ONOPRIENKO, pl. 34, fig. 4.
1990. *Sychnoelasma konincki* (M-EDW. & HAIME); VUILLEMIN, p. 40, text-fig. 21, pl. 1, fig. 10.

DIAGNOSIS: See IVANOVSKY (1967, p. 43).

MATERIAL: Two specimens; from Brda-1 (Tc.C.BRD-1/5 - 2262.0) and Brda-2 (Tc.C.BRD-2/1 - 2358.1); four acetate peels from transverse sections.

DESCRIPTION: Solitary corals with thin major septa, withdrawn from axial area at a mature stage. Septal index n/d = 20-28/3-5.0 mm. Calice deep. Major septa zaphrentoidally arranged, varying in length; counter septum longest, extending to corallite axis. Inner ends of major septa of cardinal quadrants fused to form thickened wall of keyhole cardinal fossula. Alar pseudofossulae indistinct (Pl. 16, Figs 1a-c). Minor septa free, straight, 0.3-0.4 mm in length. Cardinal and counter septa slightly shortened in ontogenetically earliest stage preserved (Pl. 16, Fig. 1a). Cardinal septum intersects entire cardinal fossula up to calice floor, but became shortened to 0.5 mm in middle part of calice. External corallite walls approximately 0.1-0.5 mm thick, with distinct growth striae.

REMARKS: The Pomeranian specimens differ from the remaining representatives of this species in smaller dimensions and much thinner major septa. The septal index for the type specimen (30/8, see MILNE-EDWARDS & HAIME 1851, pl. 5, fig. 5) and other representatives of *S. konincki* (35-38/10-24) is much larger than that of the Pomeranian specimens, but some of them, "*Verneuilites*" *konincki* var. *calmisia* VASILYUK 1960 from the Donetsk Basin in particular, resemble the Pomeranian specimens in the morphology and septal index of the early growth stages. However, septal index of mature growth of "*Verneulites*" *konincki* var. *calmisia* (32-40/8.0-12.0) differs distinctly. Specimens from the Armorican Massif (VUILLEMIN 1990) resemble the Pomeranian specimens in morphology and number of septa but their diameters are twice as large. Their n/d index = 25/10.

The remaining Tournaisian species (*S. hawbankense*, *S. clevedonense*) are much larger, possessing septal indexes 36-45/10-24 and 36/20 respectively.

OCCURRENCE: Armoricain Massif – Upper Tournaisian, Great Britain – Tournaisian; Belgium – Tournaisian; Ukraine: Donetsk Basin – Lower Viséan, Kuznetsk Basin – Tournaisian, Eastern Siberia (bank of Lena River) – Tournaisian, the Urals – Lower Carboniferous; Poland, Western Pomerania – Tournaisian.

Rugosa *incertae familiae*

The corallites described below represent solitary species belonging to the order Rugosa. Their fragmentary preservation and, in some cases, low numbers of specimens, made the recognition of their family level affiliation difficult. Based on the co-occurring corals, all of these corallites are dated as Late Famennian.

Genus *Conilophyllum* POTY & BOLAND, 1996

TYPE SPECIES: *Conilophyllum streeli* POTY & BOLAND, 1996.

DIAGNOSIS: See POTY & BOLAND (1996, p. 203).

REMARKS: The resemblance of the European species of the genera *Hebukophyllum* (*sensu* WEYER 1994) and *Conilophyllum* was interpreted as a result of adaptive convergence (POTY & BOLAND 1996). It seems, however, that in this case the similarity of representatives of both genera, observed in species ranging from the Upper Famennian through to the *sandbergi* Zone, has probably resulted from their evolutionary parallelism; both genera

lived in similar environments, which could have given rise to morphologically similar species.

Hebukophyllum is not a synonym of *Conilophyllum*; both genera should rather be considered as homeomorphs. The former, with its type species *H. xinjiangense* LIAO & CAI, 1987 (discussed by POTY & BOLAND, 1996), from the Hebukehe province, China, has an aulos-like structure in young stages, which does not occur in *Conilophyllum* POTY & BOLAND, 1996.

Conilophyllum priscum (MÜNSTER, 1840)
(Pl. 16, Figs 3, 4)

1840. *Cyathophyllum priscum* n.sp.; MÜNSTER, p. 114, pl. 9, figs 12b-d [non fig. 12a]
1982. *Caninia tragensis* n.sp.; POTY, p. 54, figs 2-5
1984. *Caninia tragensis* POTY; POTY & ONOPRIENKO, p. 204, pl. 31, figs 6-7
1994. *Hebukophyllum priscum* (MÜNSTER); WEYER, p. 187, pl. 1, figs 1-5; pl. 2, figs 1-6; pl. 3, figs 1-2; text-figs 4-6.
1996. *Conilophyllum priscum* (MÜNSTER); POTY & BOLAND, p. 205, pl.1, figs 1-3; pl. 2, fig. 1.
1997. *Conilophyllum priscum* (MÜNSTER); BOLAND, p. 78, pl. 1, fig. 7; pl. 2, figs 2, 4; text-figs 4, 5.

DIAGNOSIS: See POTY & BOLAND (1996, p. 206).

MATERIAL: Thirty-one specimens from various localities: Białogard-5 (Tc.C.BGD-5/1 - 3512.1), Biesiekierz-2 (Tc.C.BKZ-2/4 - 3124.2; Tc.C.BKZ-2/5 - 3132.5), Błotno-3 (Tc.C.BŁT-3/4 - 4355.1), Daszewo-17 (Tc.C.DSO-17/3A - 3447.0), Daszewo-19K (Tc.C.DSO-19K/7, 16, 21, 41 - 3254.3; Tc.C.DSO-19K/26, 29, 31, 36, 39, 171 - 3254.7; Tc.C.DSO-19K/25, 70, 78, 144, 145, 149, 172 -3255.4; Tc.C.DSO-19K/131, 132, 135, 136 - 3285.1), Dygowo-1 (Tc.C.D-1/9 - 3570.8), Niekłonice-1 (Tc.C.NCE-1/15 - 2989.5; Tc.C.NCE-1/1 - 3002.2), and Wierzchowo-4 (Tc.C.WHO-4/1 - 4730.0; Tc.C.WHO-4/3 - 4731.0); a few dozen acetate peels and several thin sections, mainly from transverse sections.

DESCRIPTION: Solitary corals, cylindrical in transverse section, reaching 17.0 mm in diameter; 22-29 major septa at 5.0 - 17.0 mm diameter. Major septa wavy, 0.1 mm thick in tabularium, commonly reaching 1/2 corallite radius. In young stages (n/d = 22/5) major septa may be thickened up to 0.3 mm. Minor septa, if any, short or varying in length, mostly contrajunct, reaching 1/5 length of major septa, exceptionally reaching 1/2 length of major septa; always shortened in young stages and strongly reduced at corallite diameter of 5.0 mm. Cardinal and counter septa equal in length and thickness to other major septa. Cardinal fossula poorly defined or absent. Dissepimentarium consists mostly of comparatively large, irregular, lonsdaleoid dissepiments, interrupting from 2 to 6 major septa (reaching 1/5 length of corallite circumference); dissepimentarium absent in youngest stages. Dissepiments (small, globose) appear first in transverse sections of 5.0 mm diameter. External corallite wall 0.2 - 0.4 mm thick, with distinct septal furrows.

REMARKS: Apart from the smaller dimensions, the Pomeranian corallites resemble the Belgian specimens in the majority of features. The septal index of Belgian corallites reaches 25-35/11-19. Both sets of material represent equivalent environments (shallow water oolitic limestone UAM.IG.Tc.C.DSO-19K - 3255.7 and deep water black clayey limestone - UAM.IG.Tc.C.DSO-19K/7 - 3254.3).

The generic affiliation of *C. priscum* was variably interpreted; POTY & BOLAND (1996), on the basis of the material from the Upper Famennian and Lower Tournaisian of Belgium, referred it to their newly created genus *Conilophyllum*, whereas WEYER (1994), on the basis of material from the Rhenish Mountains, referred it to the genus *Hebukophyllum*. The lack of the aulos-like structure in young stages of the Pomeranian forms referred to MÜNSTER's species suggests that POTY & BOLAND's (1996) interpretation is correct.

OCCURRENCE: *Conilophyllum priscum* appears in the Lower "Strunian" in the Omolon massif, pre-dating the Hangenberg Event; in Germany, it appears above the Hangenberg Shale, but below the Devonian–Carboniferous boundary, and in Belgium it first appears in the Lower Tournaisian. The fact that it appeared in Western Pomerania earlier than in Western Europe may suggest that it migrated from the East to the West, from the Omolon massif to Germany and Belgium via Poland. This hypothesis is supported by reconstructed patterns of sea currents at that time (GOLONKA & *al.* 1994).

In Pomerania, *C. priscum* first appeared in the "Strunian", but is also known from the Tournaisian. This may suggest its continuous occurrence across the Devonian–Carboniferous boundary in the study area, which would represent its refuge [the continuous occurrence of Rugosa across the Devonian–Carboniferous boundary also seems to be virtually proven in the Holy Cross Mountains (FEDOROWSKI 2003)]. It cannot be excluded, however, that the Tournaisian occurrence of *C. priscum* is the result of its secondary immigration from western Europe.

Also known from the western province of North America, from the Lower *crenulata–anchoralis latus* zones.

Subclass: Dividocorallia FEDOROWSKI, 1991
Order: Heterocorallia SCHINDEWOLF, 1941
Suborder: Tetraphyllina FEDOROWSKI, 1991
Family: Tetraphyllidae YOH, JIN, ZHEN & XIE, 1984
Genus: *Oligophylloides* RÓŻKOWSKA, 1969

TYPE SPECIES: *Oligophylloides pachythecus* RÓŻKOWSKA, 1969.

DIAGNOSIS: See RÓŻKOWSKA (1969, p. 161).

Oligophylloides pachythecus RÓŻKOWSKA, 1969
(Pl. 16, Fig. 5)

1969. *Oligophylloides pachythecus pachythecus* n. subsp.; RÓŻKOWSKA, p. 161, pl. 6, figs 6-9; pl. 7, figs 4, 15; text-figs 67-69, 70F.
1969. *Oligophylloides pachythecus pentagonus* n. subsp.; RÓŻKOWSKA, p. 167, text-figs 70A-E, pl. 6, fig. 14.
1969. *Oligophylloides tenuicinctus* n. sp.; RÓŻKOWSKA pp. 168-170, text-figs 71A-F, pl. 6, fig. 10.
1980. *Oligophylloides pachythecus* RÓŻKOWSKA; SUTHERLAND & FORBES, p. 497, text-figs 1, 2, pl. 40, figs 1-17, pl. 41, figs 1-17.
1980. *Oligophylloides pachythecus* RÓŻKOWSKA; WRZOŁEK, p. 513, text-figs 1A-H, pl. 49, figs 1-3.
1980. *Oligophylloides tenuicinctus* RÓŻKOWSKA; RÓŻKOWSKA, p. 608.
1987. *Oligophylloides pachythecus* RÓŻKOWSKA; KARWOWSKI & WRZOŁEK, p. 321, text-figs 1A-E, 2A-D, 3A-F, 4A-E, G, H.
1993. *Oligophylloides pachythecus* RÓŻKOWSKA; WRZOŁEK, p. 179, text-figs 1: 1-7, 2.
1995. *Oligophylloides pachythecus* RÓŻKOWSKA; WEYER, pp. 114-117, text-figs 7: 1-9, 8: 1-5; pl. 1, figs 1-7; pl. 2, figs 1-4.
2001. *Oligophylloides pachythecus pachythecus* RÓŻKOWSKA; CHWIEDUK, pp. 1191-1224, text-figs 2, 4-14, 18-23, pls 1-6.
2002. *Oligophylloides pachythecus* RÓŻKOWSKA; BERKOWSKI, p. 43, pl. 16, figs 4-7, pl. 17, figs 4-11.
2003. *Oligophylloides pachythecus* RÓŻKOWSKA; FEDOROWSKI, p. 120, pl. 59, figs 1-7, pl. 60, figs 1, 2.

DIAGNOSIS: See CHWIEDUK (2001, p. 1191).

MATERIAL: Two specimens, both from Daszewo-19K (Tc.C.DSO-19K/107 - 3278.1; Tc.C.DSO-19K/173 - 3317.3); three thin sections from transverse sections.

DESCRIPTION: Corallites cylindrical. Septal index n/d = 12/1.5 mm. In corallite lumen three generations of septa form four septal systems. Oblique septum distinct at corallite axis. External corallite wall (protoheterotheca) smooth, 0.2 mm thick.

REMARKS: On the basis of the topotype and other material, CHWIEDUK (2001) documented the synonymy of *Oligophylloides tenuicinctus* RÓŻKOWSKA, 1969 with *Oligophylloides pachythecus* RÓŻKOWSKA, 1969. Characters considered by earlier authors as diagnostic of *O. tenuicinctus* occur during the early growth of *O. pachythecus*. The thin-walled specimens from Pomerania are therefore included here in *O. pachythecus*.

OCCURRENCE: Germany (*Wocklumeria* Zone), Poland: Holy Cross Mountains, Sudetes Mountains, Western Pomerania (*marginifera*, Upper *expansa–praesulcata* zones).

Genus *Frechastraea* SCRUTTON, 1968

TYPE SPECIES: *Cyathophyllum pentagonum* GOLDFUSS, 1826.

DIAGNOSIS: See HILL (1981, p. F284).

?*Frechastraea* sp.
(Pl. 4, Figs 1-3)

MATERIAL: Three fragments of colonies from Chojnice-3 (Tc.C.CHE-3/1 - 2535.2) and Koczała-1 (Tc.C.KCA-1/1, 2 - 2680.0). Four transverse and one longitudinal section with acetate peels.

DESCRIPTION: Colonies astreoid and thamnasterioid. Mean septal index = 18/11. Major septa spindle-like and carinated in dissepimentarium (Pl. 4, Fig. 3); thin in tabularium, with inner ends slightly curved; withdrawn from axis, leaving a free area 0.5-2.0 mm in diameter. Minor septa spindle-shaped, carinated, confined to dissepimentarium, which occupies 1/2 corallite radius. Inner dissepimentarium consists of 2 to 4 rows of dissepiments, inclined towards corallite axis, outer dissepimentarium formed from 6-8 rows of globose dissepiments (Pl. 4, Fig. 2). Tabularium 5.0 mm in diameter. Tabulae incomplete, tabellae horizontal at corallite axis and vesicular near dissepimentarium.

OCCURRENCE: Poland, Western Pomerania – Upper Frasnian.

Order Calyxcorallia FEDOROWSKI, 1991
Family Heterostrotionidae POTY & XU, 1996
Genus *Heterostrotion* POTY & XU, 1996

TYPE SPECIES: *Diphyphyllum*? *vesicotabulata* YÜ, 1934, p. 87.

DIAGNOSIS: See POTY & XU (1997, p. 101).

REMARKS: FEDOROWSKI (1991) proposed a new taxonomic concept for some Devonian and Carboniferous Anthozoa, and introduced the subclass Dividocorallia, including two orders: Heterocorallia and Calyxcorallia. In Calyxcorallia he placed, among other corals, the family Heterostrotionidae with the genus *Heterostrotion* POTY & XU, 1996.

POTY & XU (1996, 1997) placed *Heterostrotion* in the order Rugosa, in a new subfamily Heterostrotioninae of the family Lithostrotionidae D'ORBIGNY, 1852. I follow herein the new systematics of FEDOROWSKI (1991), who classified *Heterostrotion* in the order Calyxcorallia, of the subclass Dividocorallia.

Heterostrotion sp.
(Pl. 16, Fig. 6)

MATERIAL: Two specimens, both from Dygowo-1 (Tc.C.D-1/15, 15B - 3848.6); single thin section and two acetate peels from transverse sections.

DESCRIPTION: Corallites rounded in transverse section, 10.0 mm in diameter. Septal index n(last generation)/d = 28/10.0 mm. Septa vary in length; thick near corallite wall, tapering toward axis, connected in septal systems (*sensu* FEDOROWSKI 1991). Oblique septum short, located centrally. Minor septa range from 1/4 to 1/3 length of corallite radius, penetrating tabularium. Dissepimentarium narrow, with up to 3 ranks of small interseptal, sporadically transseptal dissepiments. External corallite wall 0.2 mm thick.

REMARKS: The very limited material available prevents a rigid identification of the growth form of the specimens studied. The heterocoral septal arrangement, the impossibility of distinguishing cardinal and counter septa, the narrow dissepimentarium, and the short minor septa are characteristic features of *Heterostrotion*. Specimens from Pomerania display diameters similar to those of *S. sudeticum* from the Upper Famennian of the Sudetes FEDOROWSKI (1991), but possess larger number of septa (n/d for *S. sudeticum* = 20/9.2x7.4). Specimens described by BERKOWSKI (2002) from the Famennian of Dzikowiec (the Sudetes) as *Heterostrotion*? sp., display a similar number of septa, but smaller corallite diameters (n/d = 27/7).

OCCURRENCE: Poland, Pomerania, Famennian.

THE PALAEOECOLOGY AND PALAEOGEOGRAPHY OF THE LATE DEVONIAN – EARLY CARBONIFEROUS CORALS

Similarly to the distribution of modern corals, the rugose corals characterised primarily the equatorial areas of the Late Devonian and Early Carboniferous world (Text-figs 7-9). They are abundant in several regions of China, Vietnam, Japan, Australia, Western Canada, the United States, Russia (Omolon Massif, the Urals, Kuznetsk, Donetsk and Moscow basins), Poland, and Western Europe (England, Belgium and Germany). The high taxonomic diversity and abundance of the group in Western Pomerania makes this area an important locality for both deep- and shallow-water rugose corals of that time. The coral fauna demonstrates that Pomerania during the Late Devonian–Early Carboniferous was an equatorial region with fairly stable environmental conditions, albeit disturbed twice by pan-regional (Kellwaser and Hangenberg) events.

The earliest Devonian corals in Pomerania are dated as Givetian. This is markedly later than in the Holy Cross Mountains, southern Poland, where they first appeared in the latest Emsian (in the *patulus* or *partitus* Zone of the Grzegorzowice section; RÓŻKOWSKA 1954). Although this heterochroneity may appear to be strictly artificial, being largely a result of the lack of material, it may also reflect the heterochronous appearance of the required environment in both areas. The ecological succession of the Givetian Rugosa (in the middle of the *varcus* Zone), is well evidenced in southern Poland (GÜRICH 1896, RÓŻKOWSKA 1960, WRZOŁEK 1992, FEDOROWSKI 2003); at that time Pomerania abounded in the pioneering species *Disphyllia laxa* (Koczała-1), which was also common in the Givetian of southern Poland, and in probably endemic species of the genera *Heliophyllum*, *Breviphyllum* and *Temnophyllum* (CHWIEDUK, in preparation).

The increased expansion of corals in the Frasnian was caused by further progression of the Devonian transgression. In the Frasnian, the territory of Poland was in the centre of the West-European Province. This might have caused a substantial differentiation of the coral fauna, as a result of good communication and exchange of coral faunas with those from southern Poland and western Europe (*Peneckiella fascicularis, P. szulczewskii, Phillipsastrea macrommata, Pterorrhiza berdensis, Pt. recta, Thamnophyllum germanicum, Th. monozonatum*), as well as from more distant areas, including North Africa, East Asia, Australia (*Temnophyllum menyouense*), China (*Disphyllum kweihsiense*) and the Urals (*P. fascicularis, Ph. macrommata, Pt. multizonata, Te. isetense, Th. german-*

Fig. 7. Locations of the Frasnian coral fauna shown on the Frasnian (375 Ma) palaeogeography (map after GOLONKA & *al.* 1994, slightly simplified)

icum, Th. monozonatum). Western Pomeranian corals comprised predominantly the dissepimented colonial genera *Phillipsastrea,* ?*Frechastraea, Hexagonaria, Disphyllum, Peneckiella, Pterorrhiza, Thamnophyllum* (Tables 1a, 4), represented by branching and massive colonies. With the exception of *Phillipsastrea* and ?*Frechastraea*, represented by massive colonies and predominantly in the upper Frasnian, all other genera occur mostly in the lower Frasnian (*falsiovalis – hassi* zones). Of the dissepimented solitary coral genera, *Spinophyllum* and *Charactophyllum* (unpublished identifications by M. RÓŻKOWSKA), *Fedorowskicyathus* and *Mictophyllum*

Fig. 8. Locations of the Famennian coral fauna shown on the Famennian (365 Ma) palaeogeography (map after GOLONKA & *al.* 1994, simplified); see Text-fig. 7 for explanation

(RÓŻKOWSKA 1979) as well as *Grypophyllum* and *Temnophyllum* are relatively common. No species of the non-dissepimented ceratoid corals are known from Pomerania or southern Poland (RÓŻKOWSKA 1979, FEDOROWSKI 2003).

According to preliminary paleoecological analysis of the Late Devonian corals of Poland by RÓŻKOWSKA (1980), and subsequently by WRZOŁEK (1988, 1992), FEDOROWSKI (1997, 2003), and BERKOWSKI (2002), it appears that, although Rugosan and Dividocorallian corals cannot automatically be applied to the interpretation of the environmental parameters (FEDOROWSKI 2003), they may be critical in such interpretations when found in living position, or at least *in situ*, and when well preserved (FEDOROWSKI 2003). Taking into account the results of the above-listed palaeoecological studies, as well as the composition of the coral assemblages studied herein, and the occurrence of the Frasnian corals in the stromatoporoid-coral limestones in Pomerania, the shallow-water, warm and well-aerated sea of the carbonate platform is suggested as the most probable living environment of both the colonial and solitary corals studied herein. The similarity of the Frasnian coral fauna from the southern part of the area studied (*Hexagonaria hexagona kowalae*, *Temnophyllum elongatum*, and *Disphyllia laxa* in the Givetian – ?Lower Frasnian) to that known so far exclusively from the Holy Cross Mountains, suggests a permanent, or at least temporary connection between these areas.

The global crisis, which brought about the extinction of most of the corals of the Devonian type at the Frasnian–Famennian boundary, was caused by a marine transgression (POTY 1986, SORAUF & PEDDER 1986, SORAUF 1992), correlated with the Kellwasser Event. This fauna never regained its abundance from before the event. With the exception of the Sudetes, China, and Tian-Shan, colonial corals disappeared altogether, and the number of solitary dissepimented taxa decreased considerably. The re-entrance of the rugosans took place in the *rhomboidea–marginifera* Zones (POTY 1984, 1986, 1999; SCRUTTON 1988). These first corals, represented mostly by small, solitary, both non-dissepimented and dissepimented taxa, have only rarely been identified in Europe (POTY 1986, 1999). Among the Pomeranian faunas, only two Famennian genera (*Charactophyllum* and *Tabulophyllum*; cf. Tables 1a-b) represent the Frasnian lineages. Both taxa are dissepimented, and interpreted as living in shallow and warm seas. The small and non-dissepimented corals of the Late Frasnian deeper basins became more common only in the late Famennian (*marginifera*, *expansa-praesulcata* Zones). They are known from Germany (WEYER 1971, 1972, 1973a, 1973b, 1978, 1979, 1981, 1982, 1984, 1989, 1995, 1997, 1999), Northern Africa (WEYER 1997, 1999), North America (SORAUF 1992), Kazakhstan (SOSHKINA 1960), Australia (HILL 1954, HILL & JELL 1970) and Poland (the Holy Cross Mountains: RÓŻKOWSKA 1969, BERKOWSKI 2002, FEDOROWSKI 2003; the region of Cracow and the Sudetes

Fig. 9. Locations of the Lower Carboniferous coral fauna shown on the Early Carboniferous (345 Ma) palaeogeography (map after GOLONKA & *al.* 1994, slightly simplified); see Text-fig. 7 for explanation

Mountains: BERKOWSKI 2002, FEDOROWSKI 2003). Their first appearance in Pomerania is dated as *trachytera* Zone. The dominant species belong to the genera *Cyathaxonia*, *Syringaxon*, *Saleelasma* and *Metriophyllum*. HILL (1938–39) referred to these solitary corals as the "*Cyathaxonia*" fauna, which she considered deep water. At least in the case of the Pomeranian fauna, however, both the nature of the sediment and the conodont biofacies (MATYJA 1993) suggest that they lived essentially in a shallow water, slightly restricted, subtidal environment. A shallow water environment (in the north-western part of the study area) is additionally indicated by the presence of colonial corals, noted rarely in single boreholes. This confirms earlier postulates (FEDOROWSKI 1981, 1997, 2003) that rugose corals are not a reliable bathymetric indicator.

The Frasnian–Famennian boundary crisis, dated as the interval from the *linguiformis* Zone to the *rhomboidea* Zone, was not preceded by a gradual extinction of the benthic species, which suggests that the extinction was caused by factors that appeared suddenly. FEDOROWSKI (1981) and POTY (1986) associate this extinction with a change in water temperature. In Pomerania, the number of benthic forms grew continuously in the post-crisis basin, with decreasing depth and better aeration at that time (MATYJA 1993); however, it was only in the *expansa* Zone of the Late Famennian that abundant rugose corals are noted. The reason for this phenomenon, observed worldwide, remains unclear.

In the latest Famennian (upper *expansa–praesulcata* Zones), the corals flourished again, with numerous species characteristic of the carbonate platforms, which did not occur earlier in the Famennian. The coral fauna was amply represented both in shallow-sea environments, e.g. in France (SALÉE 1913), Belgium (DEHÉE 1929, POTY 1984, 1986, 1995, 1999), Germany (WEYER 1994, 1997), Poland (the region of Cracow: BERKOWSKI 2002; Sudetes Mountains: FEDOROWSKI 1991; Western Pomerania: CHWIEDUK 1998), Novaya Zemlya (GORSKY 1935, 1938), the Omolon Massif (ONOPRIENKO 1979b, POTY & ONOPRIENKO 1984), China (WU & *al.* 1981, POTY & XU 1996) and New Mexico (SORAUF 1992), and in deep-water environments (Text-fig. 8, Tab. 5), e.g. in Germany (FLÜGEL 1974), China (LIAO & CAI 1987), the Omolon massif (ONOPRIENKO 1979b), Poland (RÓŻKOWSKA 1969, BERKOWSKI 2002, FEDOROWSKI 2003) and Morocco (BERKOWSKI 2002).

Also identified from Pomerania are taxa, which are quoted typically as indicative of the "Strunian" (*Campophyllum* and ?*Palaeosmilia aquisgranense*), the Carboniferous type *Bounophyllum*, and ?*Nervophyllum*, unknown hitherto from the area. As in the case of the west-European *Dibunophyllum* and *Clisiophyllum*, the genus *Nervophyllum* seems to have its morphological equivalent in the uppermost Famennian. The "re-appearance" of *Nervophyllum* in the uppermost Viséan, after a gap in the Tournaisian, is interpreted herein as caused by adaptive convergence.

Item	NAME OF SPECIES	STAGE	FRASNIAN						
		REGION	EUROPE		ASIA				AU
		PROVINCES	WE	EE	U	C	DB	MB	WA
1.	*Disphyllum kweihsiense*		x	x	-	x	-	-	-
2.	*Hexagonaria hexagona kowalae*		-	x	-	-	-	-	-
3.	*Mictophyllum guniae*(*)		-	x	-	-	-	-	-
4.	*Peneckiella fascicularis*		x	x	x	-	-	x	-
5.	*Peneckiella szulczewskii*		x	x	-	-	-	-	-
6.	*Phillipsastrea macrommata*(**)		x	x	x	-	-	-	-
7.	*Pterorrhiza berdensis*		x	x	x	-	-	-	-
8.	*Pterorrhiza multizonata*(*)		-	x	x	-	x	x	-
9.	*Pterorrhiza recta*(**)		x	x	-	-	-	-	-
10.	*Spinophyllum fasciculare*(**)		x	x	-	-	-	-	-
11.	*Temnophyllum elongatum*		-	x	-	-	-	-	-
12.	*Temnophyllum isetense*		-	x	x	-	-	-	-
13.	*Temnophyllum menyouense*		-	x	-	-	-	-	x
14.	*Thamnophyllum germanicum*(**)		x	x	x	-	-	-	-
15.	*Thamnophyllum kozlowskii*(*)		-	x	-	-	-	-	-
16.	*Thamnophyllum monozonatum*		x	x	x	-	-	-	-
17.	*Thamnophyllum soshkinae*(**)		-	x	-	-	-	-	-

Tab. 4. Palaeozoogeographic distribution of Frasnian Rugosa taxa from Western Pomerania. Geographic areas: AU – Australia, C – China, DB – Donetsk Basin, EE – East Europe, MB – Moscow Basin, U – the Urals, WA – East Australia, WE – West Europe.

(*) – see RÓŻKOWSKA (1979). (**) – unpublished archival identifications by M. RÓŻKOWSKA and J. FEDOROWSKI, not discussed in the present article.

Item	NAME OF SPECIES	STAGE	FAMENNIAN			
		REGION	EUROPE		ASIA	
		PROVINCES	WE	EE	U	O
1.	*Bounophyllum pomeranicum*		-	x	-	-
2.	*Campophyllum cylindricum*		-	x	-	x
3.	*Campophyllum flexuosum*		x	x	-	-
4.	*Campophyllum gosseleti*		x	x	-	-
5.	*Cyathaxonia (C.) famenniana*		-	x	-	-
6.	*Cyathaxonia (C.) rozkowskae*		-	x	-	-
7.	*Amplexocarinia rozkowskae*		-	x	x	-
8.	*Guerichiphyllum kowalense*		-	x	-	-
9.	*Metriophyllum soshkinae*		-	x	x?	-
10.	Oligophylloides pachythecus		x	x	-	-
11.	*?Palaeosmilia aquisgranense*		x	x	-	-
12.	*Saleelasma* cf. *delepini*		x	x	-	-
13.	*Syringaxon* cf. *rozkowskae*		-	x	-	-

Tab. 5. Palaeozoogeographic distribution of some Famennian Rugosa taxa from Western Pomerania. See Tab. 4 for explanation of geographic area abbreviations; O – Omolon region

Global lowering of the sea level in the latest Famennian caused the separation of numerous smaller basins and a marked increase in faunal endemicity. The appearance of a number of new (most probably endemic) taxa (see Table 1c) in the study area suggests that it was also the case with the Kujawy-Pomeranian Basin. Further differentiation of the fauna within the Kujawy-Pomeranian basin suggests that the basin might have been subdivided into two smaller sub-basins (southern and northern ones) in the latest Famennian; either entirely isolated or divided by a shoal. The large dissepimented corals of the southern sub-basin are very similar to those known from southern Poland, Belgium, France and western Germany. Those from the northern sub-basin, in contrast, with mixed faunas of the *Cyathaxonia* and *Canino-Clisiophyllum* types (*sensu* HILL 1938–39), are much closer to the fauna of Rügen (*Rylstonia* cf. *smythi* and numerous species of small non-dissepimented specimens). The Pomeranian coral fauna has also one taxon – *Campophyllum cylindricum* – in common with the Omolon region.

The mixing of faunas representing various zoogeographical provinces (Tabs 4-6) and the development of endemic faunas (Tab. 1c) constitute evidence of pulse-like isolation of the Kujawy-Pomeranian Basin. The isolation could have been associated with the activation of the East-European platform during Variscan movements. The biogeographical subdivision of the study area could have resulted from the appearance of extensive shoal barriers. However, establishing of a cold marine current system could also have led to the similar biogeographical effect.

Shortly before the end of the Devonian, part of the coral fauna (including the genus *Campophyllum*) disappeared from the present territory of Poland, Belgium, Germany and of the Omolon Massif. The abundance and taxonomic diversity of corals at that time decreased consequently and was markedly lower than during the subsequent very latest Devonian (Tabs 1b-c, 5). Unlike,

Item	NAME OF SPECIES	STAGE	TOURNAISIAN - VISÉAN							
		REGION	EUROPE		ASIA					N.A
		PROVINCES	WE	EE	U	O	KU	DB	MB	WI
1.	*Claviphyllum eruca*(**)		x	x	-	-	-	-	-	-
2.	*Conilophyllum priscum*		x	x	-	x	-	-	-	x
3.	*Cyathoclisia modavense*		x	x	x	-	x	x	-	-
4.	*Eostrotion tortuosum*		x	x	-	-	-	-	-	-
5.	*Siphonophyllia cylindrica hasteriensis*		x	x	-	-	-	-	-	-
6.	*Sychnoelasma konincki*		x	x	x	x	x	x	-	-
7.	*Zaphrentites parallela*		x	x	x	-	x	-	x	-

Tab. 6. Palaeozoogeographic distribution of some Lower Carboniferous Rugosa taxa from Western Pomerania. See Tabs 4, 5 for explanation of geographic area abbreviations; KU - Kuznetsk, WI – Western Interior of North America (N.A.)

however, after the Frasnian–Famennian boundary event, during the Early Tournaisian a continuous progressive evolution of some of the Late Famennian corals, e.g. of *Conilophyllum priscum*, took place. This phenomenon, ascribed to perturbations confined to the Hangenberg Event, disturbed markedly the latest Devonian sea life.

Although the Early Carboniferous coral fauna of Pomerania is scarce and represented by few taxa, it is clearly indicative of a shallow-sea environment (*Conilophyllum*, *Spirophyllum*, *Siphonophyllia* and *Caninia*). This is further evidenced by the oolitic limestone sedimentation.

In the Tournaisian, the palaeogeographical affinities of rugose corals in Pomerania were similar to those in the latest Famennian. The assemblages from the southern part of the area are large corallites of the genera *Caninia*, *Siphonophyllia* and *Conilophyllum*, well known from western Europe, and also encountered in the Sahara, Northern Africa, the Kuznetsk and the Donetsk basins, in the Urals and in the Omolon Region (Text-fig. 9). The forms encountered in the northern part of the area are usually small, non-dissepimented corals (*Eostrotion, Rylstonia, Cyathaxonia, Rotiphyllum, Drewerelasma, Claviphyllum*), known from Rügen (WEYER 1975) and Ireland (SOMERVILLE 1994). Apparently, having been isolated in the Late Famennian, corals of the various geographical provinces were involved in the global circulation during the Tournaisian (Tabs 1d, 6). The changes in the morphology of the Tournaisian corals, which lost the axial structure typical of the "Strunian" corals, must have been caused by the crisis associated with the Hangenberg Event, and are indicative of a significant modification of the environmental conditions in the Tournaisian.

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PLATE 1

1 – *Drewerelasma* sp. A, UAM.IG.Tc.C.BKZ-2/3 - 3123.1, × 4.
2 – *Zaphrentites* cf. *crassus* (HUDSON, 1944), UAM.IG.Tc.C.BRD-1/10 - 2326.0, × 3.
3 – *Hexagonaria hexagona kowalae* WRZOŁEK, 1992, UAM.IG.Tc.C.UNI-2/8 - 4981.3, × 2.
4 – *Eostrotion tortuosum* (MICHELIN, 1846), UAM.IG.Tc.C.BKZ-2/10C - 3145.5, × 4.
5 – *Rotiphyllum* sp. A, UAM.IG.Tc.C.BKZ-2/7 - 3123.1, × 4.
6 – *Zaphrentites* cf. *parallela* (CARRUTHERS, 1910), UAM.IG.Tc.R.GRB-1/2A - 3084.1, × 3.
7 – *Caninia* sp., UAM.IG.Tc.C.BRD-1/2 – 2319.9, × 4.
8 – *Campophyllum flexuosum* (GOLDFUSS, 1826), UAM.IG.Tc.C.BKZ-2/25 - 3269.3, × 4.
9 –?*Palaeosmilia aquisgranensis* (FRECH, 1885), UAM.IG.Tc.C.BAB-1/5A - 2629.5, × 1.
10 – *Siphonophyllia cylindrica hasteriensis* (SALÉE, 1913), UAM.IG.Tc.C.BRD-1/3 - 2262.0, × 1.


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PLATE 2

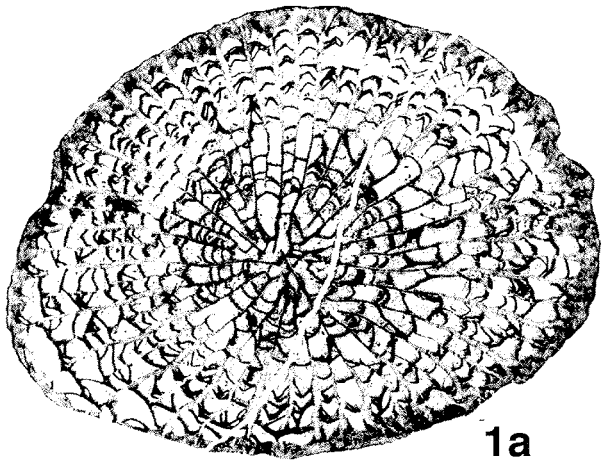
1 – *Temnophyllum isetense* (SOSHKINA, 1951), 1 – UAM.IG.Tc.C.PLL-1/1, 1a,c × 4; 1b × 30.

2, 6 – *Disphyllum kweihsiense* YOH, 1937, 2 – UAM.IG.Tc.C.JMO-1/1, × 4, 6 – UAM.IG. Tc.C.JMO-1/2, × 4.

3-5 – *Grypophyllum* cf. *primum* (WEDEKIND, 1923), 3 – UAM.IG.Tc.C.UNI-2/1, × 5, 4 – UAM.IG. Tc.C.UNI-2/3, × 5, 5 – UAM.IG.Tc.C.UNI-2/5, × 5.

7 – *Temnophyllum elongatum* RÓŻKOWSKA, 1979, UAM.IG.Tc.C.KSA-1/8, × 4.

8 – *Temnophyllum menyouense* HILL & JELL, 1970, UAM.IG.Tc.C.WBZ-1/1, × 4.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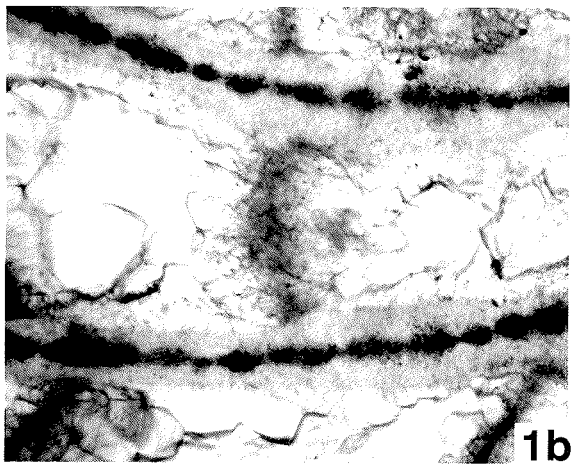
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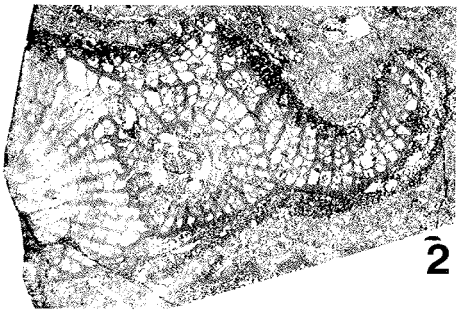
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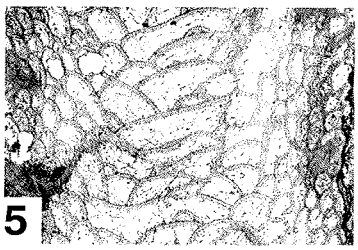
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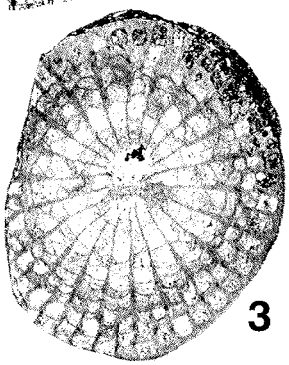
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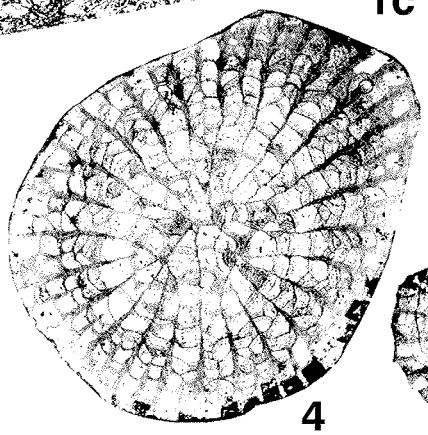
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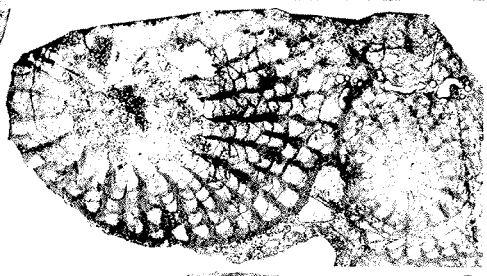
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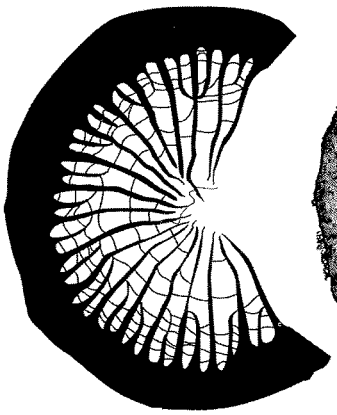
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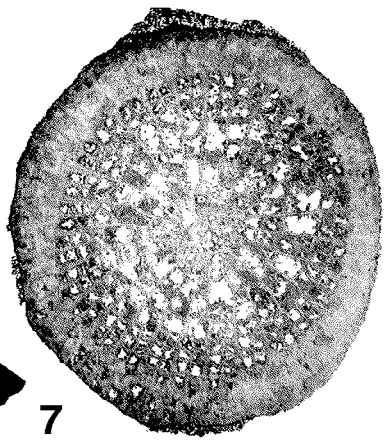


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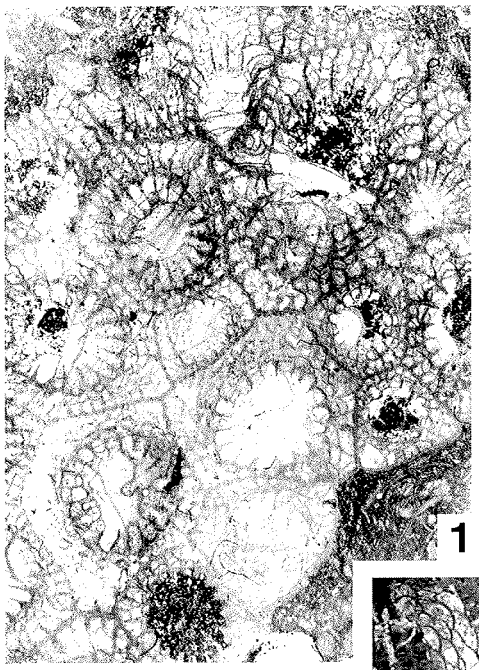
PLATE 3

1-3 – *Disphyllia laxa* (GÜRICH, 1896), 1 – UAM.IG.Tc.C.KCA-1/1, × 3, 2 – UAM.IG.Tc.C.KCA-1/2, × 6, 3 – UAM.IG.Tc.C.KCA-1/3, × 20.

4 – *Hexagonaria hexagona kowalae* WRZOŁEK, 1992, UAM.IG.Tc.C.UNI-2/8, 4a × 3, 4b × 10, 4c × 5.

5-8 – *Pterorrhiza berdensis* (SOSHKINA, 1939), 5 – UAM.IG.Tc.C.KCA-1/3, × 35, 6 – UAM.IG.Tc.C.KCA-1/4, × 35, 7 – UAM.IG.Tc.C.POL-2/1, × 4, 8 – UAM.IG.Tc.C.POL-2/2, × 6.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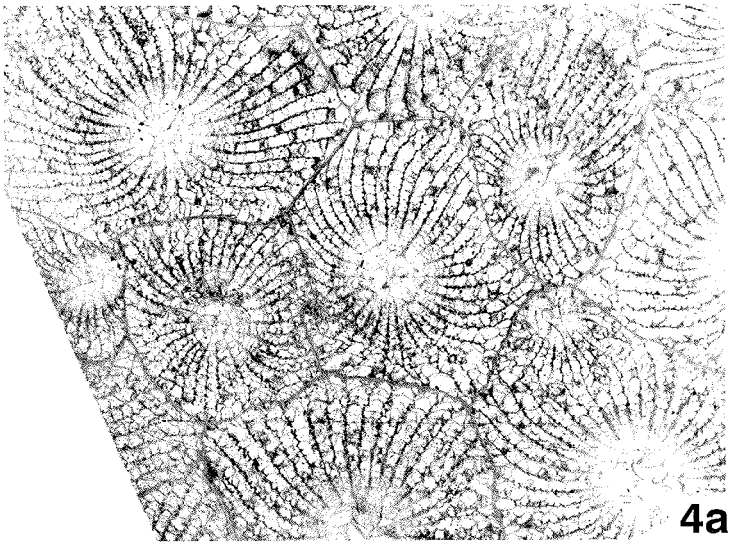
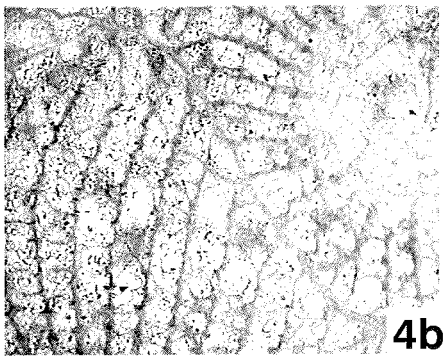
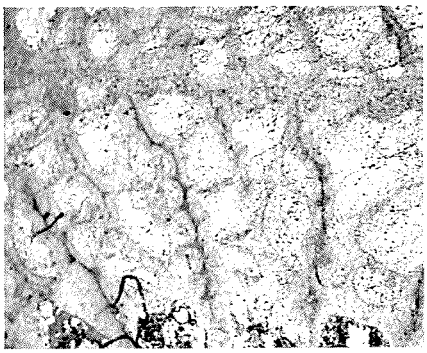

4a


2


4b


5


6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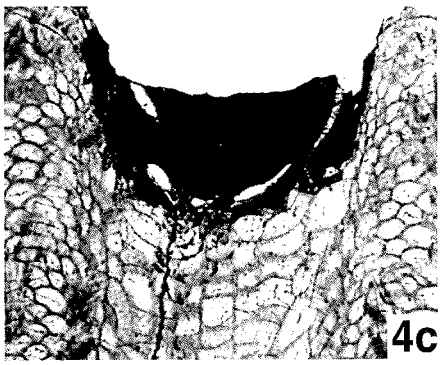
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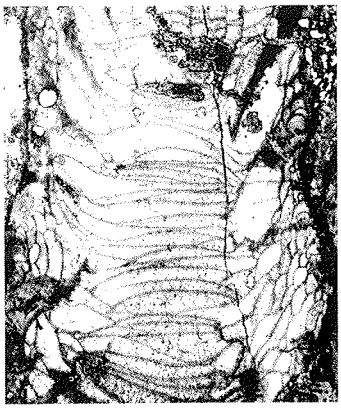
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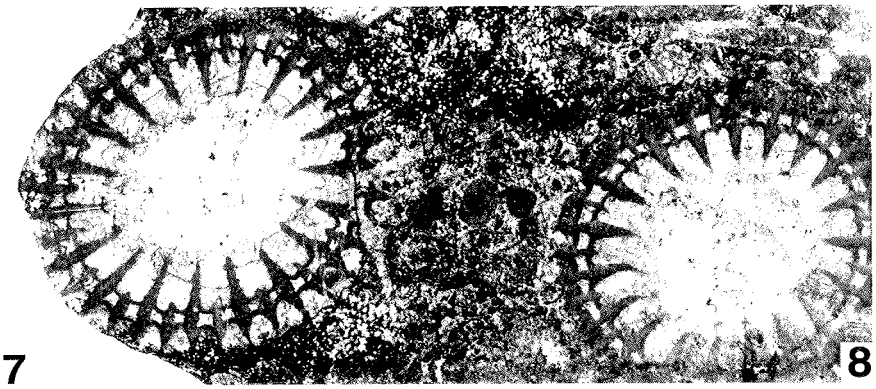

8

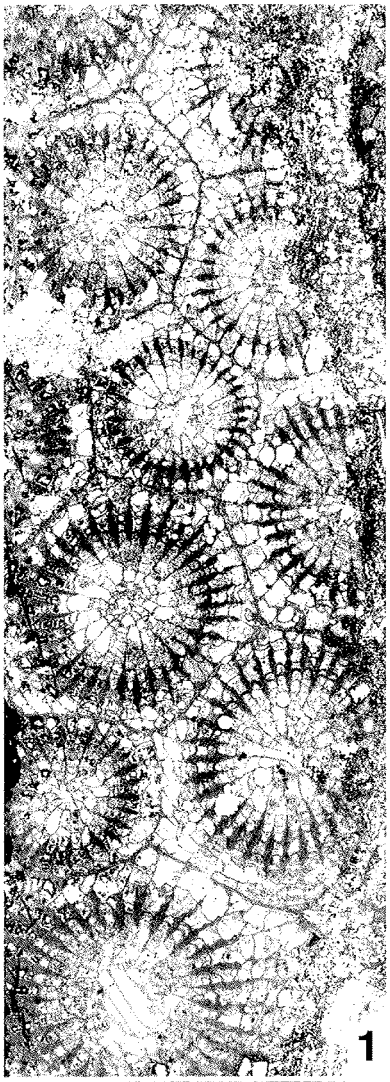
PLATE 4

1-3 – ?*Frechastraea*, 1 – UAM.IG.Tc.C.KCA-1/1, × 2, 2 – UAM.IG.Tc.C.CHE-3/1, × 5, 3 – UAM. IG.Tc.C.KCA - 1/2, × 5.

4-7 – *Guerichiphyllum kowalense* RÓŻKOWSKA, 1969, 4 – UAM.IG.Tc.C.D-1/26, × 4, 5 – UAM. IG.Tc.C.DSO-19K/17, × 6, 6 – UAM.IG.Tc.C.D-1/28, × 8, 7 – UAM.IG.Tc.C.D-1/26(4), × 8.

8, 9 – *Thamnophyllum monozonatum* (SOSHKINA, 1939), 8 – UAM.IG.Tc.C.JMO-1/3, × 6, 9 – UAM.IG.Tc.C.JMO-1/4, × 6.

10 – ?*Friedbergia* sp., UAM.IG.Tc.C.CHO-1/1, × 12.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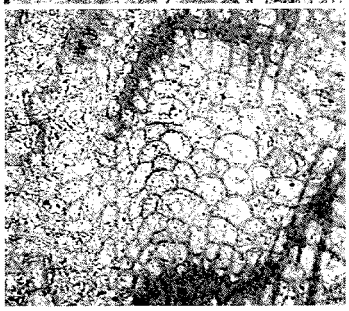
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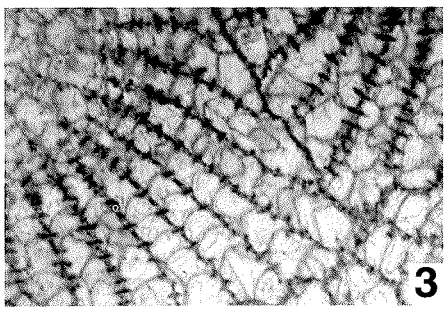
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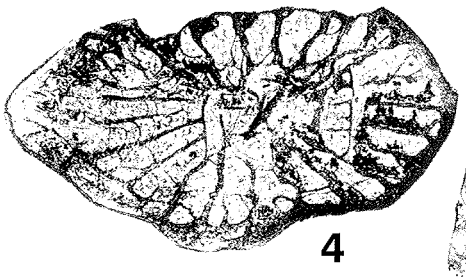
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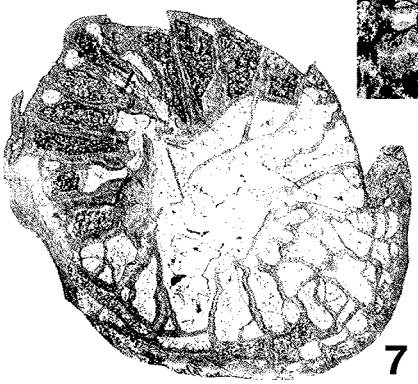
5


6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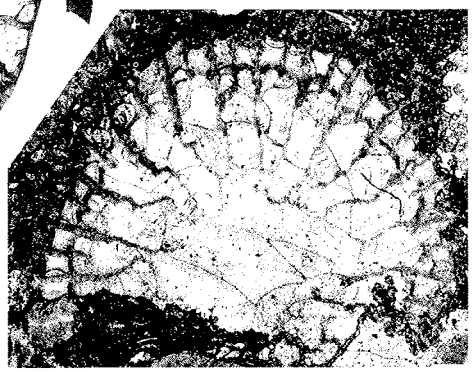
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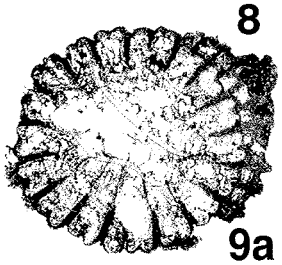

9a


9b


10

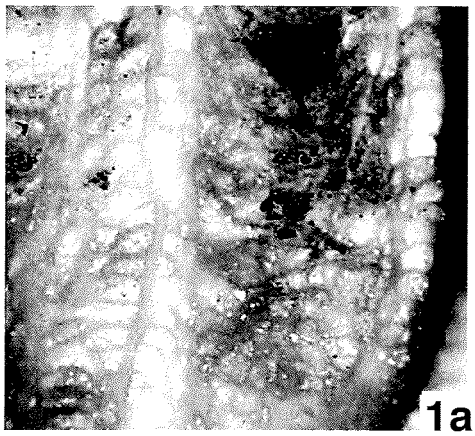
PLATE 5

1, 2 – *Peneckiella szulczewskii* RÓŻKOWSKA, 1979, 1a – UAM.IG.Tc.C.KSA-1/2, × 10, 1b – UAM. IG.Tc.C.KSA-1/2, × 12, 2 – UAM.IG.Tc.C.KSA-1/3, × 10,

3, 4 – *Peneckiella fascicularis* (SOSHKINA, 1952), 3a – UAM.IG.Tc.C.CHE-3/5, × 10, 3b – UAM.IG. Tc.C.CHE-3/5, × 4, 4 – UAM.IG.Tc.C.CHE-3/6, × 6.

5 – *Amplexocarinia rozkowskae* FEDOROWSKI, 2003, UAM.IG.Tc.C.KŁO-3/8, × 10.

6, 7 – *Syringaxon* cf. *rozkowskae* FEDOROWSKI 2003, UAM.IG.Tc.C.DSO-19K/43, 6a-b,d × 15, 6c × 30, 7 × 15.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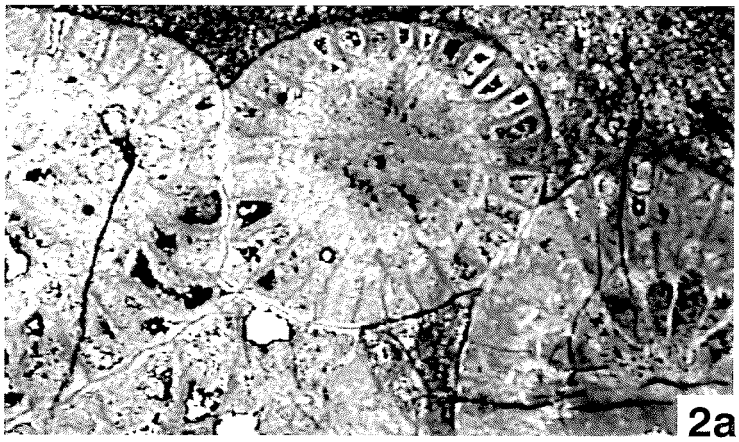
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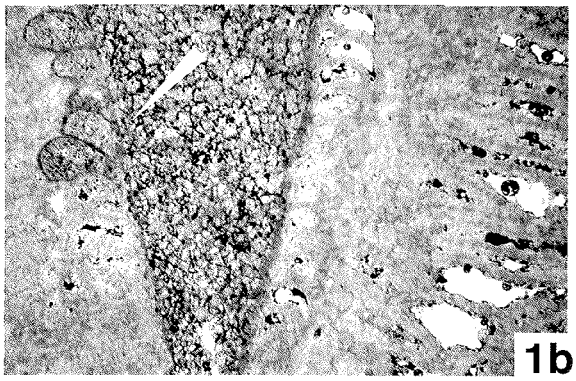
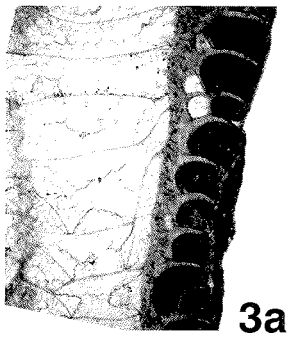
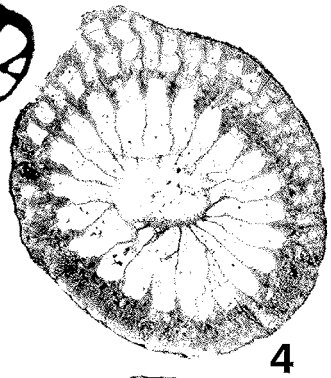

1b


3a


2b


5a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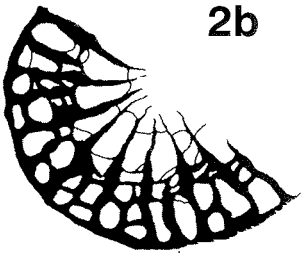
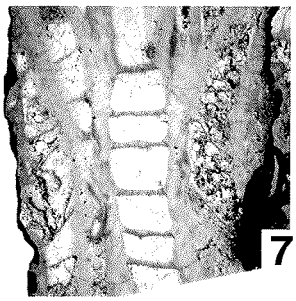
3b




5b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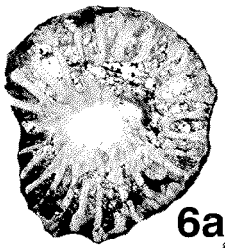
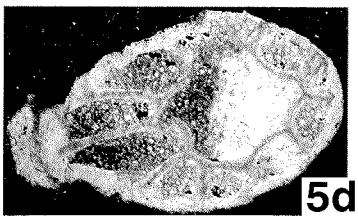
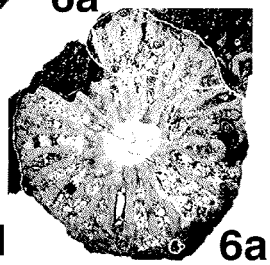
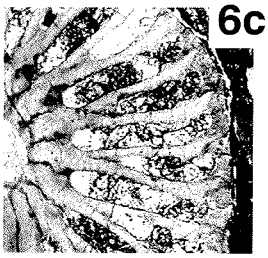
5c


6a


5d


6a


6c

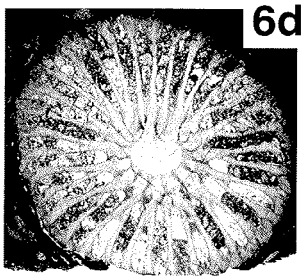

6d

PLATE 6

1-4 – ?*Syringaxon* sp. nov. A. 1 – UAM.IG.Tc.C.G-9/21, × 12, 2 – UAM.IG.Tc.C.DSO-19K/47, × 12, 3 – UAM.IG.Tc.C.G-9/11a, × 12, 4 – UAM.IG.Tc.C.DSO-19K/108, × 15.

5 – ?*Syringaxon* sp. nov. B, UAM.IG.Tc.C.DSO-19K/60, 5a × 35, 5b × 12, 5c,d × 10.

6, 7 – *Campophyllum cylindricum* (ONOPRIENKO, 1979), 6a-c – UAM.IG.Tc.C.DSO-19K/109, × 5, 6d × 15, 7 – UAM.IG.Tc.C.BKZ-2/4, × 5.

8 – *Campophyllum* cf. *ursinum* SORAUF, 1992, 8 – UAM.IG.Tc.C.DSO-19K/19, × 5.

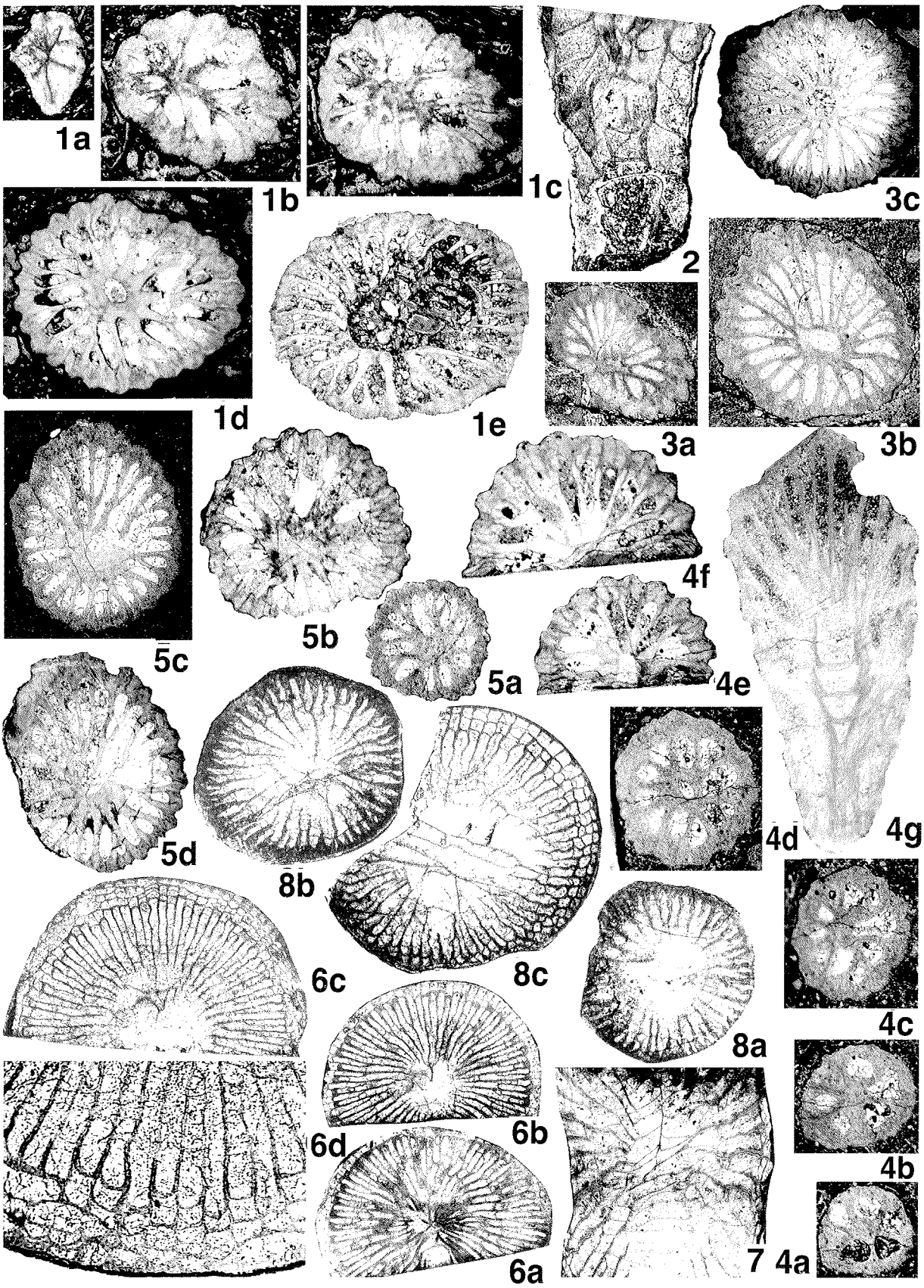

1a
1b
1c
2
3c
1d
1e
3a
3b
5c
5b
4f
4g
5a
4e
5d
8b
4d
8c
4c
6c
8a
6b
4b
6d
7
4a
6a

PLATE 7

1-3 – *Campophyllum flexuosum* (GOLDFUSS, 1826), 1, 2 – UAM.IG.Tc.C.DSO-19K/1, 1a × 20, 1b-g × 6, 1h × 4, 2 × 12, 3 – UAM.IG.Tc.C.DUN-1/4, × 4.

4-6 – *Campophyllum gosseleti* WEYER, 1997, 4 – UAM.IG.Tc.C.DSO-19K/117, × 6, 5 – UAM.IG.Tc.C.DUN-1/20, 5a × 3, 5b × 5, 6 – UAM.IG.Tc.C.DSO-19K/121, 6a × 3, 6b, 6c × 8.

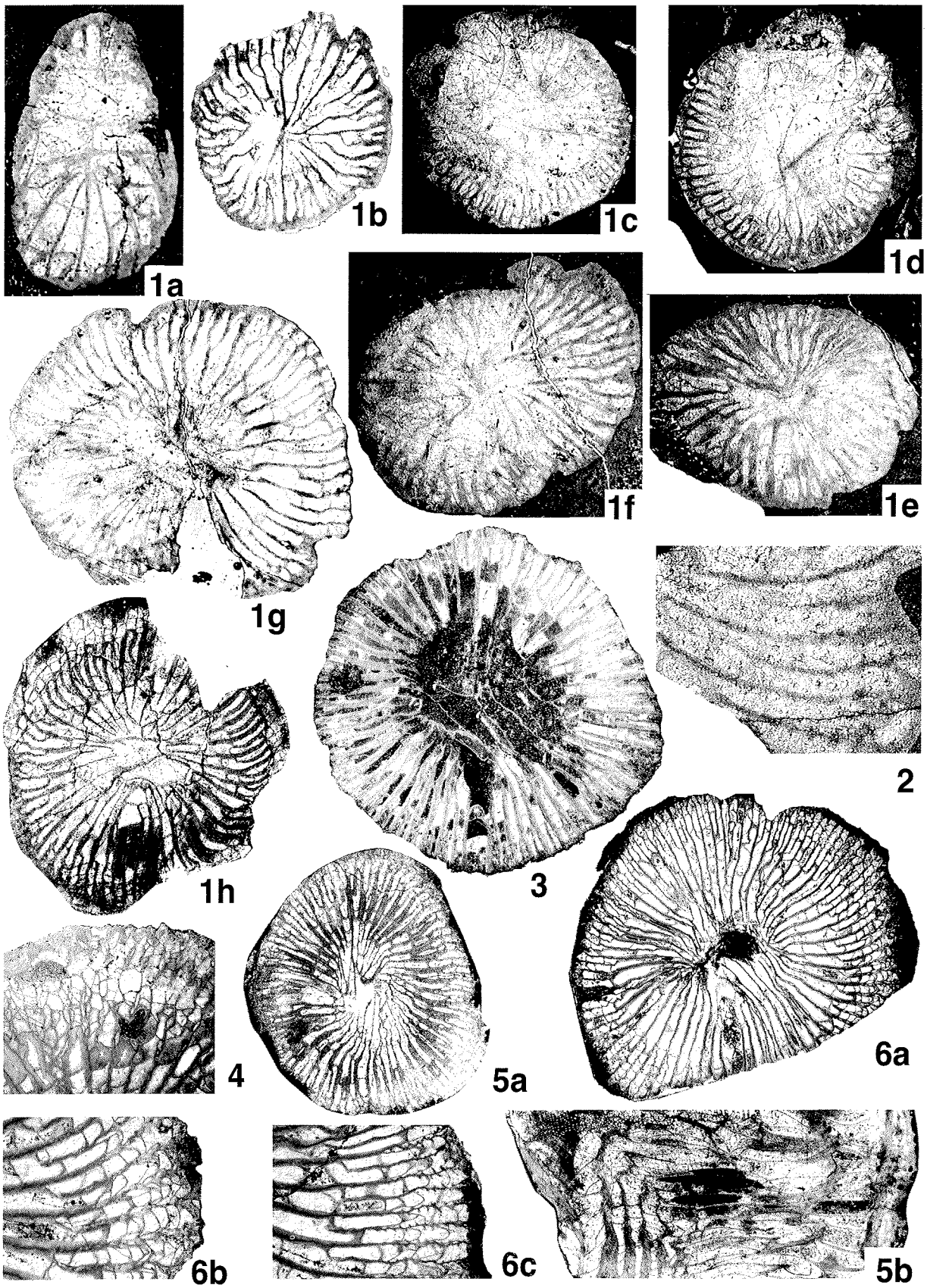

1a
1b
1c
1d
1e
1f
1g
1h
2
3
4
5a
5b
6a
6b
6c

PLATE 8

1-8 – ?*Campophyllum* sp. nov. A. 1 – UAM.IG.Tc.C.G-9/20, × 8, 2 – UAM.IG.Tc.C.G-9/21, × 4, 3 – UAM.IG.Tc.C.DSO-19K/122, 8a × 6, 8b × 4, 4 – UAM.IG.Tc.C.G-9/28a/9 × 10, 5 – UAM.IG.Tc.C.G-9/28a/2, 5a × 8, 5b × 10, 6 – UAM.IG.Tc.C.BAB-1/2, × 4, 7 – UAM.IG.Tc.C.DSO-19K/153, × 5, 8 – UAM.IG.Tc.C.G-9/26, × 8.

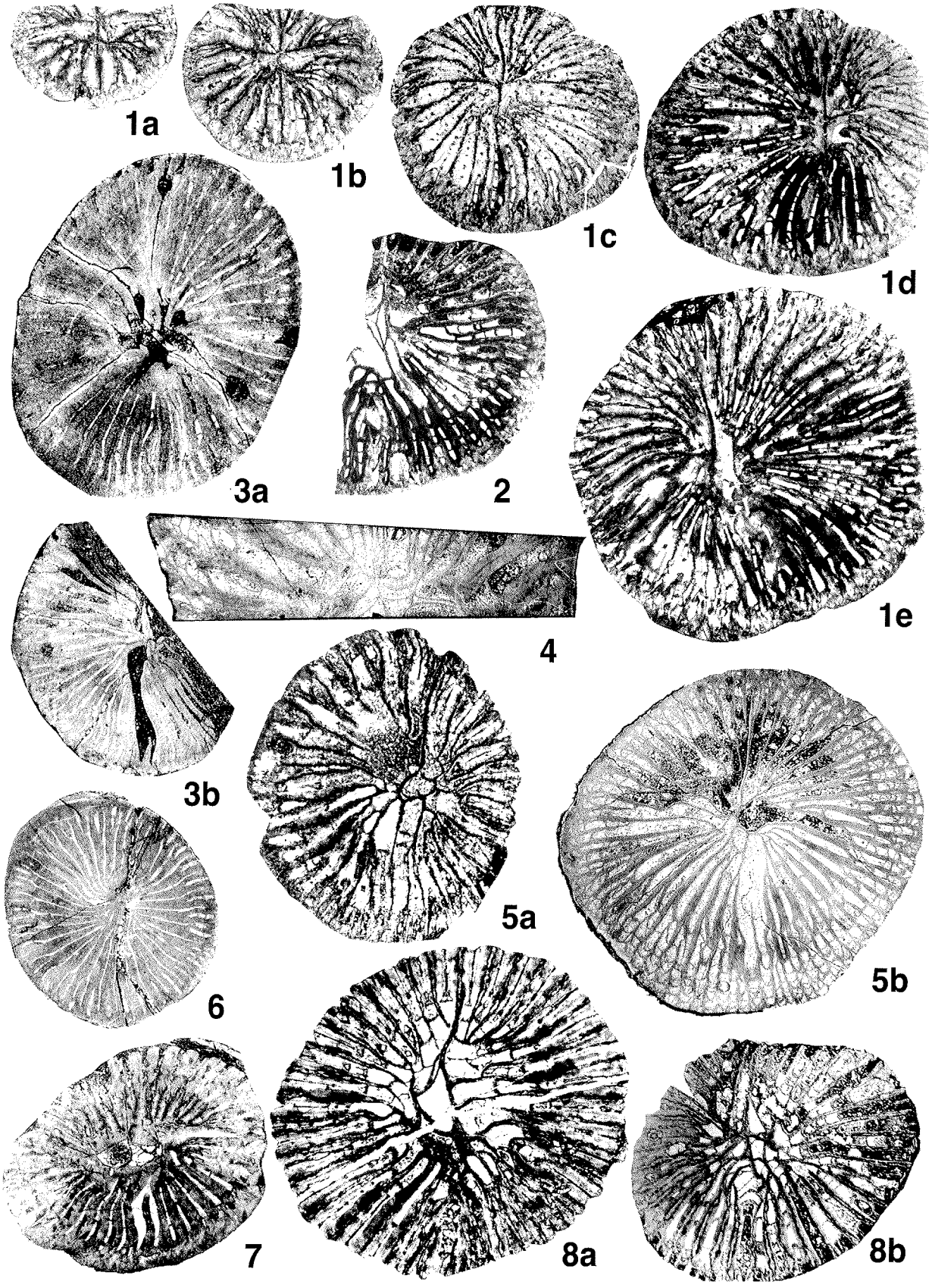
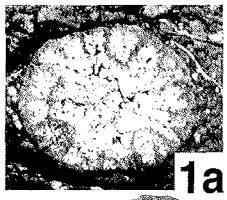

1a
1b
1c
1d
1e
2
3a
3b
4
5a
5b
6
7
8a
8b

PLATE 9

1-3 – ?*Lophophyllum* sp. A. 1 – UAM.IG.Tc.C.DSO-19K/38, 1a-g × 12, 1h × 24, 2 – UAM. IG.Tc.C.DSO-19K/39, × 8, 3 – UAM.IG.Tc.C.DSO-19K/23, 3a × 8, 3b × 30, 3c × 10.

4 – *Siphonophyllia cylindrica hasteriensis* (SALÉE, 1913), UAM.IG.Tc.C.BRD-1/4, × 4.

5, 6 – *Caninia* sp., 5 – UAM.IG.Tc.C.BRD-1/2, × 4, 6 – UAM.IG.Tc.C.BRD-1/8, × 4.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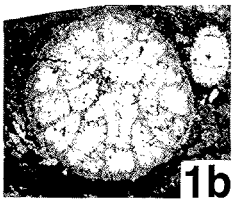
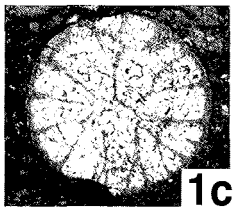
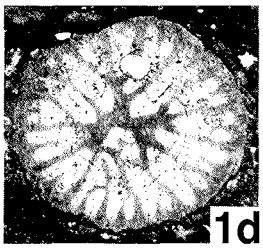
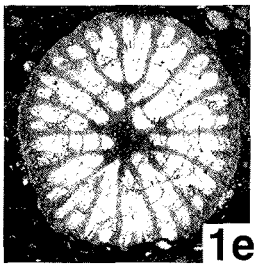

1b


1c


1d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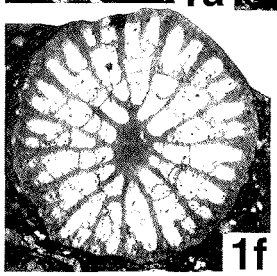
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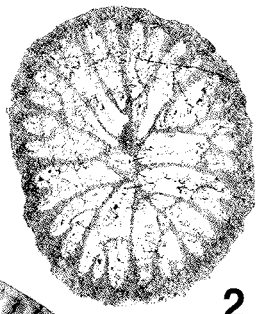
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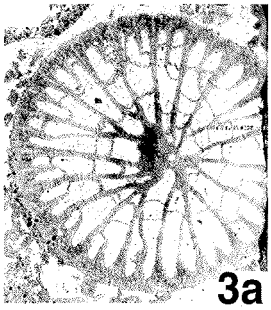
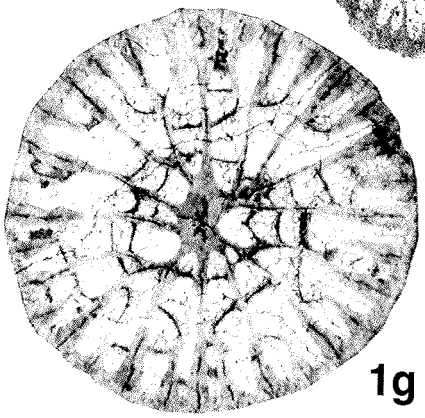
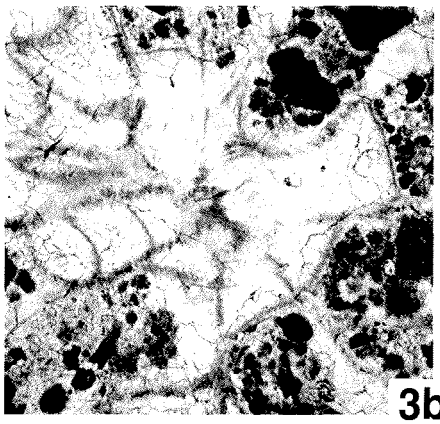
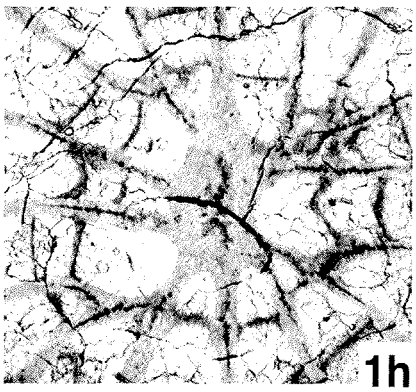
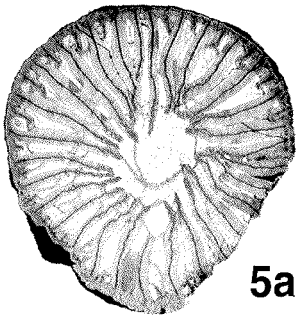

3a

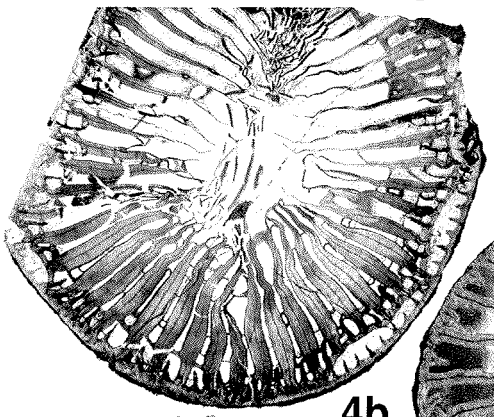

3c


1g

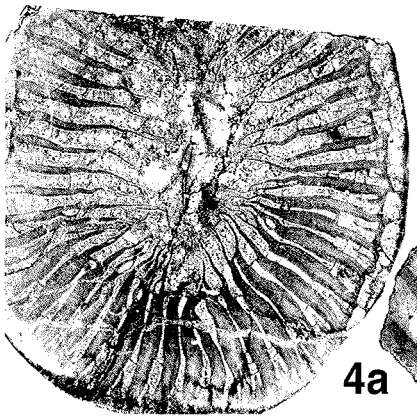

3b


1h


5a


4b


5b


4a

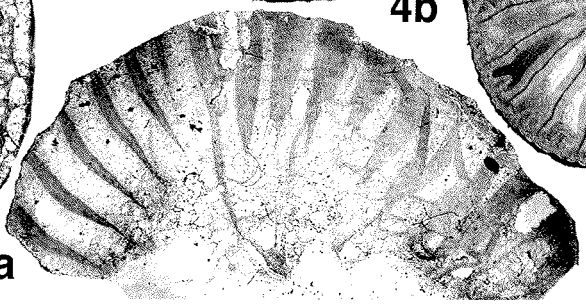

6

PLATE 10

1, 2 – *Metriophyllum soshkinae* RÓŻKOWSKA, 1969, 1 – UAM.IG.Tc.C.D-1/28(1), × 10, 2 – UAM. IG.Tc.C.D-1/28(2), × 10.

3-6 – *Saleelasma* cf. *delepini* (VAUGHAN, 1915), 3 – UAM.IG.Tc.C.BGD-9/4, × 12, 4 – UAM. IG.Tc.C.KRL-1/2, × 10, 5 – UAM.IG.Tc.C.DBA-2/1, × 10, 6 – UAM.IG.Tc.C.NWG-1/1, × 10.

7-9 – *Cyathaxonia* (*C.*) *famenniana* FEDOROWSKI, 2003, 7 – UAM.IG.Tc.C.G-9/2(1), × 30, 8 – Tc. C.DSO-19K/51, 8a, c × 15, 8b × 45, 9 – UAM.IG.Tc.C.D-1/26, 9a, 9b, 9d – × 8, 9c × 18.

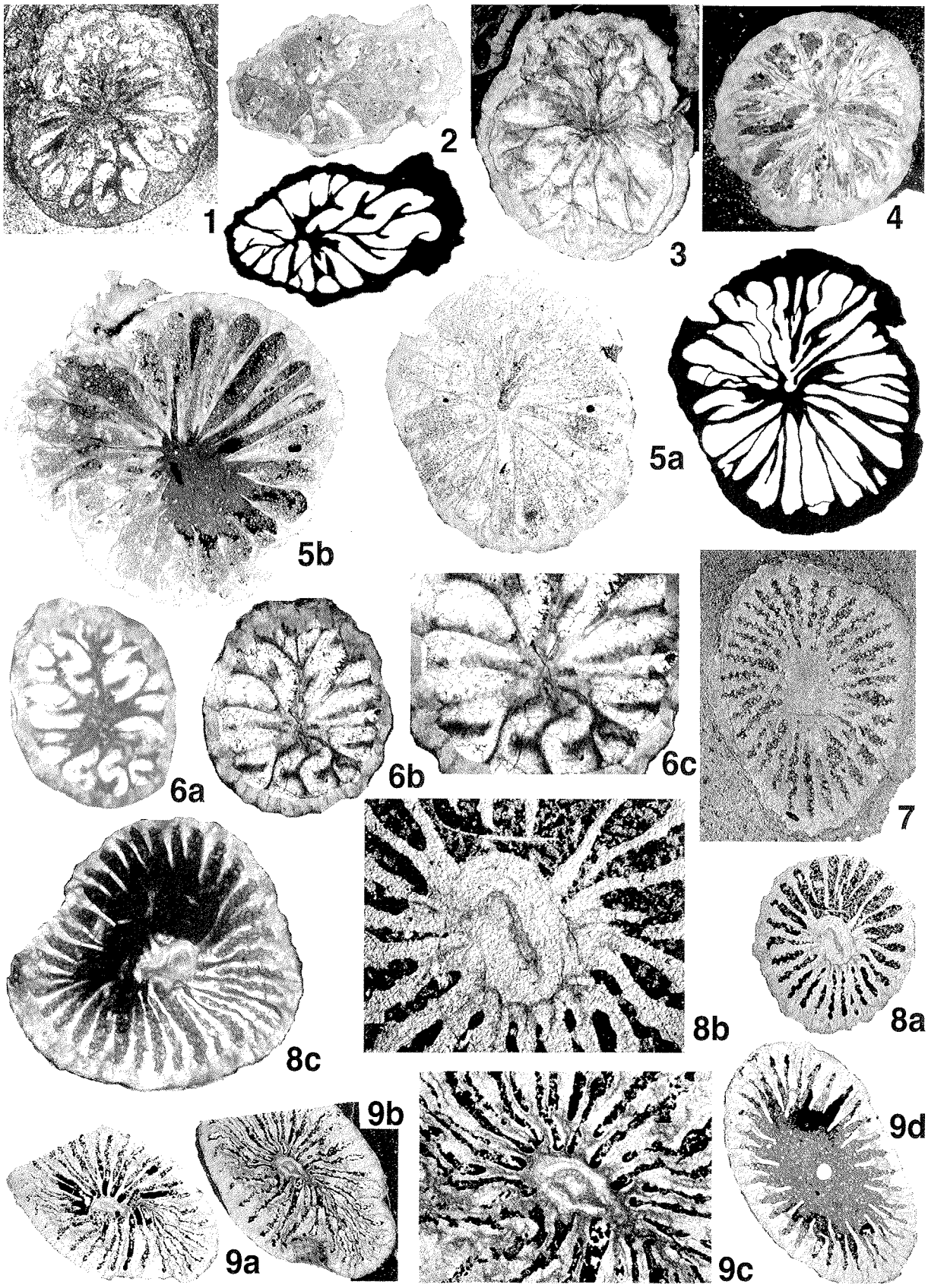

1
2
3
4
5a
5b
6a
6b
6c
7
8a
8b
8c
9a
9b
9c
9d

PLATE 11

1, 2 – *Cyathaxonia* (*Cyathaxonia*) cf. *rozkowskae* FEDOROWSKI, 2003, 1 – UAM.IG.Tc.C.D-1/26a, × 8, 2 – UAM.IG.Tc.C.D-1/9(10), 2a-c × 8, 2d × 24.

3, 4 – ?*Nervophyllum* sp., 3 – UAM.IG.Tc.C.WHO-4/4, 3a, c × 4, 3b × 10, 4 – UAM.IG. Tc.C.WHO-4/2, 4a, c, d × 4, 4b × 12.

5 – ?*Spirophyllum* sp., UAM.IG.Tc.C.BKZ-2/10, 5a, b × 5, 5c × 25.

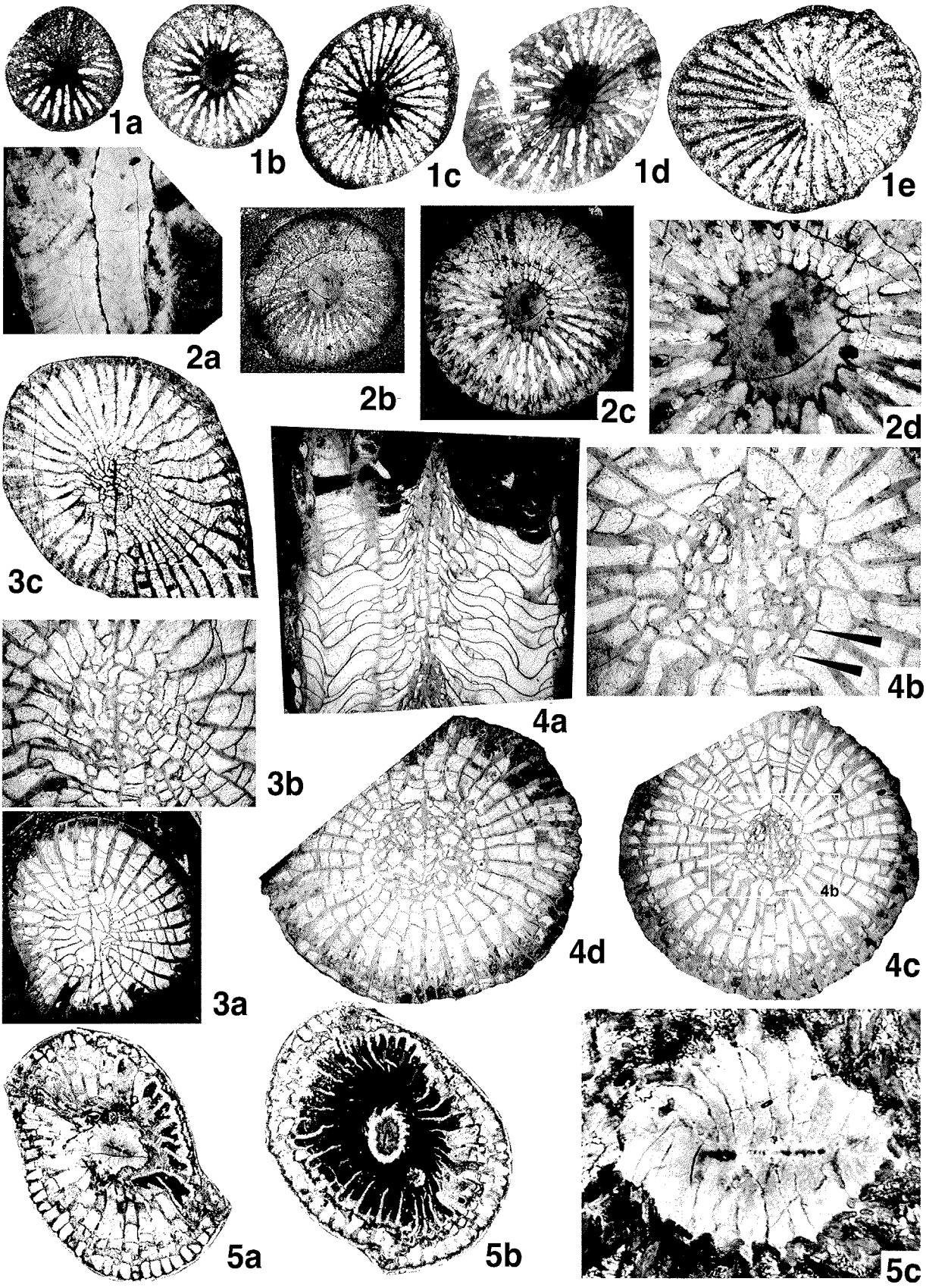

1a
1b
1c
1d
1e
2a
2b
2c
2d
3c
4a
4b
3b
4d
4b
4c
3a
5a
5b
5c

PLATE 12

1 – *Eostrotion tortuosum* (MICHELIN, 1846), UAM.IG.Tc.C.BŁT-3/1, 1a, c-g × 5, 1b × 25.
2 – *Cyathoclisia modavense* (SALÉE, 1913), UAM.IG.Tc.C.BRD-1/7, 2a-d × 7, 2e × 15, 2f × 20.
3 – *Rylstonia* cf. *smythi* WEYER, 1975, UAM.IG.Tc.C.D-1/9a, × 8.
4-7 – *Bounophyllum pomeranicum* sp.nov., 4 – UAM.IG.Tc.C.DSO-19K/48, × 70, 5 – UAM. IG.Tc.C.DUN-1/1, × 6, 6 – UAM.IG.Tc.C.DUN-1/9, × 4, 7– UAM.IG.Tc.C.DSO-19K/9, × 5.

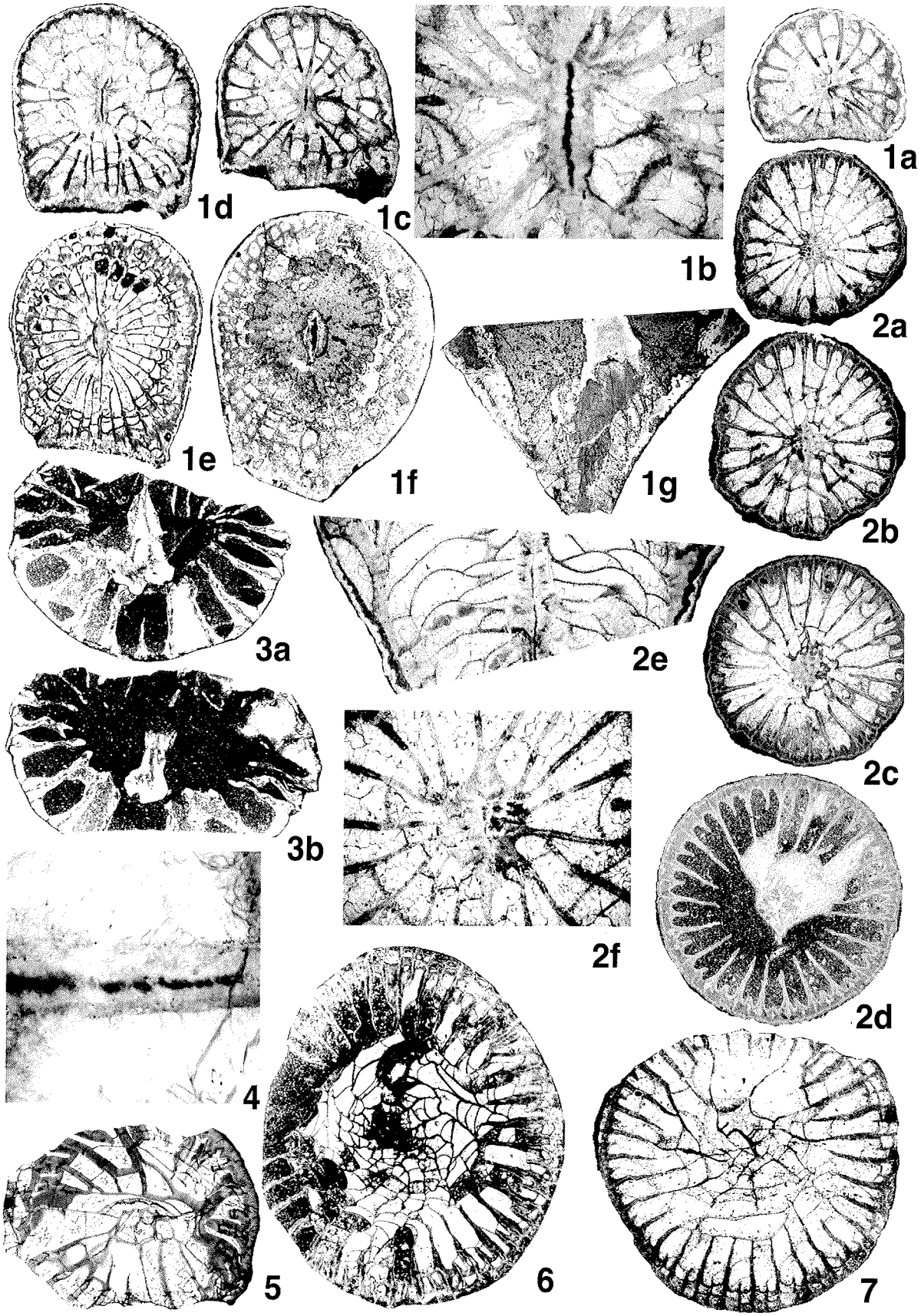

1a
1b
1c
1d
1e
1f
1g
2a
2b
2c
2d
2e
2f
3a
3b
4
5
6
7

PLATE 13

1-4 – *Bounophyllum pomeranicum* sp.nov., 1 – UAM.IG.Tc.C.G-9/11a/7, 1a, b × 20, 1c × 15, 1d-e × 10, 1f-g × 5, 1h × 4, 2 - UAM.IG.Tc.C.G-9/11a/1, × 6, 3 – UAM.IG.Tc.C.DSO-19K/48, × 4, 4 – UAM.IG.Tc.C.DUN-1/16A, 4a, c, d × 4, 4b × 6.

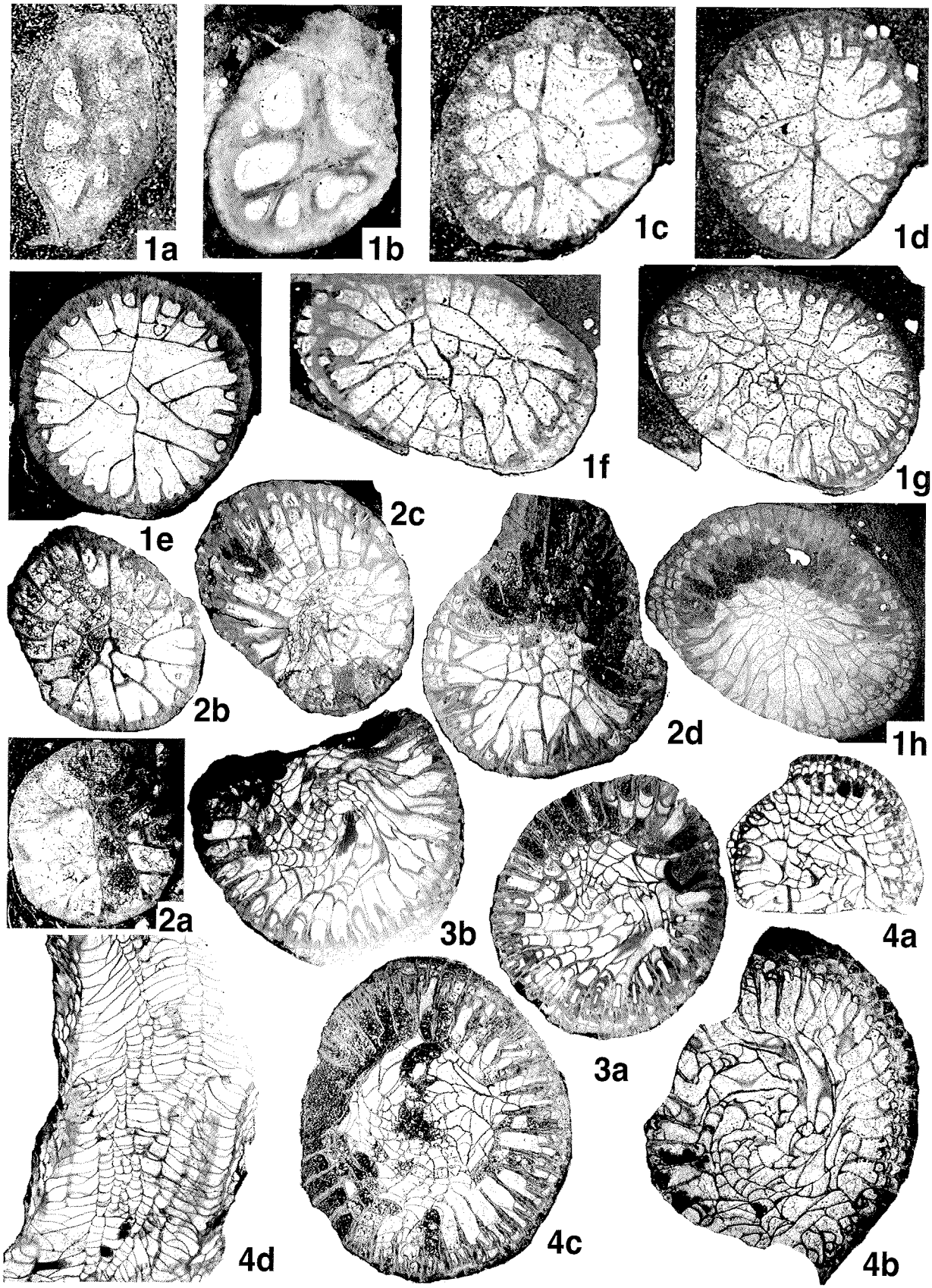

1a
1b
1c
1d
1e
1f
1g
1h
2a
2b
2c
2d
3a
3b
4a
4b
4c
4d

PLATE 14

1-3 – ?*Palaeosmilia aquisgranensis* (FRECH, 1885), 1 – UAM.IG.Tc.C.G–9/23, 1a, b × 3, 1c × 12, 2 – UAM.IG.Tc.C.BAB-1/3, × 3, 3 – UAM.IG.Tc.C.BAB-1/8, × 3.

4 – ?*Bradyphyllum bojkowskii* FEDOROWSKI, 1968, UAM.IG.Tc.C.BRD-1/9, × 5.

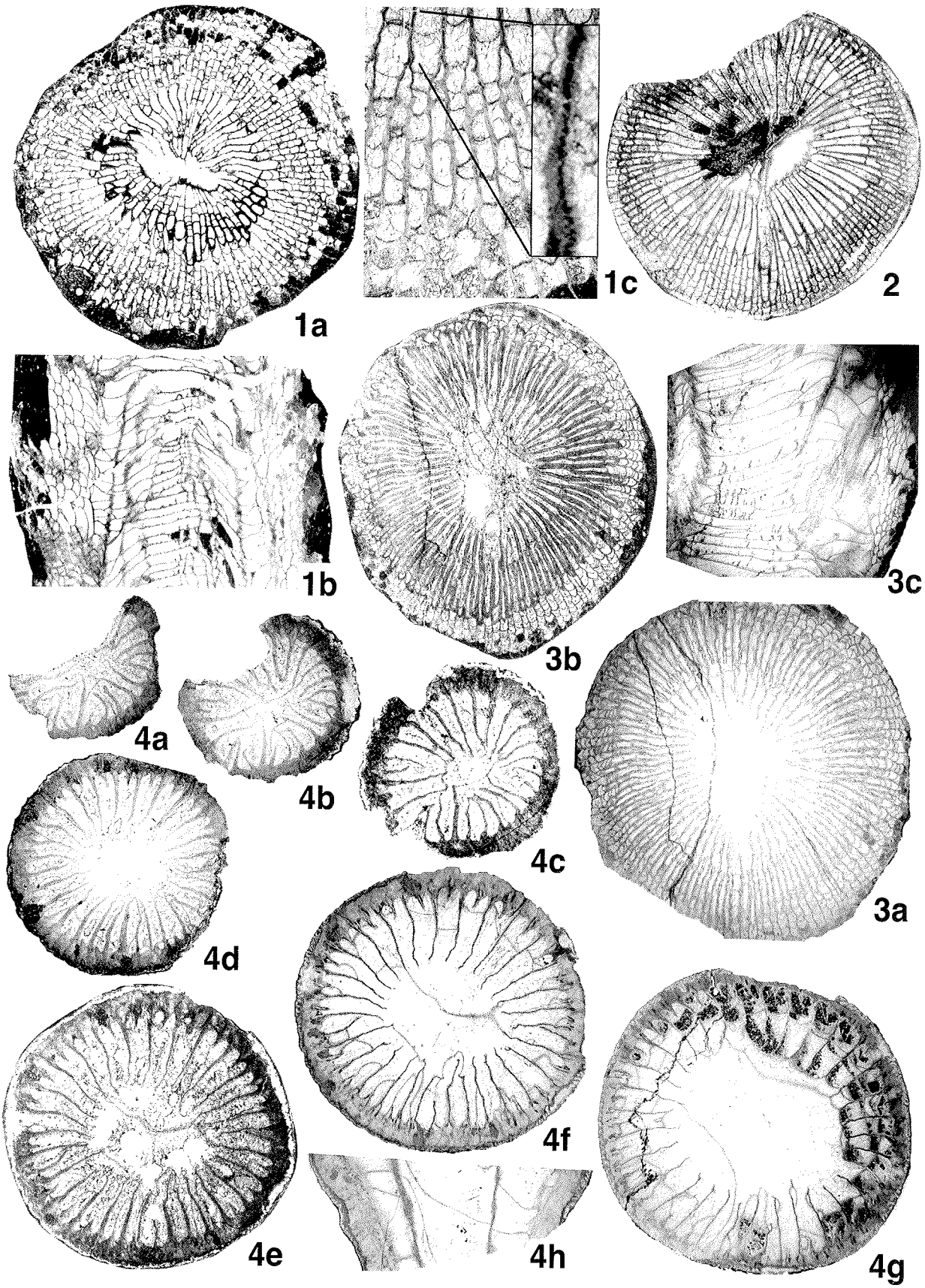

1a
1b
1c
2
3a
3b
3c
4a
4b
4c
4d
4e
4f
4g
4h

PLATE 15

1, 2 – *Rotiphyllum* sp. B, 1 – UAM.IG.Tc.C.D-1/22, × 5, 2 – UAM.IG.Tc.C.D-1/13, × 10.
3 – *Drewerelasma* sp. A., UAM.IG.Tc.C.BKZ-2/3, 3a × 10, 3b-d × 5, 3e × 30.
4 – *Rotiphyllum* sp. A, UAM.IG.Tc.C.D-1/8, × 4.
5 – *Zaphrentites* cf. *parallela* (CARRUTHERS, 1910), UAM.IG.Tc.C.BRD-1/2, 5a, b × 8, 5c × 6.
6 – *Zaphrentites parallela* (CARRUTHERS, 1910), UAM.IG.Tc.C.BGD-7/1, × 6.

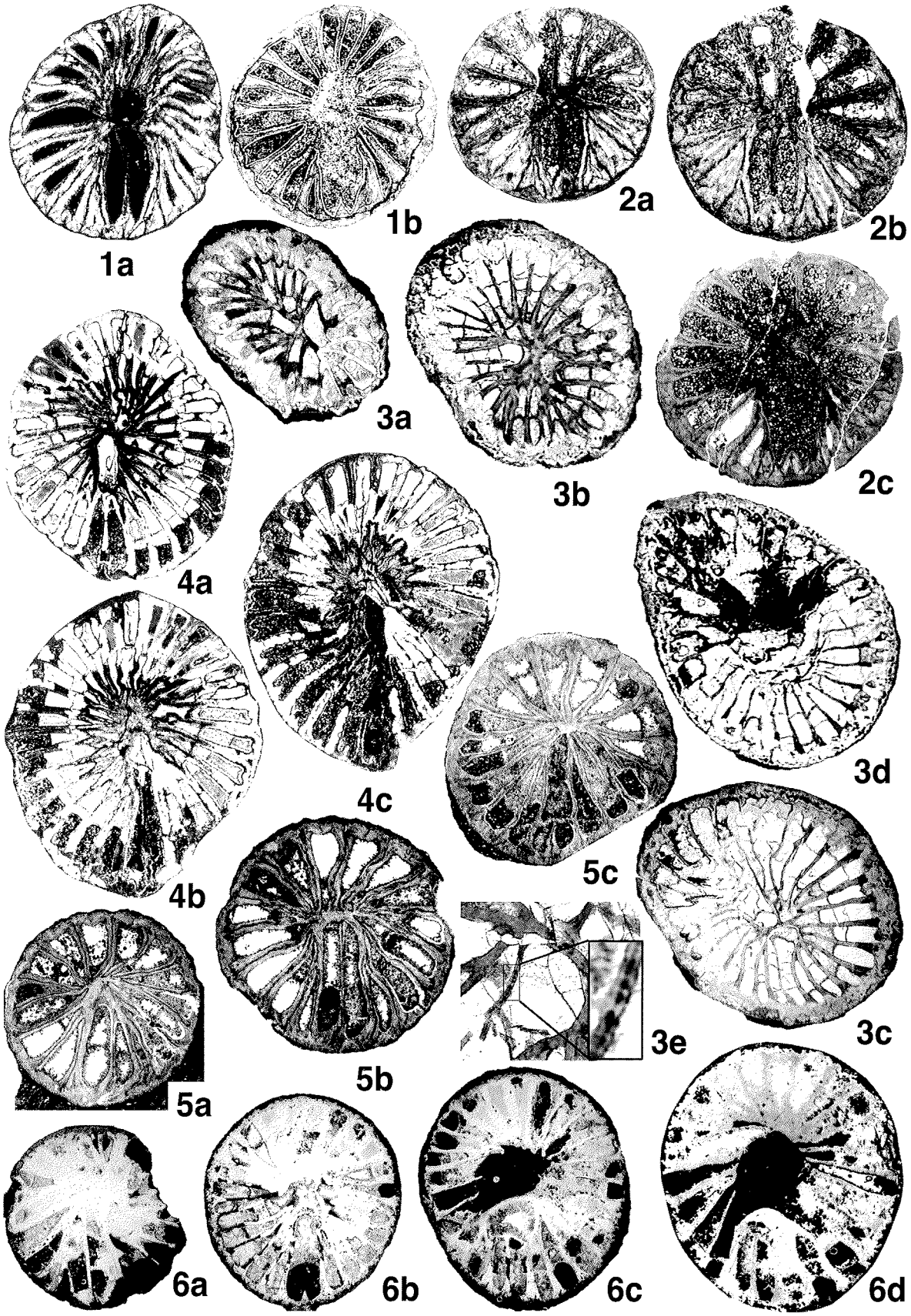

1a
1b
2a
2b
3a
3b
2c
4a
4c
3d
4b
5c
3c
5b
3e
5a
6a
6b
6c
6d

PLATE 16

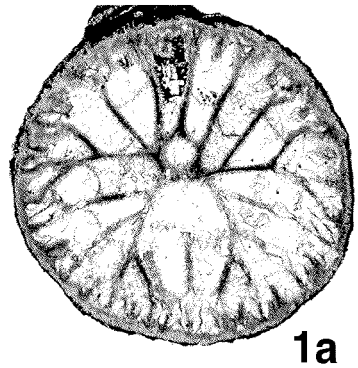
1 – *Sychnoelasma konincki* (MILNE-EDWARDS & HAIME, 1851), UAM.IG.Tc.C.BRD-1/5, 1a × 15, 1b × 12, 1c × 10.

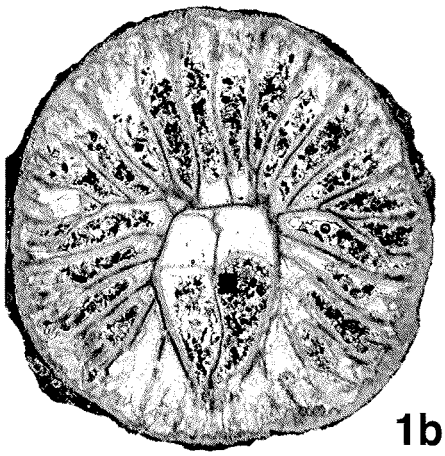
2 – *Zaphrentites* cf. *crassus* (HUDSON, 1944), UAM.IG.Tc.C.D-1/13, × 8.

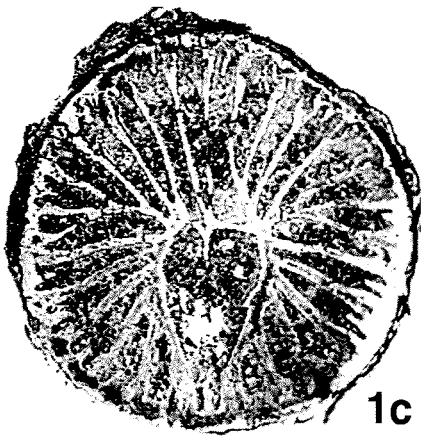
3, 4 – *Conilophyllum priscum* (MÜNSTER, 1840), 3 – UAM.IG.Tc.C.DSO-19K/7, × 8, 4 – UAM.IG.Tc.C.DSO-19K/135, × 4.

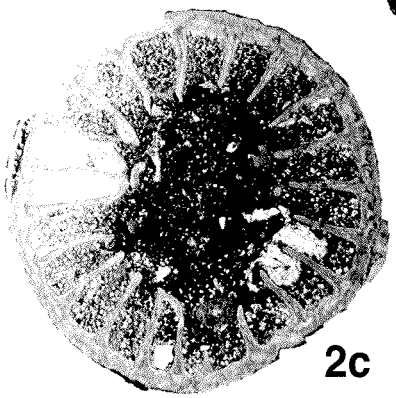
5 – *Oligophylloides pachythecus* RÓŻKOWSKA, 1969, UAM.IG.Tc.C.DSO-19K/107, × 30.

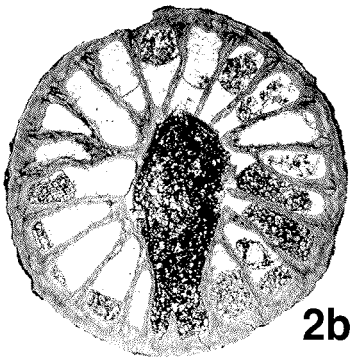
6 – *Heterostrotion* sp. UAM.IG.Tc.C.D-1/15, × 5.


1a


1b


1c


2c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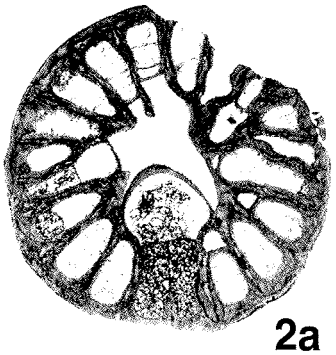
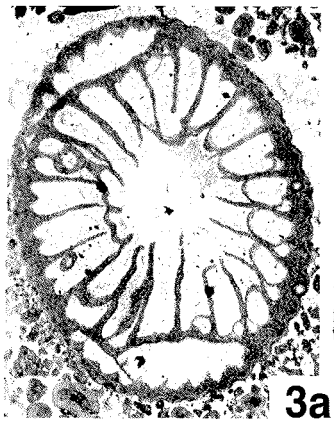
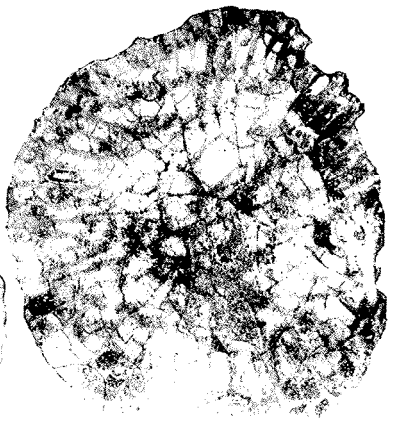

2a


3a


4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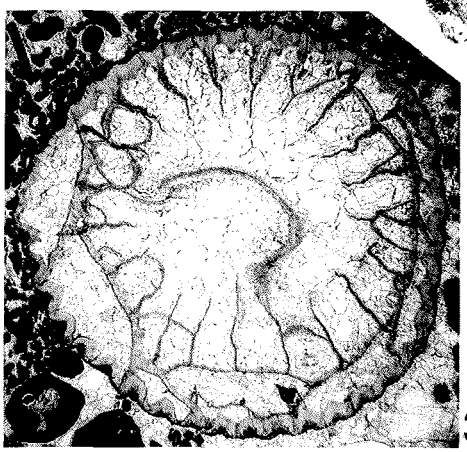
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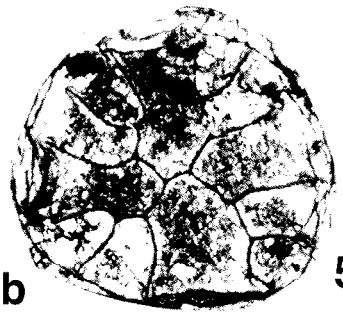
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