A C T A P A L A E O N T O L O G I C A P O L O N I C A

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FAMENNIAN TETRACORALLOID AND HETEROCORALLOID FAUNA FROM THE HOLY CROSS MOUNTAINS (POLAND)

Contents

Abstract. — Famennian corals of the south-western part of the Holy Cross Mountains (Góry Świętokrzyskie) from Kadzielnia, Zaręby, Łagów (Dule), Gałęzice (Besówka), Kowala and Jabłonna are described in the present work. About 3,000 specimens have been collected and 55 species and 5 subspecies of 36 genera — described. A new family, Kielcephyllidae, two new subfamilies, Friedbergiinae and Guerichiphyllinae, 9 new genera, 36 new species and 5 subspecies have been erected. On the basis of a lithological analysis of beds, faunal assemblages and the preservation state of corallites, it has been concluded that in the Lower Famennian a shallow sea existed at Kadzielnia. It was temporarily connected with the open sea. The corals are mostly preserved there in a life-time place. At Zaręby, there was a lagoon with the remains of plants but with a normal salinity of water. In the Upper Famennian of Gałęzice, the sea water was well aerated and connected with the open sea. Fossils are broken but not worn off and, therefore, they were not transported. At Kowala, the sea was probably calm, not deep and well aerated. Index species for the Lower and Upper Famennian have been determined among the coral fauna examined. The age of individual zones has been determined by conodonts and where such were lacking, climeniids or trilobites. The history of the research of Famennian corals, which in general occur rarely and in monotonous assemblages, has been presented. To settle their generic assignment, the ontogeny of

corals has been studied and the results were a basis for changes introduced to the classification. A few phyla have been distinguished and their phylogenetic relationships discussed.

INTRODUCTION

The present writer was introduced to the tetracoral bearing Famennian by the late Prof. J. Czarnocki, an indefatigable investigator and excellent expert in the geology of the Holy Cross Mountains (Góry Świętokrzyskie) who died in 1951. He also indicated the localities of coral occurrence in Famennian of Kielce (Kadzielnia quarry), of Gałęzice (on Besówka Hill) and of Kowala. He made available a few corals collected at Kowala and Zaręby and which were among the collections of the Geological Institute in Warsaw. Prof. H. Makowski (Department of Historical Geology, University of Warsaw) determined the places from which came the corals of the genus *Ufimia* collected at Zaręby by him and, previously, by Prof. J. Czarnocki.

In 1950, the late Prof. Z. Gorizdro-Kulczycka made the first exposure on Kadzielnia quarry from which she collected Famennian fishes. About 200 specimens of Rugosa she found at this opportunity were given away to the present writer. This exposure has been called in the present work "Kadzielnia G." Other materials were found in the following exposures: Kadzielnia I, beds 4-1 (1959), Kadzielnia II, beds N-A (1960) and Kadzielnia III, beds 50-1 (1961). In 1962, the present author started the exploitation of Upper Famennian on Besówka Hill at Gałęzice and distinguished beds 10-1. In 1965, in 6 exposures at Zaręby, she found only a few fragments of *Heterophyllia*. In 1966 at Kowala, the author found a few Upper Famennian corals in five trenches, made close to the place of Czarnocki's previous search on a field belonging to Mr. Prędotka, a farmer. The beds containing corals were determined by Czarnocki as *Wocklumeria* beds. In addition, the author received Famennian corals collected by Prof. Z. Kielan-Jaworowska (Palaeozoological Institute, Polish Academy of Sciences, Warsaw) as she looked for trilobites on Kadzielnia quarry. Dr. Z. Wolska (Palaeozoological Laboratory, Polish Academy of Sciences, Poznań) supplied the author with corals she found when sampling conodonts at Łagów (Dule) and Jabłonna. Finally, the present writer received from Prof. H. Makowski a fragment of a climeniid limestone filled with small fragments of the coral *Oligophylloides pachythecus pachythecus* n.subsp. from Łagów (Dule).

The age of coral bearing beds was determined by Wolska (1967) on the basis of conodonts she identified by applying Ziegler's (1962) zonation for Upper Devonian.

To study the structure of corals, more than 2,000 peels of transverse and longitudinal sections were made. Many peels of serial sections were

also made to study the ontogeny. After photographing the peels figures were drawn on them in ink and then the background supressed. In addition several thin sections were made for the studies of microstructure.

ACKNOWLEDGEMENTS

I would like to express my heartfelt thanks to Prof. R. Kozłowski (Palaeozoological Institute, Polish Academy of Sciences, Warsaw) for valuable indications and advice concerning the preparation of the present work for print. My gratitude is also due to Dr. J. Fedorowski (Palaeozoological Laboratory, Polish Academy of Sciences, Poznań) for preparing toilsome, time consuming and, at the same, faithful drawings for discussions on Rugosa in general, in particular Carboniferous ones and for help in making some peels for ontogenetic studies. In addition, Dr. J. Fedorowski compared a few species of Famennian corals, studied by the author, with type species and holotypes, worked out by the late E. D. Soshkina and which are housed at the Palaeontological Institute of the U.S.S.R.'s Academy of Sciences in Moscow. I thank very much Dr. T. A. Dobroljubova and Mrs. N. V. Kabakovitsh for showing E. D. Soshkina's collections and discussing with Dr. J. Fedorowski the specific assignment of some Famennian corals. I am grateful to the Managements of the Institute of Geology and Palaeontology of the Museum of the A. Humboldt University in Berlin (German Democratic Republic) and in particular to Dr. H. Jaeger, the curator, for making available the rich collections of the Museum and lending out a few corals for comparative studies. Likewise, I thank Mr. D. Weyer, from the Geological Institute in Berlin, for sending appropriate German literature and discussion concerning corals, and Dr. H. Prescher, Director of the National Museum of Mineralogy and Geology in Dresden, for a permission to examine the Devonian fauna. My best thanks are extended to the Management of the Geological Institute in Warsaw and to Dr. M. Żelichowska, the curator of the Institute's Museum, for lending out J. Czarnocki's collections.

In working out the problems concerning Famennian corals, the writer availed herself of a considerable aid and knowledge of the following specialists: M. Pajchlowa, M. Sc., from the Geological Institute in Warsaw, prepared the profiles, described the exposures and trenches (unpublished) and discussed with the present author various geological problems. Dr. S. Cebulak and Dr. A. Różkowski from the Geological Institute, Silesian Branch in Sosnowiec, described the lithology of beds. The former examined the samples taken and sent in characteristics of the sediment (written communication), the latter described the rocks macroscopically during the author's field work and gave her useful

advice. Prof. H. Makowski determined the goniatites and climeniids, collected by the author, and settled the age of beds according to the cephalopod biostratigraphy (written communication), Dr. H. Osmólska (Palaeozoological Institute, Polish Academy of Sciences, Warsaw) determined the age of beds on the basis of trilobites she identified (in litter.) and which were sent her by the author. Dr. W. Szymańska (the same Institute) reviewed the manuscript and offered suggestions for its improvement. Mrs. K. Budzyńska, Mrs. D. Sławik and Mr. W. Siciński (the same Institute) much helped the author in preparing tables and drawings. To all these persons, the present writer expresses her deep gratitude and thanks. Finally, she feels greatly indebted to her collaborators at the Palaeozoological Laboratory, Polish Academy of Sciences, Poznań: Mr. K. Fryś and Mr. S. Bankiewicz for taking many photographs, and to Mr. W. Maciejewski for making toilsome thin sections.

ABBREVIATIONS

The following abbreviations have been used in the present work:

Z. Pal. P. Tc 3 — catalogue number of a collection housed at the Palaeozoological Institute of the Polish Academy of Sciences, Poznań Branch;

I.G. — catalogue number of the collection, housed at the Museum of the Geological Institute in Warsaw;

n/d — septal index, where n designates the number of septa, and d the diameter of the coral;

c/d — determines the relation between the diameter of the axial tube (c) and the diameter of the coral (d);

c+st/d — determines the relation between the diameter of the axial tube (c) with stereotheca (st) and the diameter of the coral (d).

DESCRIPTION OF EXPOSURES

According to Czarnocki's (1957) studies, in the Holy Cross Mountains we may distinguish two palaeogeographical regions with a different facial development, i.e. 1) the Łysogóry Region, and 2) the Kielce Region (Text-fig. 1). The boundary between those regions, running almost concordantly to the Holy Cross dislocation, was shifted, in Upper Devonian, southwards. Thus, the following two facies were formed in Famennian of the Kielce Region: 1) Kielce-Łagów synclinorium which facially belongs to the Łysogóry Region (Kadzielnia quarry) with a poor fauna of blocky and nodulous limestones forming intercalations in cypridinic shales which are about 100 m in thickness, and 2) Gałęzice--Daleszyce syncline where climeniid limestones, about 2 m in thickness, are deposited on submarine rise (Pajchlowa, 1959) and contain a fauna of cephalopods, crinoids and bivalves.

Corals from both regions, i.e. from a 10 m section of cypridinic shales

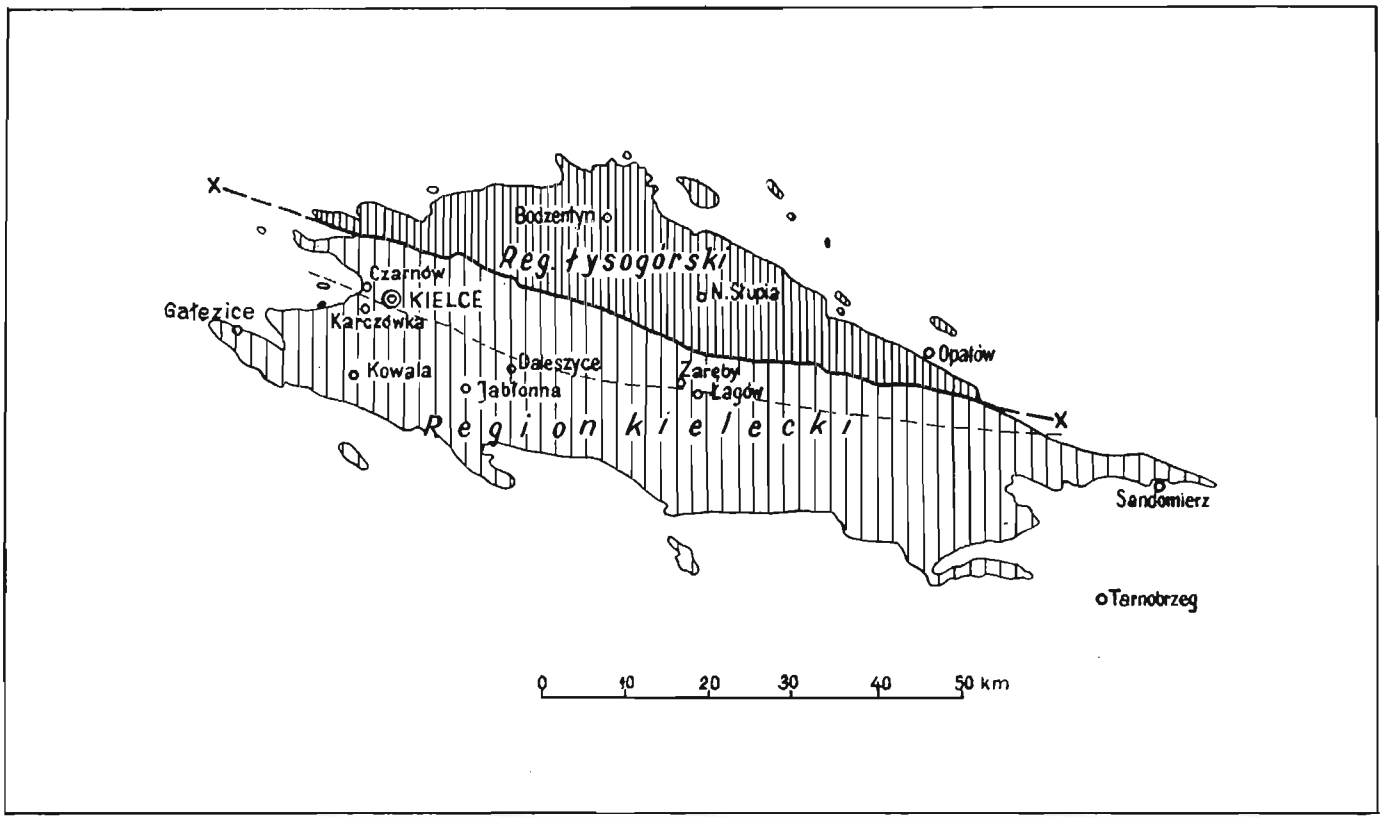

Fig. 1. — Range of Palaeozoic deposits in the Holy Cross Mountains. Noted are localities with coral bearing beds (after Osmólska, 1962, Fig. 1).

from Kadzielnia, from small outcrops at Zaręby and from the cephalopod facies of Gałęzice, Kowala, Jabłonna and Łagów are described in the present work.

Kadzielnia quarry

Between 1950 and 1961, a few exposures were made on the eastern quarry wall at a stretch of about 10 m.

The first exposure, designated "G", was made in 1950 by Prof. Z. Gorizdro-Kulczycka who, looking for Famennian fishes, also collected about 200 specimens of corals and gave them away to the present writer. The specific composition of these corals is as follows: *Petraiella centralis* n.sp., *Neaxon tenuiseptatus* n.sp., *Guerichiphyllum parvum* n.sp., *G. concavum* n.sp., *Amplexocarinia muralis* Soshk., *A. obliqua* n.sp., *Gorizdronia profunda profunda* (Soshk.), *G. profunda longiseptata* n. subsp., *G. geniculata* n.sp., *Nalivkinella profunda* Soshk., *N. rariseptata* n.sp., *Kielcephyllum cupulum* n.sp., *K. confluens* n.sp., *Kozlowskinia flos* n.sp., *K. phyllis* n.sp., and *Smithiphyllum* aff. *imperfectum* (Smith).

The next exposure, made by the present writer 2 m to the south of the previous one, comprises 4 complexes of beds which, from the base to the top, are:

Bed I, 4. Calcareous concretions in marly shales containing a poor fauna. *Amplexocarinia muralis* is a predominant rugose, accompanied by *Orbiculoidea* sp., small crinoids and cephalopods.

Bed I, 3. Blocky limestones as intercalations of dark coloured bituminous shales. The fauna of Rugosa is variable, with *Nalivkinella rariseptata* n.sp. and *Amplexocarinia muralis* as predominant species, accompanied by *Posidonia venusta* (shell impressions), *Orbiculoidea* sp., *Lingula* sp., fishes and cephalopods.

Bed I, 2. Blocky limestones as intercalations of dark coloured shales. Rich fauna, with *Amplexocarinia muralis*, *Nalivkinella rariseptata* n.sp. and *Thamnophyllum germanicum* Scrutton (one specimen), predominating among Rugosa and accompanied by calcareous tubes (probably belonging to worms), pygidia of trilobites, *Posidonia venusta*, *Orbiculoidea* sp., small crinoids and cephalopods *Cheiloceras* and *Michelinoceras*.

Bed I, 1. Gray marly shales with limestone nodules. The corals *Amplexocarinia muralis* and *Nalivkinella rariseptata* n.sp. predominate in shales. They are well preserved, situated in the planes of stratification of shales and accompanied by *Posidonia venusta*, small crinoids, remains of fishes and cephalopods.

The next exposure, 3 m further to the south, includes the complexes of beds II, N-A.

Bed II, N. Two rhythms of sedimentation: 1) folded, dark coloured shales and 2) a layer of calcareous concretions. The fauna, occurring in shales, is poor: worm tubes, *Posidonia* sp., *Orbiculoidea* sp., crinoids and indeterminable organic remains. On the other hand, the fauna in concretions is very variable. *Nalivkinella rariseptata* n.sp. and *Kielcephyllum confluens* n.sp. predominate among Rugosa and are accompanied by *Tornoceras simplex* and *Cheiloceras amblylobum*.

Bed II, M. Dark-gray marly shales with pyrite concretions interbedded by thin layers of a light-yellow shale, somewhat richer in calcium carbonate. *Kielcephyllum confluens* n.sp. and *Kozlowskinia flos* n.sp. predominate among rare corals and are accompanied by worm tubes, molluscs, *Orbiculoidea* sp., crinoids, insignificant amounts of organic remains and cephalopods, *Tornoceras simplex* and *Cheiloceras amblylobum*.

Bed II, L. Like in beds II, N and, higher, II, K, there are two rhythms of sedimentation: dark-gray marly shales, interbedded by a layer of irregular, yellow,

calcareous concretions. In dark shales, fauna is as poor as in bed II, N, whereas there are many corals which occur in a layer containing concretions richer in calcium carbonate. *Kielcephyllum confluens* n.sp. and *Kozlowskinia flos* n.sp. predominate among corals, accompanied by many cephalopods *Cheiloceras curvispina, Tornoceras simplex* and a large *Cyrtoceras* sp.

Bed II, K. Also two rhythms of sedimentation: 1) dark-gray marly shales with the remains of trilobites, worm tubes, *Posidonia* and small crinoids; 2) strongly calcareous shales, sharply contrasting with the base, with many calcareous concretions and a rich fauna. *Kielcephyllum confluens* n.sp. and *Amplexocarinia muralis* predominate among corals. They are well preserved and situated in the planes of stratification of shales. Irregular calcareous concretions, *Kozlowskinia flos* n.sp., a shell of a brachiopod, crinoids, a spine of a fish, *Cheiloceras* sp. and *Michelinoceras* sp. were observed by the present writer on an area of about 16 sq. cm.

Bed II, I. Two rhythms of sedimentation: 1) dark-gray limestones, separated by 2) a thin layer of light coloured concretions. Rare corals, *Amplexocarinia muralis* and *Gorizdronia geniculata* n.sp. are accompanied by brachiopods, fish remains, cephalopods *Cheiloceras* sp., *Michelinoceras* sp. and *Cyrtoceras* sp.

Bed II, F. Dark-gray shales. Fauna poor. *Petraiella centralis* n.sp. predominates among corals and is accompanied by the impressions of shells of *Posidonia venusta* and *Buchiola retrostriata*, as well as small crinoids, worm tubes, *Lingula* sp., cephalopods *Cyrtoceras* sp., *Michelinoceras* sp., *Tornoceras* sp. and a fish bone fragment.

Bed II, D. Dark bituminous shales with nodules of gray limestones. Fauna poor: *Amplexocarinia muralis*, brachiopods, *Orbiculoidea* sp., many fine columnals of crinoids and cephalopods as in bed II, F.

Bed II, C. Dark bituminous shales with *Kozlowskinia flos* n.sp., accompanied by a trilobite *Trimerocephalus* sp., brachiopods, crinoids and cephalopods *Cheiloceras* sp. and *Cyrtoceras* sp.

Bed II, B. Dark bituminous shales with *Kozlowskinia flos* n.sp., accompanied by rare *Lingula* sp., articulate brachiopods, crinoids and cephalopods *Cheiloceras* sp., *Cyrtoceras* sp. and *Michelinoceras* sp.

Bed II, A. Dark-gray marly shales with calcareous nodules containing *Amplexocarinia muralis, Spirifer* sp., *Trimerocephalus* sp., rare crinoids and cephalopods *Cheiloceras* sp., *Cyrtoceras* sp. and *Michelinoceras* sp.

The next exposure, made at a distance of about 4 m, comprises beds III, 50-1 (Text-fig. 2). It is about 10 m high. The bottom layer directly overlies the Upper Frasnian.

Bed III, 50 (*crepida* Zone). Dark-gray pelitic, cephalopod limestone with brown stripes, containing iron oxydes. Fauna: a coral *Petraiella centralis* n.sp., accompanied by rare crinoids and accumulations of cephalopods *Cheiloceras amblylobum, Cyrtoceras* sp. and *Michelinoceras* sp.

Bed III, 49 (15 cm thick, *rhomboidea* Zone). Dark-gray, pelitic limestone, interbedded by marly shales. Poor fauna of *Trimerocephalus caecus* and few ostracods (*Richterina*?).

Bed III, 48 (15 cm thick, *rhomboidea* Zone). Light-gray, pelitic limestones overlying clays. Brachiopods, molluscs, many ostracods, crinoids, and a cephalopod *Cheiloceras amblylobum* occur in limestone.

Bed III, 47 (8 cm thick, *rhomboidea* Zone). Hard, crystalline, dark-gray limestone overlying clay. Fauna (in limestone): a coral *Gorizdronia profunda*, accompanied by *Posidonia venusta, Trimerocephalus caecus*, ostracods, crinoids and a cephalopod *Cheiloceras amblylobum*.

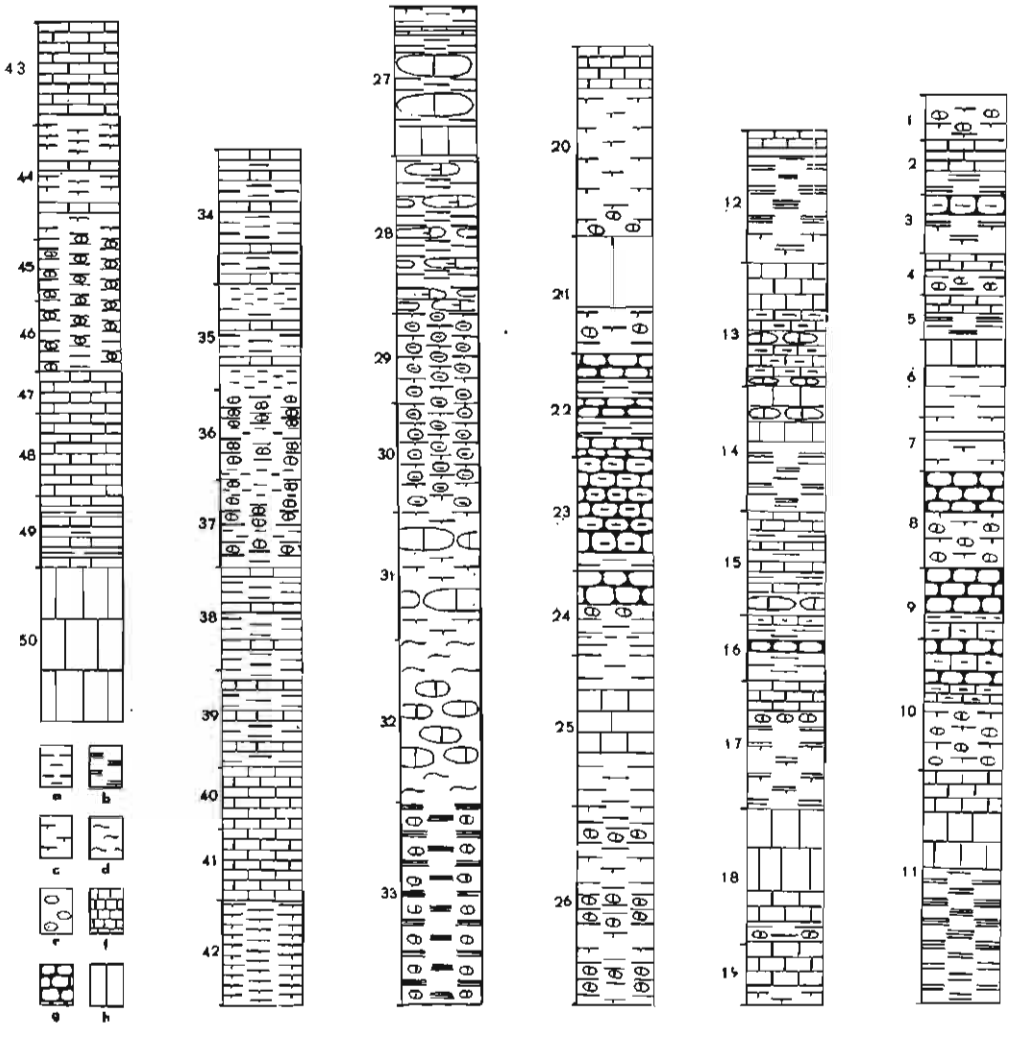

Fig. 2. — Section of exposure Kadzielnia III (after Pajchlowa, unpubl. data), scale 1:20. *a* clay shales, *b* plate limestones, *c* marly shales, *d* silt, *e* nodules and calcareous concretions, *f* crystalline limestone, *g* knoll limestone, *h* massive limestone.

Bed III, 46 (15 cm thick, *quadrantinodosa* Zone). Marly shales with nodular inclusions of dark-gray limestones. Fossils poorly preserved. *Kielcephyllum confluens* n.sp. and *Kozlowskinia flos* n.sp. predominate among corals, accompanied by cephalopods *Cheiloceras amblylobum* and *Michelinoceras* sp.

Bed III, 45 (15 cm thick, *quadrantinodosa* Zone). Dark-gray, folded, marly shales with small concretions of dark-gray, hard limestones. Dip — 56° (60°) 20°N. *Gorizdronia geniculata* n.sp. and *G. profunda*, predominant among corals, are accompanied by rare brachiopods, crinoids and damaged cephalopods *Cheiloceras* sp. and *Michelinoceras* sp., in limestones — *Posidonia* sp., brachiopods, rare trilobites, crinoids, frequent small ostracods and cephalopods *Cheiloceras curvispina* and *Michelinoceras* sp.

Bed III, 44 (20 cm thick, *quadrantinodosa* Zone). Light coloured marly shales with dark-gray concretions containing a rich organic detritus. *Gorizdronia profunda* predominant among corals, is accompanied by *Posidonia venusta*, very numerous trilobites *Trimerocephalus caecus*, numerous ostracods, rare crinoids and cephalopods *Cheiloceras amblylobum* and *Michelinoceras* sp.

Bed III, 43 (20 cm thick, *quadrantinodosa* Zone). Gray, compact, veined fine-crystalline and pelitic limestones with slaty cleavage and considerable content of organic detritus. *Gorizdronia profunda* and *Kielcephyllum densum* n.sp., predominant among corals, are accompanied by rare *Posidonia* sp., *Trimerocephalus caecus*, frequent crinoids and cephalopod *Cheiloceras* sp. which occur very frequently but are damaged and decalcified.

Bed III, 42 (30 cm thick, *quadrantinodosa* Zone). Marly gray shales with a bank of brachiopods, all of them resting on their dorsal valves and accompanied by a trilobite *Trimerocephalus mastophtalmus* and crinoids.

Bed III, 41 (15 cm thick, *quadrantinodosa* Zone). Fine-crystalline limestones (Pl. I, Fig. 1) gray with brown stripes, containing nodules and veins of pyrite. Dip — 84° (18°) N, striking 125° N. A poor fauna of *Posidonia venusta*, brachiopods, *Trimerocephalus mastophtalmus*, ostracods, crinoids and *Cheiloceras* sp.

Bed III, 40 (12 cm thick, *quadrantinodosa* Zone). Gray, crystalline, veined limestone with a poor fauna of ostracods, crinoids and *Cheiloceras* sp.

Bed III, 39 (20 cm thick, *quadrantinodosa* Zone). Light-gray limestone with brown stripes and veins of calcite, interbedded with a clay shale. A poor fauna of a coral *Petraiella kielcensis* n.sp. accompanied by *Posidonia venusta*, rare ostracods, crinoids and a trilobite.

Bed III, 38 (22 cm thick, *quadrantinodosa* Zone). Fine-crystalline limestone with veins of crystalline calcite, interbedded with black clay shales. A poor fauna of *Posidonia venusta*, ostracods and crinoids.

Bed III, 37 (30 cm thick). Conodonts lacking. Folded, clay shales with a black, lustrous surface, containing balls of gray and brown limestones, occur among mottled clays. Fauna poor: ostracods, crinoids and *Michelinoceras* sp.

Bed III, 36 (25 cm thick). Conodonts lacking. A very fine-crystalline, light coloured limestone with brown stripes, occurring among clay shales and mottled clay. Fauna poor: corals *Kielcephyllum densum* n.sp., *Petraiella centralis* n.sp., accompanied by brachiopods, ostracods and crinoids. *Cheiloceras* sp. occurs in the mottled clay.

Bed III, 35 (20 cm thick). Conodonts lacking. Dark-gray, crystalline limestones occur among black, clay shales, strongly interfolded with calcite veins. Dip — 45°N. Fauna poor: *Posidonia venusta*, brachiopods, *Cheiloceras curvispina*, ostracods and crinoids.

Bed III, 34 (30 cm thick). Conodonts lacking. Dark-gray limestone nodules occur among dark-gray marly shales, surrounded by mottled clay. Fauna poor: *Posidonia venusta*, ostracods and crinoids.

Bed III, 33 (40 cm thick). Conodonts lacking. Nodules of dark-gray limestones occur among black bituminous shales. Fissures with calcite geodes. Dip — 47° (61°)N. Fauna poor: *Posidonia venusta*, *Lingula* sp. and ostracods.

Bed III, 32 (32 cm thick). Conodonts lacking. Flat calcareous concretions occur among marly shales, surrounded by mottled mudstone. Rare ostracods.

Bed III, 31 (25 cm thick). Conodonts lacking. Large, flat calcareous concretions, lying parallelly to stratification among marly shales with a red coating. Rare ostracods.

Bed III, 30 (21 cm thick). Conodonts lacking. Flat calcareous concretions with regular crystals of pyrite occur among dark coloured, marly shales with a red

surface. Mottled clays occur between them. Fauna: here and there thin banks of shells of *Posidonia venusta* and few ostracods.

Bed III, 29 (19 cm thick). Conodonts lacking. Flat, calcareous concretions containing pyrite, occur among marly shales with ripple marks. Fauna: *Posidonia venusta*, brachiopods, trilobites and — in limestone — many ostracods.

Bed III, 28 (30 cm thick). Conodonts lacking. Elongate, flat, marly concretions among clay shales. *Gorizdronia profunda* predominates among few rugoses, accompanied by *Posidonia venusta*, rare brachiopods, ostracods and crinoids.

Bed III, 27 (30 cm thick). Conodonts lacking. Large, oval, marly concretions among gray, clay and bituminous shales. Dip — 60—70°N. Fauna in shales: worm tubes, brachiopods and *Cheiloceras* sp.

Bed III, 26 (40 cm thick). Dark-gray, marly shales, interbedded with black, bent shales with concretions of limestones with a black fracture. Dip — 48°E. Fauna in gray shales: rare corals *Guerichiphyllum parvum* n.sp., accompanied by many cephalopods *Cheiloceras curvispina*, *C. globosum* and *Tornoceras simplex*; in concretions — ostracods.

Bed III, 25 (30 cm thick). Dark and light coloured shales with nodules of dark coloured, very fine-crystalline limestone. Fauna in shales variable: corals *Guerichiphyllum parvum* n.sp. and *Kielcephyllum confluens* n.sp., accompanied by *Posidonia venusta*, worm tubes, brachiopods, *Cheiloceras curvispina*, *Michelinoceras* sp., ostracods, crinoids and a fish bone fragment. In concretions — very numerous ostracods.

Bed III, 24 (24 cm thick). Gray and red, clay shales containing limestone nodules. Fauna poor: *Posidonia venusta*, brachiopods, ostracods, trilobites and *Cheiloceras* sp.

Bed III, 23 (32 cm thick). Composition — as in bed III, 24. Fauna poor; in shales impressions of molluscs, remains of brachiopods and trilobites.

Bed III, 22 (20 cm thick). Gray, clay shales with nodules of marly limestone. Fauna poor: in shales compressed brachiopods, in limestones many ostracods.

Bed III, 21 (23 cm thick). Light coloured, clay shale with limestone nodules, containing *Posidonia venusta* and *Lingula* sp., overlaid with a thick-banked limestone lacking fossils.

Bed III, 20 (37 cm thick). In the base, marly shale with thin banks of molluscs and fragments of trilobites, overlaid with very fine-crystalline limestones with *Lingula* sp. and ostracods.

Bed III, 19 (13 cm thick). In the base, marly shales with pyrite, underlying banks of gray, crystalline limestone. In shales-banks of molluscs, in limestone — remains of trilobites, brachiopods, ostracods and *Michelinoceras* sp.

Bed III, 18 (33 cm thick). Very fine-crystalline limestone with many marly concretions. Fauna: a coral *Nalivkinella profunda*, brachiopods, molluscs and fish remains. Over this layer, there occurs a thick-banked, massive, very fine-crystalline limestone with a poor fauna of brachiopods, molluscs and crinoids.

Bed III, 17 (25 cm thick). Marly shales with traces of fauna, an intercalation of bituminous shales without fauna and a dark coloured, crystalline limestone with ostracods.

Bed III, 16 (13 cm thick). In the base, clay shale with a coral *Petraiella centralis* n.sp., together with *Posidonia venusta*, trilobites and crinoids, overlaid with hard limestone nodules with small concretions. Fauna poor: fragments of trilobites and many ostracods.

Bed III, 15 (20 cm thick). Nodules of limestone clay with traces of fauna and clay shales with impressions of molluscs.

Bed III, 14 (24 cm thick). In the base, bituminous shales with a coral *Oligo-*

phylloides pachythecus n.sp., together with *Lingula* sp. and banks of molluscs. In the top, thick-banked limestone with traces of fauna.

Bed III, 13 (20 cm thick). In the base, marly limestones with a shaly structure, containing concretions and traces of fauna. In the top, gray blocky limestone with ostracods.

Bed III, 12 (25.5 cm thick). In the bottom, marly shale with *Orbiculoidea* sp., *Posidonia venusta*, *Trimerocephalus mastophtalmus* and fish remains overlaid with gray shale, containing molluscs, brachiopods and *Trimerocephalus* sp. In the top, marly more crystalline limestone with ostracods, trilobites and crinoids.

Bed III, 11 (46 cm thick). In the base, marly, strongly clay shales with ripple marks, containing *Orbiculoidea* sp. and *Posidonia venusta*, overlaid with thick-banked limestone with a poor fauna of brachiopods, molluscs and crinoids. In the top, blocky limestone with *Posidonia* sp., *Trimerocephalus* sp. and ostracods.

Bed III, 10 (28 cm thick). In the base, marly shale with predominantly calcareous concretions and traces of fossils, overlaid with nodules of limestone with a poor fauna of bivalves.

Bed III, 9 (12.5 cm thick). Nodules of limestone with a poor fauna of crinoids.

Bed III, 8 (19.5 cm thick). In the base, marly shales with nodules of limestone and a fauna of *Lingula* sp., *Trimerocephalus* sp., *Posidonia venusta* and crinoids. In the top, nodules of marly limestone with traces of a clay substance, with pyrite and a poor fauna of ostracods. Ripple marks visible on the surface of shales.

Bed III, 7 (11 cm thick). Marly and clay shales with *Lingula* sp., ostracods, crinoids and *Michelinoceras* sp.

Bed III, 6 (10.5 cm thick). In the base, clay shale with *Lingula* sp. and *Posidonia venusta*, overlaid with fine-crystalline, almost pelitic limestone. Striking — 40°NEE, dip — 39°. Fauna poor: *Lingula* sp., ostracods and crinoids.

Bed III, 5 (9 cm thick). In the base, marly shales with pyrite and large clay concretions containing worm tubes, *Orbiculoidea* sp., *Trimerocephalus mastophtalmus* and crinoids. In the top, pelitic blocky limestone with a poor fauna of ostracods and *Posidonia venusta*.

Bed III, 4 (11 cm thick). Clay shales with concretions of calcareous shales, containing pyrite and a poor fauna of *Lingula* sp., *Trimerocephalus mastophtalmus*, *Posidonia venusta*, worm tubes and crinoids.

Bed III, 3 (11,5 cm thick). Bituminous and marly shales with *Lingula* sp., *Posidonia venusta*, *Trimerocephalus mastophtalmus* and *T. polonicus*. In the top, limestone nodules with crinoids.

Bed III, 2 (11 cm thick). Shales with few ostracods and blocky limestones with pyrite and many ostracods.

Bed III, 1 (15 cm thick). Gray, marly shales with worm tubes, *Posidonia venusta*, pygidia of trilobites and ostracods, overlaid with a fine-crystalline, almost pelitic limestone with *Posidonia* sp., crinoids and ostracods.

Facies in Kadzielnia quarry

Lower Famennian sediments at Kadzielnia are developed in the form of nodular limestones and calcareous concretions interbedding the shales. Exposure III, about 10 m long, occupies, therefore, only small part of Lower Famennian. It comprises the following conodont zones: *crepida* Zone (bed III, 50), *rhomboidea* Zone (beds III, 49-47) and *quadrantinodosa* Zone (beds III, 46-38). Higher beds do not contain conodonts. In addition, the age of *quadrantinodosa* Zone was established for bed II, K in exposure II.

A shaly facies predominates in Lower Famennian of Kadzielnia. It corresponds to the ostracod shales of Western Germany and Southern England. Shales are

mostly dark, bituminous, here and there black. On their surface there are ripple marks formed as an effect of waving on the bottom of a shallow sea. Concentrations of nectonic cephalopods occur in some places on shales. Their presence is an evidence of a connection of the basin with an open sea. Cephalopods are frequent in the basal part of Lower Famennian in beds III, 50, 46 and 45 and III, 25 and 24, whereas they are absent from younger sediments in beds III, 17 — III, 1. In some places, there occurs a rich benthonic fauna of trilobites which are mostly blind (Osmólska, 1958) as a result of living in a poorly lighted environment and of Brachiopoda Inarticulata with chitinous-phosphatic shells indicating a reducing environment. More frequent are however brachiopods with calcareous shells which here and there form banks (III, 42). Numerous are also thick, calcareous worm tubes. In some places, there occur many bivalves which form thin banks, deposited on the planes of stratification.

Corals occur mostly as solitary, less frequently budding forms. Their assemblages are monotonous although locally numerous individuals were found. Predominant are the species of the genera *Kielcephyllum* n.gen., *Kozlowskinia* n.gen., *Nalivkinella*, *Gorizdronia* n.gen. and, in particular, *Amplexocarinia*. This is a nalivkinelloid fauna with their axial tubes surrounded by cyatotheca. Corals are more frequent in shales than in limestones, occurring more frequently in some beds (II, K) and only sporadically in others, but mostly they are absent. The most are *in situ*, but in profile III, 46, they are broken, recrystallized and, consequently, probably redeposited. In younger beds they become less and less frequent. The youngest bed containing corals is III, 14. Quite different conditions are observed in exposures II and I where corals occur numerously on the surface of shales among fine, irregular calcareous concretions and where they are preserved *in situ*. There are the following proofs for this fact.

The present writer selected the most frequent species *Amplexocarinia muralis* which characterizes beds I, 1-3 and II, K-N and analyzed the preservation state of 193 specimens. In exposure I, this species makes up 24 per cent of the entire fauna of corals, in exposure II — 8 per cent, but in bed I, 2 — as much as 30 per cent. In the last-named bed, *Amplexocarinia muralis* lived in a poorly aerated basin, on a muddy bottom rich in calcium carbonate. In a few cases, corallites are preserved in a position of life, situated vertically on a layer of shale. More frequently, however, they are overthrown and, in such cases, their smooth, wide or narrow, tubelike talons are preserved. Larvae either settled directly on a muddy bottom or attached themselves to different objects resting on the bottom, as brachiopods, molluscs or other corallites. Of 193 specimens, 11 were undamaged. A large number (30 per cent) of specimens have their proximal ends preserved despite the fact that they are fragile, thin and projecting close to talon. In addition, epitheca, completely obscuring the interseptal striae, is mostly well preserved. A quantitative ratio of different ontogenetic stages, 13 per cent of young individuals, 72 per cent of middle-sized and 15 per cent of large ones, is another evidence for the occurrence of this species *in situ*. Hence we may presume that the sea in this reservoir was calm with slight waving, which caused no damage or segregation of corallites.

Beds I, 3-1 and II, K-N may be correlated with beds III, 46-38. A stratigraphic index of a conodont *quadrantinodosa* common for these beds and an identical assemblage of corals seem to support such a correlation. In these beds, there were probably analogous facial conditions.

Conclusions. — At Kadzielnia, Lower Famennian limestones and cypridinic shales were deposited on Upper Frasnian, organodetritic, light coloured limestone which in turn was deposited in a shallow sea far from the shore. A well-aerated,

Upper Frasnian bay, not connected with an open sea, was replaced in Lower Famennian of Kadzielnia by a poorly aerated basin with terrigenic sediments. This basin was shallow as shown by ripple marks and the presence of lingules which now live in a shallow (not deeper than 20 m) sea and in near-shore areas. Now and then, this basin had a connection with an open sea and it was precisely during such periods that the pelagic fauna (cephalopods) reached it.

Zaręby near Łagów

Eight exposures (I, I a-c and II-V) were dug along the right-hand bank of the Złota Woda stream. Conodonts not recorded. Age determined by the trilobites.

The lowest beds of the exposed Famennian (Ia, I, Ib), 2.3 m, 2.3 m and 1.4 m thick (according to S. Cebulak, written communication) represent fine-clastic sediments, almost amorphous mudstones with a dark organic dust, accumulated in the form of stripes, and with a carbonized organic substance. Dip of beds — 19° (195°)N, striking of beds — 105°N. Banks of *Posidonia venusta*, *Lingula* sp., assemblages of trilobites *Trimerocephalus dianopsoides*, *Phacops granulatus* and *Cyrtosymbole (Cyrtosymbole) franconica nova* occur in mudstones.

Exposure Ic (1.6 m thick). Cryptocrystalline mudstone with trilobites *Phacops granulatus*, *C. (Cyrtosymbole) franconica* and with a coral *H. (Heterophyllia) famenniana* n.sp. Corals *Ufimia supradevonica* n.sp. and *U. makowskii* n.sp., collected previously by Prof. J. Czarnocki and Prof. H. Makowski on a slope, situated near this outcrop, probably come from these beds.

Exposures II and III (1.65 and 1.52 m thick). Cryptocrystalline mudstone with stripes of a black organic dust and with a poor fauna of crinoids, indeterminable goniatites and *Lingula* sp., as well as with H. *(Heterophyllia) famenniana* n.sp.

Exposure IV and V (2.5 and 2.3 m thick). A strong admixture of a black dust and plant remains; devoid of animal fossils.

Conclusions. — According to Osmólska (1964), mudstones here and there sowewhat carbonaceous belong to cephalopod Zones III or IV as shown by the presence of trilobites *C. (Cyrtosymbole) franconica nova* and *Phacops granulatus*. The latter occurs even in cephalopod zones V and VI. Mudstones with plants and blind trilobites testify to a near-shore, calm, poorly aerated sea. The presence of crinoids, corals and brachiopods is an evidence of a normal salinity of this part of the sea.

Galęzice (Besówka)

Famennian beds directly overlying Givetian, *Amphipora* limestones and comprising 10 layers with a total thickness of about 2 m. Age determined by conodonts — from Upper *quadrantinodosa* to *costatus* Zones. According to Czarnocki (1948), cephalopod Zones III — VI (Text-fig. 3) occur in this locality.

Bed 10 (10 cm thick, *quadrantinodosa* Zone). Organodetritic nodules of limestone with *Posidonia venusta* and many trilobites of the species *C. (Cyrtosymbole) pusilla*. No corals.

Bed 9 (14 cm thick, *quadrantinodosa* Zone). Organodetritic, crystalline, plate limestone with few fine grains of quartz. Fauna poor: small brachiopods, *Posidonia venusta* and a trilobite *C. (Cyrtosymbole) franconica nova*.

Bed 8 (31 cm thick, *quadrantinodosa* Zone). Thin-plate, organodetritic limestone. Rock-building crinoids with a green tint, together with *Posidonia venusta*, *Michelinoceras* sp., trilobites and few corals *C. (Cyathaxonia)* aff. *cornu* and *Neaxon tenuiseptatus* n.sp.

Bed 7 (28 cm thick, *quadrantinodosa* Zone). Organodetritic, bituminous limestone with pyrite. Rock-building crinoids with a green coating. In addition, *Posidonia venusta* and a trilobite *C. (Cyrtosymbole) franconica nova*.

Bed 6 (14 cm thick, *velifera* Zone). Organodetritic limestone and rock-building crinoids. Frequent *Posidonia venusta*, rare corals *Metriophyllum soshkinae* n.sp. and *Neaxon tenuiseptatus* n.sp.

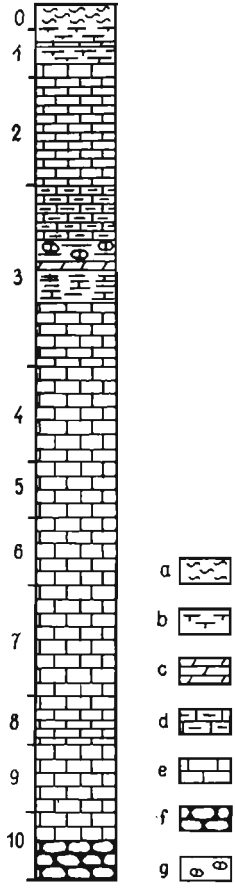

Fig. 3. — Section of exposure Gałęzice-Besówka, scale 1:20. *a* silt,, *b* marly shales, *c* marls, *d* marly limestone, *e* crystalline limestone, *f* knoll limestone, *g* calcareous nodules (after Wolska, 1967, Fig. 3*A*).

Bed 5 (13 cm thick, *velifera* Zone). Organodetritic limestone. Frequent *Platyclymenia richteri, Gonioclymenia pessoides* and *Sporadoceras varicatum. H. (Heterophyllia) famenniana* n.sp., *Neaxon tenuiseptatus* n.sp. and *Hillaxon vesiculosus* n.sp. predominate among corals.

Bed 3 (44 cm thick, *styriaca*? Zone). This is a complex of such layers as organodetritic limestone, marly shale, marl, calcareous nodules among clays and marly limestone. In limestone, there are rock-building crinoids, accompanied by *Posidonia venusta, Platyclymenia* sp. and *Gonioclymenia pessoides. Neaxon tenuiseptatus* n.sp. and *Oligophylloides tenuicinctus* n.sp. are predominant corals.

Bed 2 (23 cm thick, *costatus* Zone). Organodetritic limestone (Pl. I, Fig. 2) red on the surface with a dip of 65°N. Rich fauna of: *Posidonia venusta, Platyclymenia* sp., *Cyrtoclymenia pulcherrima, Gonioclymenia pessoides, Stenoclymenia sandber-*

geri, Sporadoceras humile, Orthoclymenia laevigata and, in addition, many ostracods and trilobites *Cyrtosymbole (Varibole) conifera. Neaxon tenuiseptatus* n.sp., *Pseudomicroplasma stasinskae* n.sp. and *H. (Heterophyllia) famenniana* n.sp. are predominant among corals.

Bed 1 (10 cm thick, *costatus* Zone). Marly shale interbedded with limestone. In shales, rich fauna of molluscs, cephalopods, many trilobites (*Phacops granulatus*) and small crinoids. *Pseudamplexus granulatus* n.sp., *C. (Cyathocarinia) tuberculata* and *H. (Heterophyllia) famenniana* n.sp. predominate among frequent corals. In the top, there occurs Lower Carboniferous, mottled, laminated clay with a Tournaisian conodont *Gnathodus girtii.*

Conclusions. — Base beds (10-5) were deposited in a neritic zone, far from the shore which is indicated by only small admixtures of a terrigenous material. As shown by the presence of crinoid meadows, the sea was then well aerated and, since the pelagic fauna of cephalopods reached this zone, there existed a connection with an open sea. The organic detritus is broken, breccia like and not worn off which testifies to the turbulence of water, near displacement and precludes the possibility of far transportation. In younger beds, the admixture of clay increases topwards with a gradual passage from marls to clay Tournaisian shales. The quantitative part of corals in faunistic assemblages increases together with a change in sediment. It is the greatest in beds 3-1, where Heterocorallia and Laccophyllinae are predominant. The fauna of clymeniids predominates in beds 4-3 which may testify to the deepening of the sea. Cephalopods disappear in bed 1 and, therefore, this is probably the moment where the connection with an open sea was terminating.

Kowala

South of the village of Kowala, 6 trenches (VI-I from S to N) in Upper Famennian deposits were made on the field owned by Mr. Prędotka, (Fig. 4). These trenches are situated about 2 km from the Kielce-Busko railway line. There is a continuity of sediments from Frasnian, through Famennian to Tournaisian (*Gattendorfia* Zone). The age of Famennian is determined by conodonts whose composition indicates the *costatus* Zone.

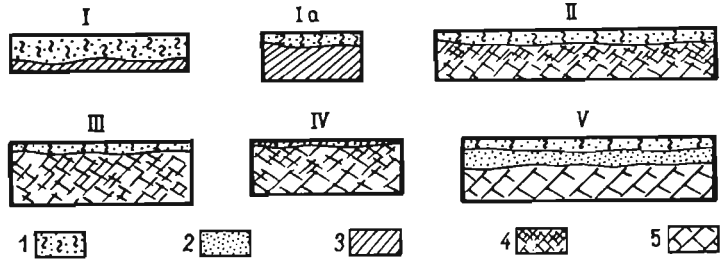

Fig. 4. — Sections of trenches at Kowala, scale 1:100. *1* soil, *2* sands, *3* shales, *4* limestone rubble, *5* limestone (after Wolska, 1967, Fig. 4).

Trench V. Gray, fine-crystalline, pelitic limestone with a fauna of fine brachiopods, molluscs, ostracods, crinoids and cephalopods: *Michelinoceras* sp., *Clymenia involescens* (cephalopod zone V) and *Sporadoceras* sp. Corals rare, *Neaxon bulloides* n.sp. being the only species.

Trench IV. Red and gray, fine-crystalline, pelitic limestone. Rich fauna of frequent bivalves and clymeniids such as *Cymaclymenia striata* (cephalopod zone V),

Kosmoclymenia sedgwicki (V and VI), *K. bisulcata*, ostracods, trilobites *Phacops wedekindi wedekindi* and *C. (Cyrtosymbole) pusilla. Amplexus* sp. predominates among few corals.

Trench III. Red, fine-crystalline, pelitic limestone with a rich fauna of cephalopods. In addition to the species of clymeniids which also occur in excavation IV, there is also *Wocklumeria sphaeroides* and occasionally occurring *Lingula* sp., *Posidonia venusta* and corals *Oligophylloides pachythecus* n.sp.

Trench II. Fine-crystalline, pelitic limestone with an admixture of a clay substance. Fauna: *Lingula* sp., *Posidonia* sp., *Wocklumeria* sp., ostracods, crinoids and of corals, *Neaxon bulloides* n.sp.

Trench Ia. Fine-crystalline, pelitic limestone with a small admixture of fine--psammitic grains of quartz. Fauna: *Orbiculoidea* sp., *Posidonia* sp., *Wocklumeria sphaeroides, Cymaclymenia striata, Sporadoceras humile* (cephalopod zone V); trilobites and a coral *Amplexus coralloides.*

Trench I. Black, bituminous, Tournaisian shales, transgressing on Upper Famennian limestone.

Conclusions. — As results from S. Cebulak's, petrographic studies (written communication), the limestones found of Kowala are similar in structure and composition to those of Kadzielnia. They are fine crystalline, pelitic, with few, small fragments of calcitic shells; few fine quartz grains and a small clay admixture. There also occur lingules. Hence we may conclude that they were formed under similar conditions in a shallow, shelf sea's near-shore zone. Since no pyrite and any larger bituminous admixture are recorded, a conclusion may be drawn that the sea bottom was well-aerated. The movement of waving and currents was very slow which is indicated by well-preserved shells of clymeniids and almost undamaged corals. These facts also preclude the possibilities of any longer transportation.

Łagów — Dule

The profile of this locality has not so far been worked out. According to the conodont stratigraphy, only the upper *quadrantinodosa* Zone occurs in this place and contains the following corals: *Metrioplexus carinatus* n.sp., *Neaxon tenuiseptatus* n.sp. and *Oligophylloides pachythecus* n.sp. They are accompanied by many clymeniids and molluscs.

Jabłonna

A profile partly described by Osmólska (1962) when she studied trilobites. Wolska (1967), who identified here conodonts, found that the base bed 2 contained *triangularis*, a conodont index. An only coral common in Lower Famennian of Kadzielnia, i.e. *Petraiella centralis* n.sp. comes from this bed.

Beds 29 and 31 (clymeniid limestones, *costatus* Zone) contain corals *Neaxon subcylindricus* n.sp., *Hillaxon vesiculosus* n.sp. and *Oligophylloides tenuicinctus* n.sp.

BIOSTRATIGRAPHIC CONSIDERATIONS

The material of corals, collected for the present work, is mostly dated strictly stratigraphically and allows one to make an analysis of a biostratigraphic value of corals that occur in Famennian (Table 1).

In Upper Frasnian, the role of age-indices is played by Disphyllidae, Phacellophyllidae and Phillipsastraeidae which, except for a few

individuals, did not pass to Famennian. The Upper Frasnian-Lower Famennian boundary represented a crucial moment in the history of Rugosa. A change took place in the environment of bioherms. A well-aerated sea and a pure water without any terrigenous suspensions was replaced in Lower Famennian by new assemblages of corals developed in a turbid, calm and poorly aerated water. Some of them were long-lived genera whose representatives were adapted to such an environment (*Guerichiphyllum* n.gen., *Amplexocarinia*). Such the genera as *Petraiella* n.gen. and *Nalivkinella*, *Gorizdronia* n.gen., *Kielcephyllum* n.gen. and *Kozlowskinia* n.gen., the latter four being related to *Amplexocarinia*, also appear, however, in Lower Famennian. So far they are known only from Lower Famennian and their species may be considered an index of this age.

In Upper Famennian the facies becomes subject to change. Sediments of a calm, turbid sea are replaced by those typical of a mobile, pure and well-aerated water. Coral assemblages are quite different. Despite a similar facies, no representatives of Frasnian corals are met with, the same as Lower Famennian, amplexocarinoid corals which are not adapted to an agitated water (Table 1).

The following new fauna of corals appears in the Upper Famennian assemblage: 1) long-lived, metriophylloid forms such as *Metrioplexus carinatus* n.sp. (*costatus* Zone) and *Syringaxon vacuus* n.sp. (*styriaca-costatus Zones*); 2) new species of the genus *Neaxon*, such as *N. bulloides* n. sp., *N. tenuiseptatus* n.sp., as well as new laccophylloid genera: *Hillaxon* n.gen. and *Czarnockia* n.gen.; 3) the first representatives of the Carboniferous fauna (few of them, such as *Cyathaxonia* aff. *cornu* and *Oligophylloides pachythecus* n.sp., occur rarely as early as in Lower Famennian). In Upper Famennian, predominant are the representatives of the laccophylloid fauna. In addition, there occur few zaphrentoid corals and many Heterocorallia.

The following new species might be an index of the Upper Famennian age: *Neaxon tenuiseptatus* n.sp., *N. bulloides* n.sp., *Hillaxon vesiculosus* n.sp., *Czarnockia obliqua* n.sp., *Cz. simplex* n.sp., *Oligophylloides pachythecus pachythecus* n.subsp., *O. pachythecus tenuicinctus* n.subsp. and *H.* (*Heterophyllia*) *famenniana* n.sp.

THE HISTORY OF STUDIES

Since Famennian corals are rare everywhere, not very much has so far been written on this subject (Table 1).

In 1839, the genus *Petraia* was described, supposedly from an Upper Devonian limestone "*Orthoceratites* Limestone" from Elbersreuth (Franconian Forest), by Münster who also distinguished a few species.

On the basis of this work, Kunth (1870), Dybowski (1873), Roemer (1883), Frech (1885) described or cited the genus *Petraia* from Famennian of Dzikowiec (in German Ebersdorf) and Mokrzeszów (in German Kunzendorf). After examining these specimens at the Humboldt University's Museum, the present writer found that these determinations were erroneous. Some of them, preserved as moulds, do not belong to this genus as they have platelike septa. Others, corniculate and with trabecular carinae on the axial margin of septa, probably belong to the genus *Neaxon* Kullmann.

Among other representatives of the Upper Devonian fauna of Germany (Westphalia), Frech (1885) described allegedly Famennian species which, according to Dr. J. Fedorowski (personal communication), are in fact Lower Carboniferous (*Clisiophyllum praecursor* Frech and *Cyathophyllum aquisgranense* Frech). *Petraia* sp. from Famennian of Kowala was described by Gürich (1896). This was probably a representative of *Neaxon* Kullmann, found by the present writer in *costatus* Zone of Kowala. Describing the French-Belgian Etroeungt, Vaughan (1915) assigned this horizon to Famennian and the corals cited, i.e. *Cyathophyllum* (*Palaeosmilia*) *aquisgranense* (Frech), *Clisiophyllum omaliusi* Gosselet and *Endophyllum transitorum* (Gröber) were considered by him to be Famennian. This are, however, typically Lower Carboniferous forms. Schindewolf (1924, 1931) examined the limestones from Elbersreuth and revised the genus *Petraia*, finding that the age of these limestones was Upper Silurian. The name of *Pseudopetraia* was given by this author to the corals which occur in a Famennian limestone from Saalfeld (Thuringia) and which were formerly assigned to *Petraia*. The name of *Pseudopetraia* Schindewolf remained, however, as a *nomen nudum*. Middle Devonian corals which do not belong to the metriophylloid phylum were described under this name by Soshkina (1949). Describing corals from Northern France. Dehé (1929) excluded Etroeungt from Tournaisian and placed this horizon, as an independent stratigraphic member, between Famennian and Tournaisian. It is also in this case that the corals described are decidedly Carboniferous. These are *Caninia dorlodoti* Salée and those mentioned above. In 1932, Gorsky described several species of corals, most likely Famennian ones, from the Kirgiz Steppe and, in 1938, also Famennian, from Novaya Zemlya. Hill (1954) described corals collected in West Kimberley, Bugle Gap Limestone and East Kimberley, Australia, and which occur in cephalopod Zones I-IV. Some of them from East and West Kimberley, are Famennian and Frasnian, whereas these from Bugle Gap Limestone (Zone IV) as *Catactotoechus* Hill and its species, are Famennian. Soshkina (1960) gave a review of the Tournaisian and Famennian fauna, from northern Kazakhstan and presented the relationships of these corals. Since a different ontogeny of the representatives of different genera precludes any closer

relationship between them, not all of her suggestions are well-founded. Thus, no phyletic relationship occurs between the genera *Caninia* and *Nicholsoniella*. This was found by Dr. J. Fedorowski (personal communication) who studied the ontogeny of a holotype of *Nicholsoniella bashkirica* Soshkina and stated that this species has a nalivkinelloid ontogeny, i.e. it has a stereocolumella and a tube with cyatotheca, whereas *Caninia* has a zaphrentoid ontogeny [1].

When the assemblages of Famennian corals from different localities in the world are compared with those from the Holy Cross Mountains, attention is attracted by their specific poverty as opposed by a great variety observed in the Holy Cross Mountains. There are 55 species and 5 forms determined only at generic level from Famennian of Poland as compared with 37 species and 5 determined only at generic level in Famennian the world over. Only favourable environment conditions (as corals are frequently preserved *in situ*) might be a cause of so rich and variable fauna of corals in the Holy Cross Mountains. Facies, in which they lived, were very variable and this is probably the reason of the variability of these corals: they occur in shales, marls and limestones. Famennian sea was almost uninhabited in some places and with a rich fauna and perhaps exuberant forest of algae in others. In some beds the sea was a closed and poorly aerated basin which provided conditions favourable to nalivkinelloid corals. During the periods of an open sea with an agitated, well-aerated water, the laccophylloid fauna was abundant. Attention is also attracted by a small number of common species of Famennian in Poland and in other countries of the world. The only common species are: *Syringaxon cyathaxoniaeformis* Gorsky, *Nalivkinella profunda* Soshkina, *Gorizdronia profunda* (Soshkina), *Amplexus coralloides* Sowerby and maybe also *Peneckiella* aff. *minus* Roemer. It should be borne in mind that the Famennian age of beds cited in Table 2, is partly still debatable.

PROBLEMS OF SYSTEMATICS

Despite the efforts of many specialists, the systematics of Rugosa is not yet satisfactorily worked out and, in many respects, there are divergences of views. Lecompte (1952) considers them to be a suborder, Hill (1956) — an order, and Soshkina, Dobroljubova and Kabakovitsh (1962) — a subclass. The definitions of lower taxons have so far been based only on the morphology which, due to the phenomenon of convergence frequent in Rugosa, causes the formation of homonyms. To

[1] Dr. W. Oliver kindly send to the present writer J. S. Williams' paper in which the latter described 3 species from the Louisiana Limestone, Famennian.

Table 1

DISTRIBUTION OF THE CORAL SPECIES IN THE CORAL-BEARING LOCALITIES AND BEDS

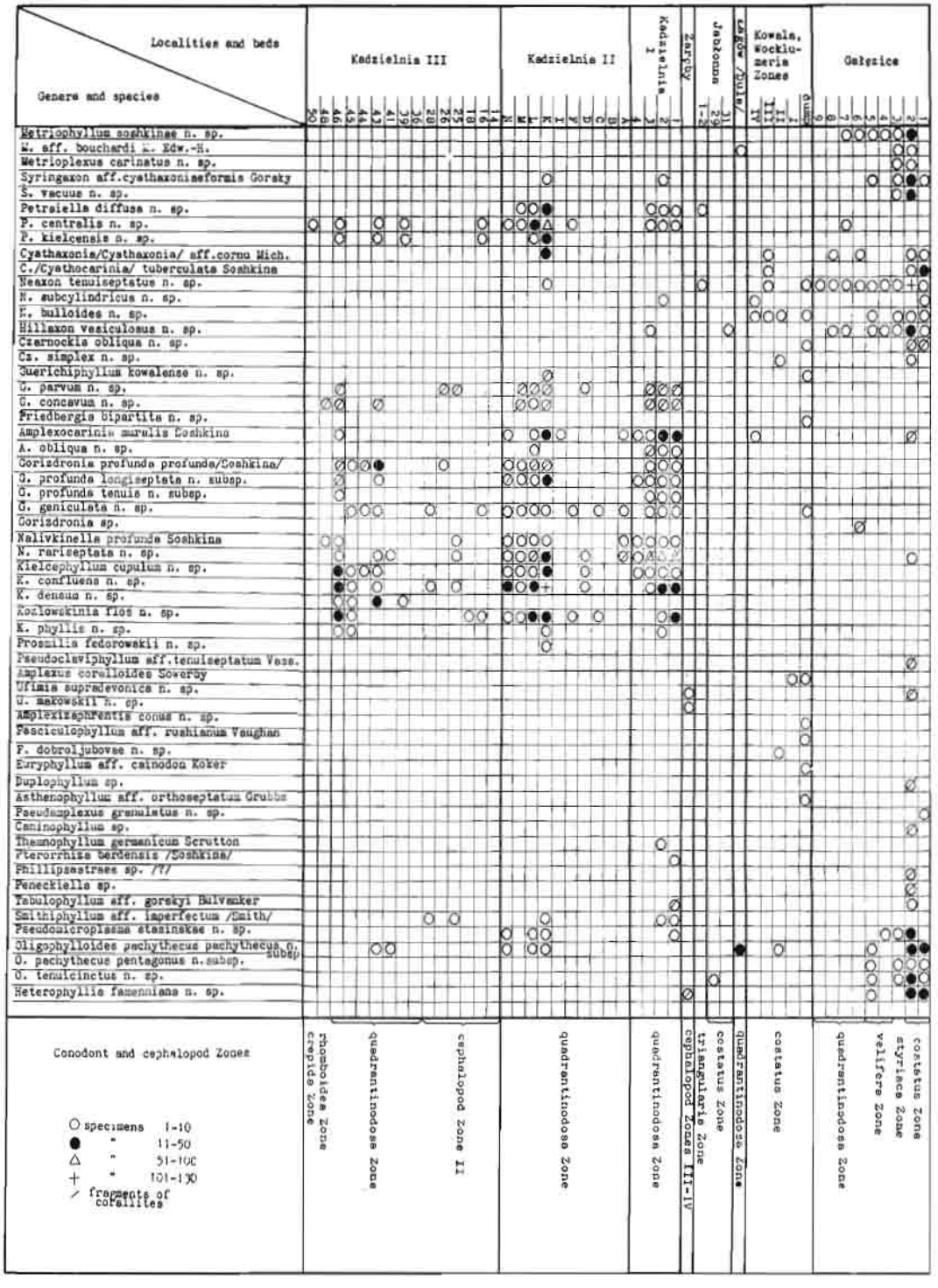

Table 2

PALAEOGEOGRAPHICAL RANGE OF THE FAMENNIAN CORALS
(POLAND EXCLUDED)

Genera and species \ Regions	Louisiana Limestone Missouri	Westphalia	Kuzbass	Novaya Zemlya	Russian Platform	Ural Mountains	Kirgiz Steppe	Kazakhstan	West Kimberley	Dugle Gap Limestone	East Kimberley	Sahara
Metriophyllum sp.									+			
Syringaxon cyathaxoniaeformis Gorsky				+			+					
Barrandeophyllum sp.									+			
B. cavum Hill									+			
B. rubrum Hill									+			
Catactotoechus Hill										+		
C. irregularis Hill										+		
C. tenuis Hill										+		
Nicholsonielle famenica Soshkina								+				
N. carinata Soshkina								+				
Belivskiella profunda Soshkina						+						
Amplexus sp.							+					
A. coralloides Sowerby							+					
A. hercynicus Roemer		+										
Neozephrentis? acuta /White [Whitfield/	+											
N.? palmeri /Howley/	+											
N.? parasitica /Worthen/	+											
Zaphrentis edyrensis Soshkina								+				
Z. loosa Hill										+		
Heliophyllum sp.			+									
H. originale Bulvanker			+									
Hexagonaria kuznetskensis Bulvanker			+									
H. yakovlevi Bulvanker			+									
Cyathophyllum/Peneckiella/ aff. minus Roemer				+								
Peneckiella sp.			+					+				
P. minima Soshkina			+									
Phillipsastraea schafferi Penecke			+									
Ph. sedgwicki Edw.-H.			+						+			
Pachyphyllum ibergense progressa Różk.			+									
Phacellophyllum /Thamnophyllum/ sp.									+		+	
Palaeosmilia contexta Hill											+	
Endophyllum caninoides Gorsky							+					
E. nelivkini microseptosa Gorsky				+								
E. elferovi septata Gorsky				+								
Loephyllum avichense Termier & Termier												+
Aulacophyllum murale Soshkina					+							
Isbellaephyllum mosquense Soshkina					+							
Donia russiensis Soshkina					+							
Caninia cornucopiae Michelin								+				
C. rudis Hill									+			
Neostringophyllum fezeniense Ivanija			+									
Cystiphyllum kimberleyense Hill									+			

establish a phylogenetic systematics it is important to know the ontogeny and blastogeny. This is an only way to find a true relationship between phyla.

The present writer has in principle based her taxonomy of Famennian corals on Hill's (1956) classification but introduced a few changes where it was justified by ontogenetic studies.

The most common in the Famennian material are Streptelasmatina and, among them, the corals of the superfamily Lindstroemiicae. The author assigned to this superfamily a few families, in which stereocolumella occurs in early ontogenetic stages, but it can persist or not over the entire life time. These are the family Metriophyllidae with the subfamilies Metriophyllinae, Syringaxoninae, Petrainae and Cyathaxoninae. In the neanic stage of Syringaxoninae, stereocolumella is replaced by an axial tube surrounded by stereotheca. In Cyathaxoninae, a pseudoseptal columella grows within the axial tube. All the subfamilies mentioned above have septa of the second order, occurring serially, and being contratingent.

Lindstroemiicae, marked by a wide adaptive variability, include a few other families which, although similar in ontogeny, have their septa of the second order appearing cyclically, if any of them are developed at all. Here belong: Laccophyllidae, in which the wall of axial tube is a phyllotheca or aulos; Amplexocariniidae, in which the wall of axial tube consists of axial or periaxial tabulae; Kielcephyllidae n.fam. with hexacoralloid characters and a not very continuous axial tube formed by axial ends of septa and with tabulae; Adamanophyllidae with dissepiments and whose longer septa are different in length and the wall of tube is a phyllocyatotheca.

Since the author unfortunately could not study their ontogeny, Amplexidae are assigned here with a reservation. The specimens of the type species *Amplexus coralloides* Sowerby from the collection of the British Museum, sent in by Dr. C. Scrutton, were devoid of the proximal end and dolomitized.

The superfamily Zaphrentoidida is marked by a zaphrentoid ontogeny. In the Famennian material examined by the author, there occur two families: Polycoeliidae Roemer, with a bilateral symmetry and proto- or metasepta varying in length and thickness, and Hapsiphyllidae Grabau whose bilateral symmetry is yet more emphasized by cardinal septum and cardinal fossula.

The superfamily Phillipsastraeicae Roemer include, in Famennian, the representatives of the two families: Phacellophyllidae Wedekind and Phillipsastraeidae Roemer. With their zaphrentoid ontogeny, the corals of this superfamily have a hexacoralloid structure, and thus they differ from the representatives of the family Kielcephyllidae n.fam.,

which has a nalivkinelloid ontogeny. Clearly, then, corals with the hexacoralloid structure, occurring with the Streptelasmatina, appear in Famennian two times.

PROBLEMS OF PHYLOGENY

On the basis of the classification presented above and in which the genetic relationships of genera similar in ontogeny are taken into account, nine phyla may be distinguished in the Famennian fauna. Their development trends are as follows (Text-fig. 5).

Petraia Münster known from Upper Silurian, having acanthine septa and no tabulae, is probably a starting form of the metriophylloid phylum. It is likely to be directly related to the Lower Famennian *Petraiella* n.gen. with a complex ontogeny which testifies to a considerable length of its development path. Its septa are platelike and, in the ephebic stage, frequently withdrawn from the axis. Tabulae crowded. Despite the lack of any symptoms of regression, *Petraiella* is not continued neither in Carboniferous nor even in Upper Famennian. The axial structure is a plastic element in the representatives of this phylum. In *Metriophyllum*, the stereocolumella occurs over the entire ontogeny; in *Metrioplexus*, developed in Middle Devonian, an empty field is formed along the axis; in *Syringaxon* this field is surrounded by stereotheca, and in *Cyathaxonia*, which appears in Lower Famennian, it is filled by a pseudoseptal columella. In *Cyathocarinia*, differentiated in Upper Famennian, columella persists but septa have trabecular carinae. In this phylum, septa of the second order appear serially and, in *Syringaxon*, they are first short, and in the course of further development, they extend and, in Upper Famennian become as strong as septa of the first order. This is a persistent (Upper Silurian-Permian) phylum, which does not display any symptoms of regression.

In the laccophylloid phylum, in the early ontogeny, corallites have the stereocolumella which is later replaced by an empty axial field, surrounded by phyllotheca. Septa of the second order appear cyclically. This is a short-lived, rapidly developing phylum which likely does not pass to Carboniferous. It is as early as Middle Devonian that symptoms of regression occur in *Guerichiphyllum* n.gen. and septa of the second order, normally developed in Middle Devonian, become subject to atrophy and complete reduction in Famennian. A similar atrophy is observed in the septa of the second order in the genus *Neaxon* Kullmann. Lonsdaleoid dissepiments occur in an Upper Famennian genus *Hillaxon* n.gen. A slightly different development trend is displayed by *Friedbergia* n.gen. which has septa varying in thickness, much the same as those of Polycoeliidae. In *Czarnockia* n.gen. there are visible symptoms of

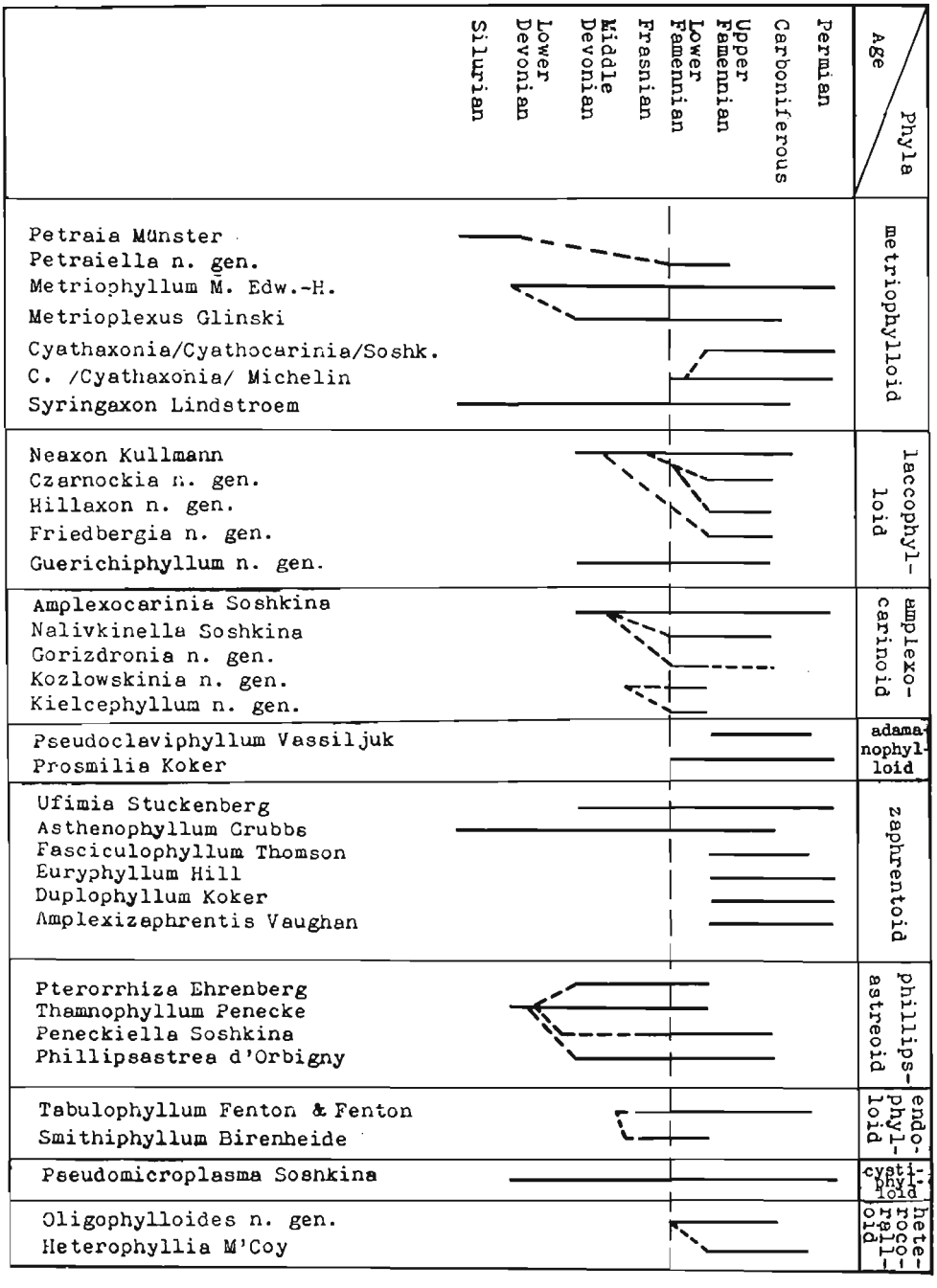

Fig. 5. — Relationships and stratigraphic range of genera.

extreme specialization: vertically disposed calyx and tabularium which probably was related with its mode of life. Most likely, the coral was resting on its convex side.

In Famennian, the nalivkinelloid phylum is the most common one. In early stages of ontogeny, its stereocolumella is replaced by the free axial area, surrounded by a cyatotheca. *Amplexocarinia* Soshkina (Middle Devonian-Permian), a persistent, conservative, but at the same time, adaptable, probably starting genus, does not display any symptoms of regression. Its septal index varies in value regardless of the geological age. A high septal index of n/d = 21/7 is observed in Givetian *A. tortuosa* Phillips and of n/d = 15/5 in Permian *A. muralis* Soshkina. Low values occur in Carboniferous *A. wagneri* de Groot (n/d = 23/12) and in Permian *A. subtilis* Schouppé & Stacul (n/d = 30/15). In a persistent species, *A. muralis* Soshkina, a value of n/d = 15/5 is unchanged from Famennian to Permian.

The length of septa of the second order is also independent of the geological age. Short in Famennian *A. muralis* and long in Famennian *A. obliqua* n.sp. Likewise, in Permian septa of the second order are in *A. composita* Schouppé & Stacul long and in *A. subtilis* Schouppé & Stacul almost invisible.

A gradual increase in the size of corallites is a character related to the phylogenetic development, which may be illustrated by some species of *Amplexocarinia* as follows:

	Length (in mm)	Diameter (in mm)
Givetian, *A. tortuosa* (in Gürich, 1896) . . .	10.0	6.0
Famennian, *A. muralis*	18.0	7.0
Carboniferous, *A. wagneri* (in de Groot, 1964)	35.0	12.0
Permian, *A. composita* (in Schouppé & Stacul, 1965)	65.0	15.0

Nalivkinella probably derives from *Amplexocarinia*. Different homeomorphic species are incorrectly assigned to it. Only those specimens whose ontogeny and structure are accurately examined in their longitudinal section may be assigned to it. The shortening of septa of the first order and a partial atrophy of axial tube are development trends of this genus, observed even in earlier stages of ontogenetic development (Text-fig. 6). This tendency is strongly marked in a derivative form, i.e. *Gorizdronia* n.gen. which has an extremely simplified structure: septa of the first order amplexoid, septa of the second order frequently completely reduced and axial tube developed only in the early-neanic stage. Two genera with a hexacoralloid structure and having a loose cyatotheca around

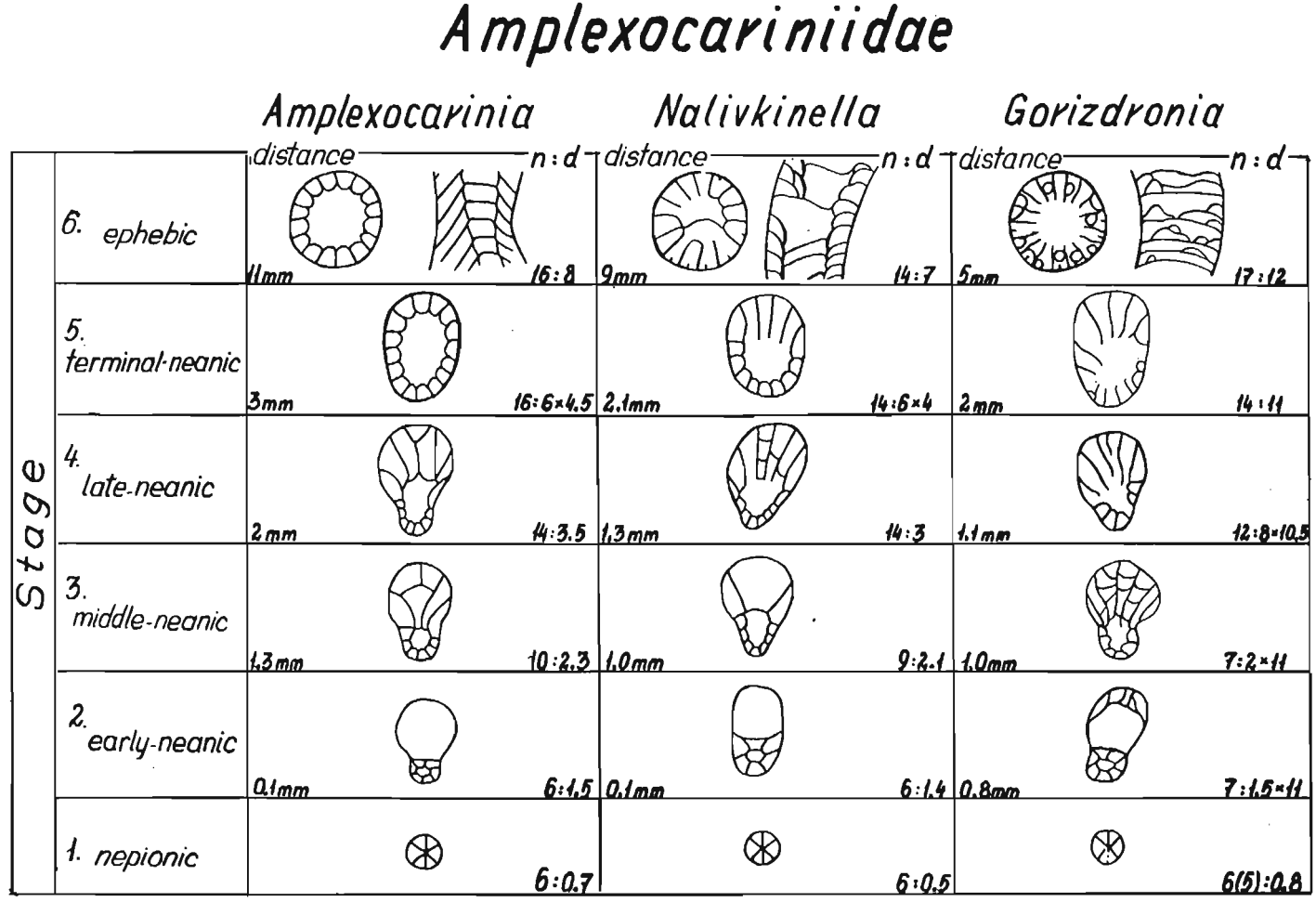

Fig. 6. — Six ontogenetic stages and longitudinal sections of the representatives of Amplexocariniidae (semidiagrammatic).

the axis of the corallite have been assigned to this nalivkinelloid phylum. *Kozlowskinia* n.gen. still has septa of two different lengths and dissepimental paratheca occurring in places where the epitheca is lacking. Closely related with it is the regressive *Kielcephyllum* n.gen. in which septa of the second order were subject to atrophy and septa of the first order are separated from epitheca by lonsdaleoid vesicles. *Prosmilia* Koker, a genus which in its young stage has a cyatotheca and, as a mature individual, has the structure of septa identical with those in Polycoeliidae (i. e. varying in strength and length), has been assigned to the adamanophylloid phylum. Despite of its young phylogenetic age, lonsdaleoid vesicles are already observed in this genus.

The zaphrentoid phylum, even in its early youth has a strongly marked, bilateral symmetry expressed by a feathery arrangement of septa and the presence of fossulae. This phylum comprises two families, Hapsiphyllidae and Polycoeliidae. According to Schindewolf (1952), Hapsiphyllidae is a starting family. To this family Ivanovskij (1960) assigned the Ordovician and Silurian protozaphrentids (*Tungussophyllum* Ivanovsky with its type species *Zaphrentis conulus* Lindstroem (1868)). *Asthenophyllum* Grubbs is a similarly persistent genus reaching from Silurian to Famennian inclusive. A reduction of septa of the second order and decrease in a septal index which, according to Grubbs (1939, p. 34) amounts in Silurian to n/d = 18/7 and in Upper Famennian to n/d = 18/11, are observed in the phylogenetic development of this genus.

Ufimia Stuckenberg is a Famennian representative of the family Polycoeliidae. Schindewolf (1942) and Kullmann (1965) traced the development of the species of this genus, probably related to each other and presented a phylogenetic series which includes: *Plerophyllum* (*Ufimia*) *prius* Kullmann (Middle Devonian of Spain), *Ufimia carbonaria* Stuckenberg (?Lower Carboniferous of Ural) and *Plerophyllum* (*Ufimia*) *kobayashii* Schindewolf (Middle Permian of the Island of Timor). An Upper Famennian species *Ufimia supradevonica* n.sp., from the Holy Cross Mountains, has been assigned by the present writer to this series. Since its septa are not rhopaloid, this Famennian species is, however, somewhat different.

The evolution of further genera of this phylum appearing in Upper Famennian and strongly differentiated in Carboniferous and Permian, is little-known to the present writer.

The phillipsastraeoid phylum has been recently penetratingly studied (Różkowska, 1957; Schouppé, 1958; Pickett, 1967; Scrutton, 1968). According to Pickett (*l.c.*, p. 38), the family Phillipsastraeidae which he believes, must include Disphyllidae and Phacellophyllidae, is subject to a mosaic evolution. In his opinion, two trends, i.e. the passage from solitary to colonial forms and from the calice with a sharp to that with an everted edge are predominant in this evolution.

The author of the present work distinguishes, like in 1957, two parallel developing phyla, i.e. the disphylloid and phillipsastraeoid, which display similar development trends and which, consequently, had probably common ancestors. The disphylloid phylum, becomes extinct in Upper Frasnian, whereas the phillipsastraeoid phylum is even in Famennian, represented by four damaged individuals. These are, however, only relics of once abundant group of corals. *Peneckiella* Soshkina, common in Frasnian of Europe and having a very complex structure of dissepimentarium, which is a characteristic feature of a high phylogenetic stage of development, is one of the representatives. Specimens, almost identical in structure, were also described by Strusz (1965) from Couvinian of Australia. The age of Siegenian is determinated by the conodont index which was stated by Philip & Pedder (1967). This is a phenomenon of longevity, never recorded before in a coral which, over the entire Devonian, preserved its uniform, highly specialized structure.

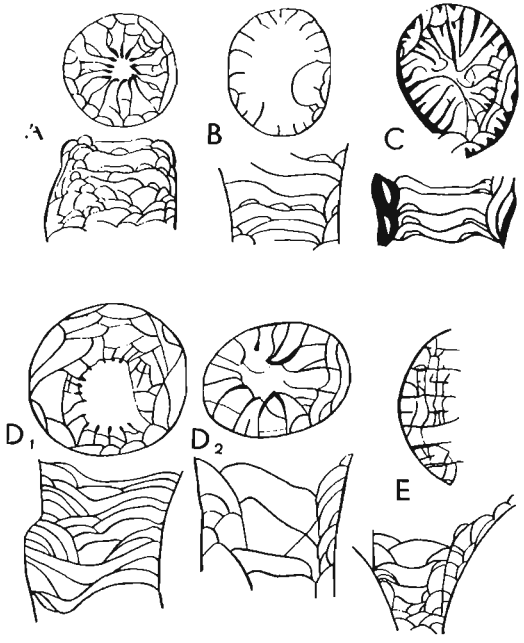

Fig. 7. — Late phylogenetic stage with lonsdaleoid dissepiments in Kielcephyllidae n.fam., Laccophyllidae Grabau, Chonophyllidae Holmes. *A Kielcephyllum* n.gen., *B Smithiphyllum* Birenheide, *C Tabulophyllum* Fenton & Fenton, *D Guerichiphyllum* n.gen., *E Hillaxon* n.gen. (all figures semidiagrammatic).

The endophylloid phylum is represented by *Tabulophyllum* Münster and *Smithiphyllum* Birenheide which occur in Frasnian and pass, although in small amounts, to Famennian. Probably, they are in the final stage of the development of their phylum. Such forms with

symptoms of regression abundantly occur in Famennian (Text-fig. 7). To assign them to an appropriate phylum one must know their ontogeny. The ontogeny of *Tabulophyllum* was studied by Smith (1945), but that of *Smithiphyllum* is unknown. The similar microstructure is given by Pedder (1965) as a common character. According to the present writer's opinion, microstructures may however differ within the same phylum.

The cystiphylloid phylum is represented by one genus, *Pseudomicroplasma* Soshkina which persisted from Lower Devonian to Permian(?) inclusively. Corals with a cystiphylloid structure appeared twice in the history of Rugosa. Soon they became extinct, not exceeding the Middle Devonian. *Pseudomicroplasma* was the only genus preserved. It is characterized by short septal thorns which almost do not exceed the septotheca.

The heterocoralloid phylum distinguishes from other corals by a different arrangement of its septa, which do not occur serially, as in Tetracoralla (the I order septa), or cyclically — progressively, as in Hexacoralla, but in a single cycle and in a full number which appear in the early ontogeny. Very significant is the trend which determines their phylogeny: the oldest representative of *Oligophylloides* n.gen., which appears in Lower Famennian, has a heavily built skeleton and a wide talon and, therefore, belongs to the sessile benthos. *Heterophyllia*, which also occurs as early as Upper Famennian, has a lighter skeleton and a smaller talon but continues to belong to the sessile fauna. The Carboniferous *Heterophyllia* has hooks on the outer surface of the wall and, as concluded by Schindewolf (1941), it has passed to the pseudoplanctonic mode of life. This would serve as a significant example of extending the environment, rather rarely met with among corals. The number of septa is also varying in the evolution of heterocoralloids: *Oligophylloides* has 12 and *Heterophyllia*, in Famennian, 19 septa. This trend relates *Oligophylloides* to *Heterophyllia*. *Hexaphyllia* from the Lower Carboniferous in which the number of septa is unchangeable, would make up a side branch.

SYSTEMATIC DESCRIPTIONS

Order **Rugosa** M.Edw.-H., 1850
Suborder **Streptelasmatina** Wedekind, 1927
Superfamily **Lindstroemiicae** Počta, 1902

Due to a similar ontogeny and microstructure, as well as a serial occurrence of septa of the second order and acceleration in countercardinal quadrants, the genera *Metriophyllum* M. Edw.-H., 1850, *Metrioplexus* Glinski, 1963, *Metrionaxon* Glinski, 1963 and *Syringaxon* Lindstroem,

1882 are assigned by Glinski (1963, p. 332) to the family Lindstroemiidae Počta, 1902.

The present writer has raised the family Lindstroemiidae to the rank of a superfamily, Lindstroemiicae Počta, 1902 and included in it the families and subfamilies which are marked by a similar ontogeny of the metriophylloid type:

1. The family Metriophyllidae Hill, 1939 which comprises the following subfamilies: Metriophyllinae Hill, 1939; Syringaxoninae Hill, 1939; Petrainae de Koninck, 1872; Cyathaxoniinae M. Edw.-H., 1850. According to the present writer, the representatives of all these subfamilies have characters typical of the family Lindstroemiidae (sensu Glinski).

2. The family Laccophyllidae Grabau, 1928, including the following subfamilies: Laccophyllinae Grabau, 1928; Guerichiphyllinae n.subfam.; Friedbergiinae n. subfam. The representatives of these subfamilies are marked by the presence of axial tube whose wall is formed by axial ends of septa (phyllotheca or stereotheca).

3. The family Amplexocariniidae Soshkina, 1941, which includes corals with axial tube formed by axial or periaxial tabulae (cyatotheca).

4. The family Kielcephyllidae n. fam. with corals having a hexacorallloid structure and with axial tube formed with the participation of tabulae and axial ends of septa (stereo-cyatotheca).

5. The family Adamanophyllidae Vassiljuk, 1959, comprising corals which, in their young stage, have axial tube surrounded by cyato--phyllotheca, dissepiments situated peripherally and septa with a polycoeloid arrangement.

6. The family Amplexidae Chapman, 1893. Since its ontogeny is unknown, the assignment of this family to the Lindstroemiicae is so far open to discussion.

Family **Metriophyllidae** Hill, 1939 emend.

Diagnosis. — Stereocolumella may persist over the entire ontogeny or be replaced by axial tube. Septa of the second order occur serially. Horizontal carinae may be present or absent. "Pseudoseptal" columella may occur.

Subfamily **Metriophyllinae** Hill, 1939

Genera assigned: *Metriophyllum* M. Edw.-H., 1850; *Lopholasma* Soshkina, 1928; *Asserculinia* Schouppé & Stacul, 1959; *Metrionaxon* Glinski, 1963; *Metrioplexus* Glinski, 1963.

Stratigraphic and geographic range: Devonian-Permian; N. America, Europe, Asia, Australia.

Diagnosis. — Corals with horizontal carinae. Septa connected in the axis or withdrawn from it.

Genus *Metriophyllum* M. Edw.-H., 1850

(Type species: *M. bouchardi* M. Edw.-H., 1850)

1850. *Metriophyllum* M. Edw.-H.; H. M. Edwards & J. Haime, A monograph..., p. 69.
1900. *Lopholasma* Simpson; G. B. Simpson, Preliminary..., p. 206.
1959. *Asserculinia* Schouppé & Stacul; A. v. Schouppé & P. Stacul, Säulchenlose..., p. 284.

Species assigned: In addition to the species assigned to *Metriophyllum* by Smith (1945), Holwill (1964) and Pedder (1967), here belong *M. iovense* Stainbrook 1946, *M. gracile* Soshkina, 1928 (non Schlüter, 1889), *M. ilitschense* Soshkina, 1928 *M. primum* (Schouppé & Stacul, 1959) and *M. skalense* Fedorowski, 1965.

Stratigraphic and geographic range: Devonian-Permian; N. America, Eurasia and Australia.

Diagnosis. — See Holwill (1964). Microstructure of wall lamellar and of septa — trabecular-fibrous.

Remarks. — Due to the presence of axial tube, corals described by Gürich (1896) and Sobolev (1904) from Givetian of the Holy Cross Mountains under the name of *M. gracile* Schlüter should be assigned to the genus *Metrionaxon* Glinski, 1963. *M.* (*Aemulophyllum*) Oliver, 1958 has not characteristic horizontal carinae, the edge of its calice is everted as that in *Ceratophyllum* and, therefore, it cannot be assigned to the genus *Metriophyllum*; whereas *Metriophyllum*(?) sp., described by Kullmann (1965), having long horizontal carinae, should be assigned to it.

Metriophyllum soshkinae nom. nov.

(Text-fig. 8 *A-J*; Pl. II, Figs. 1-2)

1928. *Lopholasma gracile* Soshkina (non Schlüter, 1889); E. D. Soshkina, Nižnepermskie..., p. 368, Fig. 12.

Diagnosis. — *Metriophyllum* with a thick epitheca, 14 major septa 4.5 mm in diameter and strong flanged carinae descending to the axis.

Material. — Twenty three corallites, mostly strongly damaged. Talon or calyx preserved in some of them.

Description. — Corallites with a thick, porcelain, white epitheca having thin growth striae and thicker, roller-like wrinkles, running obliquely towards talon. Talon may be wide, flattened or narrow (when the coral is attached to another one such as, for instance, *Oligophylloides* sp.).

Transverse section. Septa straight or mildly arcuate, connected with each other to form four systems resulting from the connection, at four

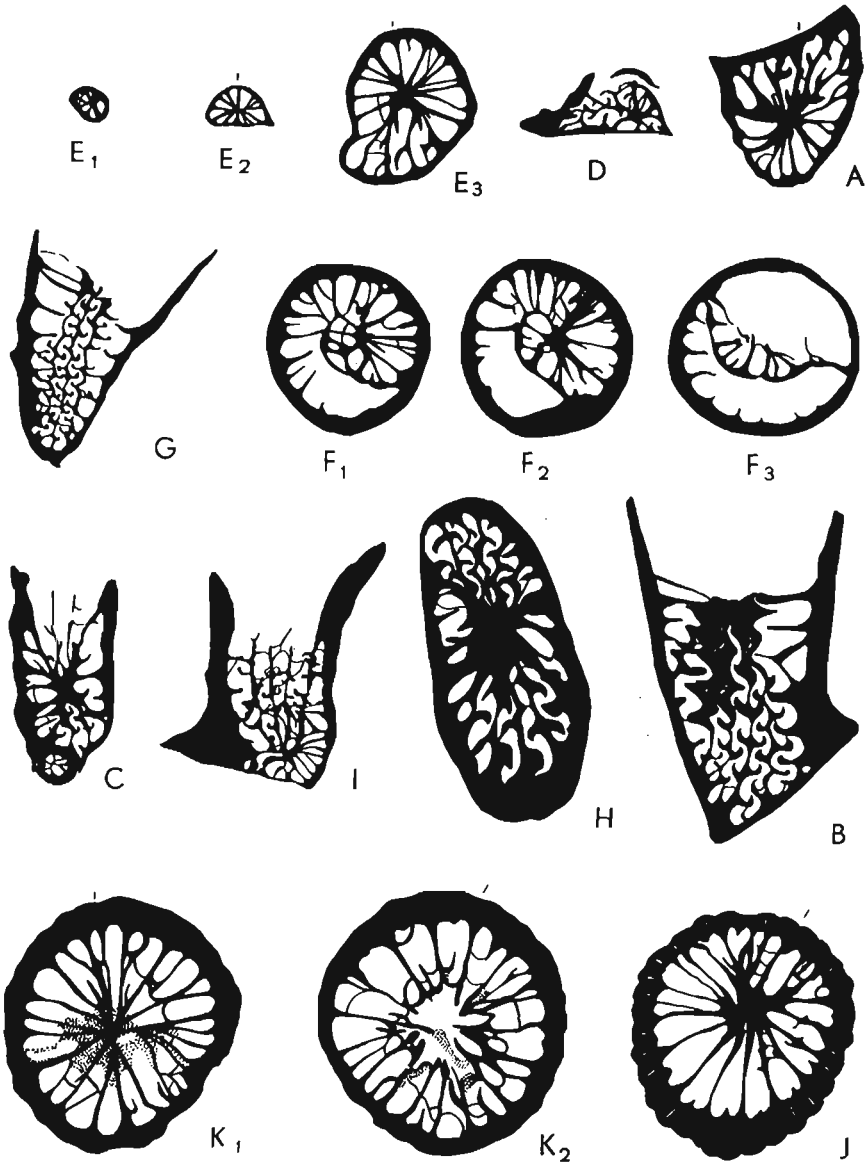

Fig. 8. — *A-I Metriophyllum soshkinae* nom. nov.: *A* neanic stage with a trace of attachment (Z. Pal. P. Tc No. 3/2246); *B* longitudinal section with talon (No. 3/2246); *C* transverse-oblique section of a corallite overgrowing an *Oligophylloides tenuicinctus* n.sp. (No. 3/2370); *D* transverse section through neanic stage, six septa fused axially, talon small (No. 3/2444); E_1 neanic stage, E_2 neanic stage, E_3 early ephebic stage (No. 3/2257); F_1-F_3 a series of transverse sections through a budding corallite, hysterobrephic stage (No. 3/2503); *G* longitudinal section, horizontal carinae on wall and upturned on septa (No. 3/2511); *H* transverse-oblique section, strongly hook-like carinae (No. 3/2258), holotype; *I* longitudinal section, calyx deep, talon, upturned carinae occur on septa (No. 3/2619).

J-K Metriophyllum aff. *bouchardi* M. Edw.-H.: *J* transverse section through a mature individual, major and minor septa visible (No. 3/2342); K_1-K_2 transverse sections, K_1 below calyx, K_2 through the base of calyx, septa retreated from axis (No. 3/2170).

A-H, J-K Gałęzice, bed 2; *I* Gałęzice, bed 3. All × 3.4.

points, of metasepta with corresponding four protosepta. Carinae strong, some of them descending towards the axis, others parallel to septa and stretching from wall to axis or short. Stereocolumella thickened by a deposit of stereoplasma. The n/d index for a few specimens is given below with a certain reservation due to carinae similar to septa: n/d = 10/2.3 mm; 12/3.2 mm, 14/3.6 mm; 12/3.7 mm; 14/4 mm; 14/4.5 mm.

Longitudinal section. Talon flattened, wide or narrow. Calyx deep· flat-bottomed and with steep walls. In a tangential, longitudinal section, septa zigzagging, hooklike carinae occurring in bends. Other septa straight, carinae opposite each other. In an axial section, horizontal carinae are visible, reaching from wall to axis or somewhat shorter. Tabulae infrequent, thin and convex.

Ontogeny (Text-fig. 8 *A, D, E_1-E_2*) was studied by Holwill (1964) and Fedorowski (1965). An *early-neanic stage* (Text-fig. *8* E_1), 1×0.8 mm in diameter and having 6 protosepta connected in axis to form a stereocolumella and two metasepta near counterlateral septa has been preserved on one of the Famennian specimens. With a diameter of 2×1.3 mm, the number of septa amounts to 12, cardinal septum is situated on the convex side and counterseptum close to the flattened side. Upturned carinae still lacking. Four systems of septa clearly visible.

Variability considerable observed in the thickness of skeletal elements and density of carinae.

Budding (Text-fig. 8 F_1-F_3). This rare phenomenon was described in detail by Fedorowski (1965, p. 339). One of the Famennian specimens has a bud in its histeronepionic stage. The budding is axial and constitutes a rejuvenation. A new epitheca is formed around columella and new septa with carinae are formed on it, whereas on the opposite side the young coral still uses epitheca and septa of the parent coral.

Remarks. — Corals, described by Stainbrook (1946, p.410) as *M. iowense* from Independence Shale, have a septal index of 16×2/7.2-9.1 and strong, upward inclined carinae (according to Stainbrook, p. 411, uncinate carinae) similar to those in *M. soshkinae*. These forms are not, however, conspecific since *M. iowense* has longer septa of the second order and a lower septal index. A Permian species *Lopholasma gracile* Soshkina, 1928 (non Schlüter, 1889) has a much the near septal index (13/2 as compared with 10/2.3 in Famennian specimens) and similar hooklike carinae and thick skeletal elements occur in both forms. The present writer considers them to be conspecific. *M. gracile* Soshkina is, however, a homonyme of *M. gracile* Schlüter and, consequently, this name should be replaced by another (Holwill, 1964, p. 115). Since, during his visit to Moscow, Fedorowski (oral communication) found that Soshkina failed to do this, the present writer feels entitled to introduce, for this form, a new name — *M. soshkinae* nom.nov.

Occurrence. — Poland: Gałęzice (Besówka), beds 2,3-5,7, Upper Famennian; *costatus, styriaca, velifera* and *quadrantinodosa* Zones. U.S.S.R.: Eastern Ural, Lower Permian.

Metriophyllum aff. *bouchardi* M. Edw.-H., 1850
(Text-fig. 8 *J*, K_1-K_2; Pl. II, Figs. 4-5)

Material. — Nine damaged specimens, embedded in zoogenic limestone.

Description. — Rounded costae corresponding to interseptal spaces, are visible on a thick epitheca on a slightly exposed fragment.

Transverse section. Corallites round, surrounded by a thick (to 0.8 mm) epitheca. Septa spindlelike swollen at the base and along the axis rhopaloid, form a stereocolumella thickened by deposits of stereoplasma. Cardinal septum long, situated in an indistinctly outlined fossula. Counterseptum does not differ from counterlateral septa. The n-d index 18-22/7.5 mm. Minor septa scarcely penetrating lumen. Carinae rare, thin, only slightly bent upwards. At the base of calice septa are withdrawn from the axis and the corallite resembles the representatives of the genus *Metrioplexus* except for the fact that in *Metrioplexus* the free area along the axis appears in the meanic stage. Sections of tabulae are visible between septa.

Remarks. — Famennian specimens are similar in structure to the Frasnian species *M. bouchardi* from which they differ, however, in a slightly larger septal index (18-22/7.5 as compared with 18/10 in Frasnian specimens). In the present author's opinion, both these forms are closely related.

Occurrence. — Poland: Gałęzice (Besówka), beds 1 and 2, Upper Famennian, *costatus* Zone; Łagów (Dule), black clymeniid limestone mixed *rhomboidea-quadrantinodosa* Zone. France: Ferques near Boulogne; Frasnian.

Genus *Metrioplexus* Glinski, 1963
(Type species: *Metrioplexus richteri* Glinski, 1963)

Species assigned: ?*Lopholasma ilitschense* Felser, 1937 (non Soshkina, 1928), *M. richteri* Glinski, 1963 and *M. carinatus* n.sp.

Stratigraphic and geographic range: Middle and Upper Devonian of Europe.

Diagnosis. — See Glinski (1963, p. 328). Microstructure of walls lamellar, of septa — fibrous-trabecular.

Remarks. — From plexus *Metriophyllum* Glinski, 1963 separated corallites, which display the tendency to withdraw their septa from the

axis. Specimens having stereotheca around axial tube were called by him *Metrionaxon*, and those with thin axial ends were assigned by him to the genus *Metrioplexus*. This author expresses the supposition that *Metrioplexus* may be a junior synonym of *Nalivkinella* Soshkina, 1928 which would depend on the presence of carinae. Since *Nalivkinella* has not such carinae, it is not congeneric with *Metrioplexus*.

Metrioplexus (?) *carinatus* n.sp.
(Text-fig. 9 *A-F*; Pl. II, Fig. 3)

Holotype: Specimen Z. Pal. P. Tc No. 3/2278; Text-fig. 9 D_1-D_2.
Type horizon: Upper Famennian, *costatus* Zone.
Type locality: Gałęzice (Besówka), bed 2.
Derivation of the name: Lat. *carinatus* = provided with carinae.

Diagnosis. — A *Metrioplexus* with septa of two different lengths. The n/d index = 18/6. Free axial area narrow. Strong, upturned carinae. In the axis tabulae domelike or horizontal.

Material. — Six damaged specimens embedded in zoogenic limestone, 16 peels and 2 thin sections.

Description. — Corallites subcylindrical, straight or slightly bent, with a thick epitheca on which wide, flattened interseptal striae are visible.

Transverse section. Corallites round, with a thick (1.2 mm) epitheca. Major septa straight, long. Free, axial area with a diameter of, e.g., 0.5 mm when the corallite is 3 mm in diameter or wider, with a diameter of 1.5 mm when the corallite is 4.8 mm in diameter. Carinae thick, strongly upturned. Axial ends of septa either thin and without stereotheca or thick and forming, together with swollen tabulae, a more or less compact stereotheca. Minor septa very short and either completely embedded in wall or slightly projecting in the tabularium. The n/d index for a few specimens amounts to: 8/1.2, 8/1.3, 8/1.4, 10/1.4, 8/1.5, 10/1.5, 14/3, 16/4.4 and 18/6.1.

Longitudinal section. In the tangential section, there are visible sections of septa with almost horizontal, slightly upturned, strong carinae. In the axial section, tabulae are thin or thick, complete, along the axis raised in a domelike manner and peripherally steeply descending.

Ontogeny (Text-fig. 9 A_1-A_3). — The smallest remains embedded in limestone have n/d = 11/1.1. Epitheca and septa thick. Axial area, free of septa, already existing. Counterseptum as strong as adjoining counterlateral septa. Septal formula: $\frac{1\,|\,0}{2\,|\,2}+6$.

Variability observed in the thickness of skeletal elements, density of carinae, size of axial area and convexity of tabulae. Here and there, axial ends of septa may be rhopaloid.

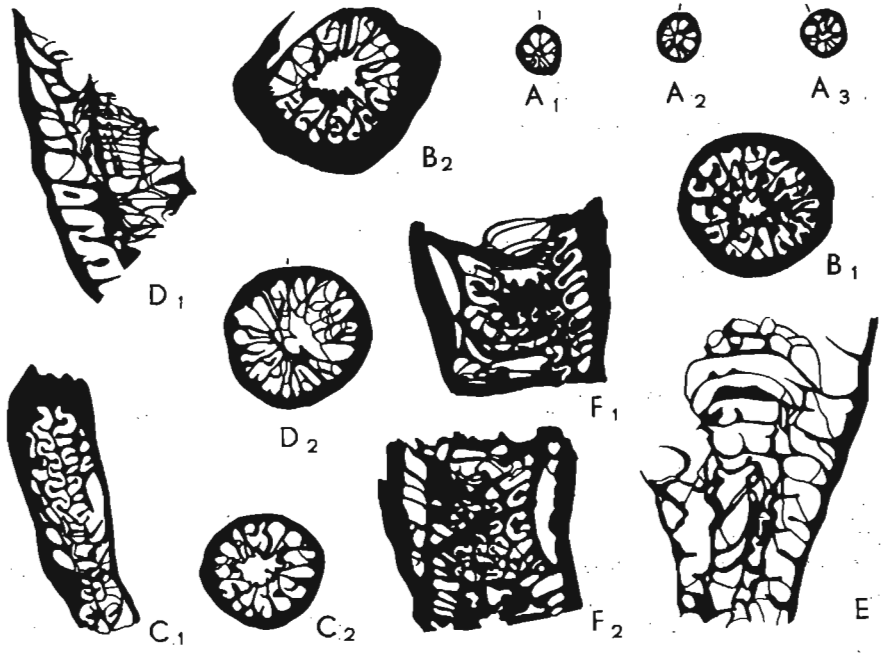

Fig. 9. — *Metrioplexus*? *carinatus* n.sp.: A_1-A_3 a series of sections through early neanic stage, axial ends of septa fused in stereotheca (Z. Pal. P. Tc No. 3/2348); B_1-B_2 transverse sections through a mature stage, carinae strongly hook-like (No. 3/2041); C_1 longitudinal-tangential section, C_2 transverse section (No. 3/2249); D_1 longitudinal-axial section, D_2 transverse section (No. 3/2278), holotype; *E* longitudinal-axial section through a large individual (No. 3/225); F_1-F_2 longitudinal sections, F_1 axial, F_2 periaxial section (No. 3/2034).
A, *C-E* Gałęzice, bed 2; *B*,*F* Gałęzice, bed 1. All × 4

Remarks. — The new species differs from *M. richteri* Glinski, an only species ever known so far, in the following characters: 1) skeletal elements, in particular epitheca, are much thicker; 2) carinae are more crowded and more strongly upturned; 3) free axial areas are smaller and, here and there, surrounded by stereotheca. *M. carinatus* n.sp., assigned to *Metrioplexus*, has not characters so typical of this genus as those presented by Glinski (1963, p. 330). In some sections, axial ends of septa are rhopaloid and form stereotheca. Since in serial transverse sections, the axial part of the coral is variable, the present writer only tentatively assigns the specimens described to *Metrioplexus*.

Occurrence. — Poland: Gałęzice (Besówka), beds 1-3, Upper Famennian, *costatus* and *styriaca* Zones.

Subfamily **Syringaxoninae** Hill, 1939 emend.

Genera and subgenera assigned: *Syringaxon* Lindstroem, 1882; *Stewartophyllum* Busch, 1941; *Syringaxon* (Saucrophyllum) Philip, 1962; *S.* (*Barrandeophyllum*) Počta, 1902, *S.* (*Catactotoechus*) Hill, 1954.

Stratigraphic and geographic range: Silurian-Lower Carboniferous: N. America, Eurasia, Australia.

Diagnosis. — Corals with a metriophylloid ontogeny, with stereotheca around axial tube and — sometimes — with dissepiments.

Remarks. — Schouppé (1951) considers *Barrandeophyllum* Počta, 1902 to be a new subgenus, and Philip (1962) introduces *Saucrophyllum* as a new subgenus of *Syringaxon*. Hill (1954) introduces a new Famennian genus *Catactotoechus*, after the writer's opinion a subgenus of *Syringaxon*.

Genus *Syringaxon* Lindstroem, 1882

(Type species: *Cyathaxonia siluriensis* M'Coy, 1850)

Synonyms: an exhaustive synonymy was given by Kullmann (1965, p. 65).

Species assigned: In addition to the species mentioned by Kullmann (1965, p. 70), *S. cyathaxoniaeformis* Gorsky, *Syringaxon* sp. (Philip, 1962), *S. vacuus* n.sp. and *S.* aff. *cyathaxoniaeformis* Gorsky are assigned to this genus in the present work.

Stratigraphic and geographic range: Silurian-Lower Carboniferous; N. America, Eurasia, Australia.

Diagnosis. — Wall consisting of a lamellar epitheca with septotheca adhering to it; septa trabecular in structure and with trabecular nodes; minor septa appear serially, dissepiments lacking.

Syringaxon aff. *cyathaxoniaeformis* Gorsky, 1932

(Text-fig. 10 *A-E*; Pl. II, Fig. 9)

Material. — Twenty seven mostly vestigial specimens, embedded in zoogenic limestone. Twenty two peels of transverse and longitudinal sections and 11 thin sections.

Description. — Corallites small, slightly bent, horn-shaped. The longest specimen devoid of proximal end, 11 mm long and 4 mm in maximum diameter. Epitheca longitudinally striated with fine growth wrinkles.

Transverse section. Triangularly extended bases of septa adhering to each other. Their axial ends rhopaloid form a thick stereotheca, additionally thickened by deposit of stereoplasma. The lumen of tube either completely closed or considerably contracted. Axial tube, together with the ring of stereoplasma, occupy more than half of the diameter

(d:c+st = 4.7:2.5). Cardinal septum free, situated in a narrow fossula. Two minor septa, equally strongly developed, are situated close to the counterseptum. Together they form a characteristic triplet. All other minor septa adhere to the septum of I order situated on the side of counterseptum and are fused with it on the side of the cardinal septum within the limits of stereotheca or close to it. They are as strong as major septa.

Longitudinal section. Calyx deep and depressed in a funnel-like manner along the axis. Calyx edge sharp. Outer wall and stereotheca thick. Lumen of tube fissure-like in shape.

Ontogeny was very accurately examined several times (Butler, 1935; Kullmann, 1965; Fedorowski, 1965). The results of these studies are, in principle, in conformity with each other, except for the difference concerning the time of appearance of stereotheca and minor septa. Besides, in *S. siluriensis* M'Coy, 1850, the first metasepta appear in countercardinal quadrants and in *S. pinguis* Kullmann, 1965 — in cardinal quadrants. According to Fedorowski's (1965) observations, in *S. bohemica* (Barrande), they also appear first in cardinal quadrants. Since septum of II order appears after the occurrence of a young metaseptum and fuses with an older metaseptum, the appearance of II order septa is serial (or, according to Kullmann, 1965, alternately serial).

Remarks. — The species discussed differs from other representatives of *Syringaxon* in strongly swollen skeletal elements. In addition, its major and minor septa, equally strongly developed, are connected with each other near stereotheca. The number of septa is small, 30 with a diameter of 6 mm, and the lumen of tube is very narrow. All these characters occur in *S. cyathaxoniaeformis* Gorsky from the Uppermost Devonian of the U.S.S.R. On the other hand, Famennian specimens have less conspicuous septal carinae and septa which do not fuse with each other peripherally.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure I, bed 2; II, beds K and N; III, bed 14, Lower Famennian (*quadrantinodosa* Zone); Gałęzice (Besówka), beds 1-3 and 5, Upper Famennian (*costatus-velifera* Zones).

Syringaxon vacuus n.sp.

(Text-fig. 10 *F-J*; Pl. II, Fig. 10)

Holotype: *Specimen* Z. Pal. P. Tc No. 3/2340; Text-fig. 10 *H*.

Type horizon: Upper Famennian, *costatus* Zone.

Type locality: Gałęzice (Besówka), bed 2.

Derivation of the name: Lat. *vacuus* = empty, after the lack of a deposit of stereoplasma.

Diagnosis. — A *Syringaxon* which, with a diameter of 3 mm, has 20 almost equally strong major and minor septa and a very poor deposit of stereoplasma. Lumen of tube wide equalling nearly a half of a diameter of the coral. Tabulae dense.

Material. — Thirteen, mostly damaged specimens collected in the zoogenic limestone. Twenty peels and 5 thin sections have been made.

Description. — *Transverse section.* Section oval, diameter small, 2.0-3.5 mm, number of major and minor septa, 16-20. Major and minor septa almost equally strong and long. Both minor septa fused with counterseptum within the limits of stereotheca or are inclined to it. Stereotheca thin, 0.1-0.2 mm. Lumen of tube wide, its diameter amounting to 0.5-1.5 mm.

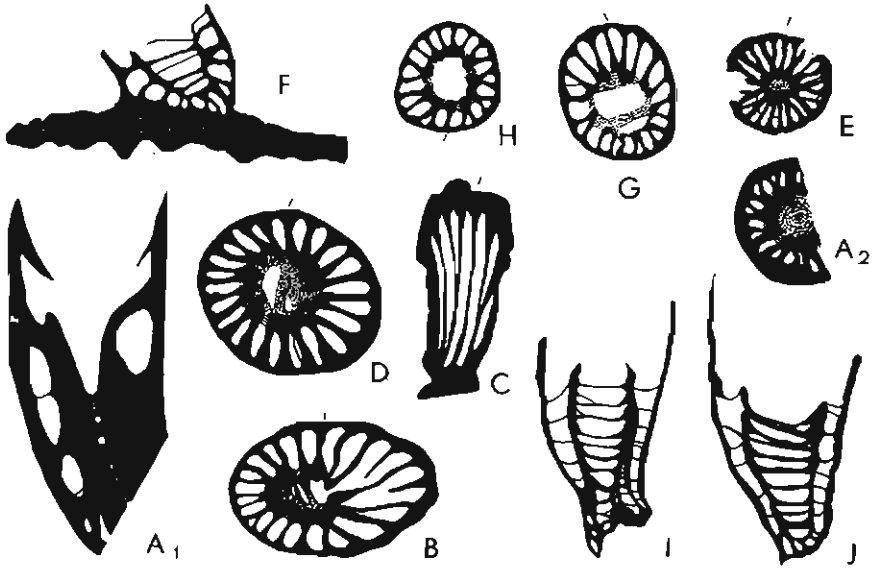

Fig. 10. — *A-E Syringaxon* aff. *cyathaxoniaeformis* Gorsky: A_1 longitudinal section of a deep calyx with a fissurelike axial tube, A_2 transverse section of a half of coral, major and minor septa fused together near stereotheca, axial tube filled with stereoplasma (Z. Pal. P. Tc No. 3/2652); *B* transverse, slightly oblique section (No. 3/2461); *C* oblique section of part of calyx with cardinal septum (No. 3/2588); *D* transverse section of a large individual (No. 3/2131); *E* transverse section of a small individual (No. 3/951).

F-J Syringaxon vacuus n.sp.: *F* longitudinal section of a young individual attached to *Neaxon* sp. (No. 3/2151); *G* transverse, slightly oblique section (No. 3/2473); *H* transverse section, tabularium wide, major and minor septa fused together near stereotheca (No. 3/2340), a holotype; *I* longitudinal section (No. 3/2109); *J* longitudinal section (No. 3/2142).

A Gałęzice, bed 6; *B-D, F-J* Gałęzice, bed 2; *E* Kadzielnia II, bed K. All × 4.6

Longitudinal section. Conical and slightly bent, short (2.0-6.5 mm) forms, adhering to other corals or to the bottom by a narrow or wide surface. Calyx wide and deep, walls steep, bottom concave with stereo-

theca slightly raised above it. Tabularium wide, its axial part within the limits of the tube has closely distributed concave tabulae. Four to nine tabulae are distributed over 2.5 mm of the height of the specimen. Periaxial tabulae are thinner and more widely spaced.

Variability small, expressed in the thickness of skeletal elements and the width of axial tube.

Remarks. — *S. vacuus* n.sp. is similar to *S.* aff. *cyathaxoniaeformis* Gorsky in its n/d index and in an almost identical length of major and minor septa, but differs in a poor deposit of stereoplasma. It has the tube with a very wide lumen and a wide calyx. The new species is somewhat similar to *S. smithi* Prantl, 1938, figured by Kullmann (1965, p. 73), but minor septa of the Czech and Spanish specimens are slightly shorter.

Occurrence. — Poland, Gałęzice (Besówka), beds 1, 2, 5 and the dump, Upper Famennian (*costatus-velifera* Zone).

Subfamily **Petrainae** de Koninck, 1872

Genera assigned: *Petraia* Münster, 1839; *Petraiella* n.gen.

Stratigraphic and geographic range: Upper Silurian-Lower Famennian; Germany, Poland.

Diagnosis. — Corals with lamellar-undulated epitheca with septotheca adhering to it. Septa trabecular. Ontogeny metriophylloid. Septa acanthine or laminar with two different lengths. Stereocolumella occurring either only in the early ontogeny or over the entire individual development. Minor septa contratingent. Tabulae lacking or, if present, irregularly distributed. Calyx either deep or shallow. Septa predominant in countercardinal quadrants.

Remarks. — The diagnosis of this subfamily takes in a few opposed characters, probably resulting from the phylogenetic development. The oldest representatives (with the genus *Petraia*) occur in the Upper Silurian. They have a deep calyx, their septa in calyx are of the acanthine type, tabulae lacking. The Upper Devonian *Petraiella* n.gen. has a different structure (see p. 44).

Genus *Petraiella* n.gen.

(Type species: *P. kielcensis* n.sp.)

Derivation of the name: *Petraiella* — genetically related to the genus *Petraia* Münster.

Species assigned: *P. kielcensis* n.sp., *P. diffusa* n.sp., *P. centralis* n.sp.

Stratigraphic and geographic range: Lower Famennian of the Holy Cross Mountains.

Diagnosis. — Solitary corallites with a shallow calyx and laminar septa. Major septa, in the mature stage, are either connected along the axis or withdrawn from it. Tabulae incomplete, occurring in different arrangement.

Remarks. — *Petraiella* n.gen., similar to the *Petraia*, is probably a continuation of this genus. Differences are shown below:

Age	Genus	Septa	Calyx	Tabulae	Epitheca
Silurian	*Petraia* Münster	acanthine	deep	lacking	lacking
Famennian	*Petraiella* n. gen.	laminar	shallow	dense	strong

Petraiella diffusa n. sp.
(Text-figs. 11 *A-C*, 13)

Holotype: Specimen Z. Pal. P. Tc No. 3/1159; Text-fig. 11*A*.
Type horizon: Lower Famennian, *quadrantinodosa* Zone.
Type locality: Kielce (Kadzielnia quarry), exposure II, bed K.
Derivation of the name: Lat. *diffusus* = disorderly, after an irregular distribution of septa and tabulae.

Diagnosis. — A *Petraiella* with septal index n/d = 32/6, stereocolumella in the nepionic and neanic stages, as well as a wide axial area in the ephebic stage. Cardinal septum long, counterseptum short. Tabulae incomplete, irregularly distributed.

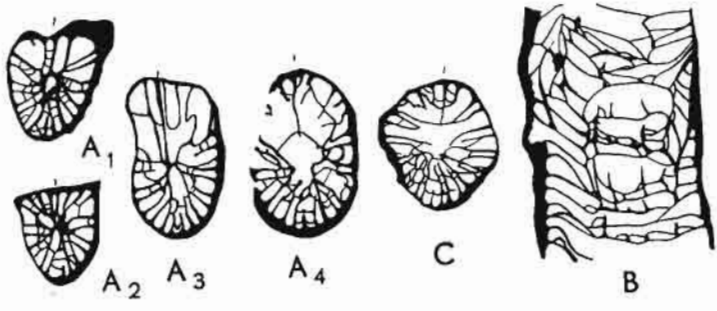

Fig. 11. — *Petraiella diffusa* n.gen., n.sp. A_1-A_4 serial transverse sections of a neanic stage, cardinal septum long, counterseptum short (Z. Pal. P. Tc No. 3/1159), holotype, × 5; *B* longitudinal section (No. 3/939), × 5; *C* transverse section of an ephebic stage (No. 3/1263), × 3.5.
Kadzielnia II, bed K

Material. — Twenty six mostly very small and vestigial specimens of which 31 peels and 2 thin sections were made.

Description. — Corallites slender, subcylindrical, about in the proximal part. The largest length amounts to 18 mm. Talon wide. Epitheca thick,

obscuring septal grooves. Visible are only growth wrinkles and annulations which run obliquely to talon. Calyx shallow, oblique to the axis of corallite.

Transverse section. Section round. An n/d index of 28/3.8. Epitheca thick (to 0.4 mm), septa thin, bent, with thin, triangular bases, not reaching the axis. Minor septa almost equally strong as major septa. The disposition of septa irregular: they may be inclined to each other and, in some places, form aulos and, in other places, systems or they may be short and radially disposed. Cardinal septum long, situated in cardinal fossula, counterseptum short, situated in fossula. A strong acceleration in countercardinal quadrants. Distribution of septa according to the following formula: $\frac{5\,|\,5}{7\,|\,7}+2$.

Longitudinal section. Epitheca thick, periaxial tabulae, adhering to it, are raised to the axis, horizontal or descending to the axis. Axial tabulae concave, flat or convex. Additional plates occurring on tabulae.

Ontogeny (Text-fig. 11 A_1-A_4). — 1) *Nepionic stage* — not preserved. 2) *Early-neanic stage.* Longer diameter amounting to 2.0 mm, number of major and minor septa — 21. Septa form systems and are connected along the axis in stereocolumella. Counterseptum very short, situated in a closed fossula. Cardinal septum does not differ from adjoining septa and is situated on the side of talon. 3) Transverse section, made 1 mm higher. Longer diameter amounting to 2.3 mm, number of septa — 21. Cardinal quadrants become nearly empty. Cardinal septum long, two parallel septa occurring close to it. Septa reach axial tube. Counterseptum continues to be short. 4) Section made 0.5 mm higher. Longer diameter amounting to 3.3 mm, number of septa to 21. Cardinal septum and an adjoining septum, together with two systems from countercardinal quadrants are connected together along the axis. Counterseptum very short. 5) Section made 2.8 mm higher. Longer diameter amounting to 3.5 mm and number of septa to about 28. Septa withdrawn from the axis. Their arrangement and length are irregular. The longest is cardinal septum. Three short septa, inclined to it occur nearly. Counterseptum is yet shorter.

Variability. — There is a very wide range of variability. There are no two identical specimens. Septa, differing in length, either form a regular wreath near the wall or are combined to form irregular systems and reach different lengths. Tabulae considerably differ in their arrangement.

Remarks. — Specific differences occur primarily in ontogeny: *P. diffusa* n.sp. has cardinal septum long and counterseptum short; *P. centralis* n.sp. has both cardinal and counterseptum long, fused together along the axis; *P. kielcensis* n.sp. has cardinal septum short and counterseptum

long. The last two species have, in the ephebic stage, very similar structures.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposures I, beds 1-3; II, beds K, L and N; III, bed 43, Lower Famennian (*quadrantinodosa* Zone); Jabłonna, bed 2, Lower Famennian (*triangularis* Zone).

Petraiella centralis n.sp.

(Text-figs. 12 *A-C*, 13; Pl. II, Fig. 6; Pl. VIII, Fig. 4)

Holotype: Specimen Z. Pal. P. Tc No. 3/943; Text-fig. 12 A.
Type horizon: *quadrantinodosa* Zone.
Type locality: Kielce (Kadzielnia quarry), exposure II, bed K.
Derivation of the name: Lat. *centralis* = central, after cardinal septum and counterseptum fused together along the axis.

Diagnosis. — A *Petraiella* with a septal index amounting to 40/6.5. During the entire ontogeny cardinal septum and counterseptum together with two adjoining minor septa (triplet) reach or almost reach the axis. Tabularium varying in structure.

Material. — Fifty four more or less damaged specimens coming from shales (in such cases they are almost complete) or limestones (small fragments). Sixty seven peels and two thin sections were made.

Description. — The best preserved specimen, 19.8 mm long, subcylindrical and slender, has a long (8 mm) talon with wavy edges, situated on a slightly convex side of corallite and raised along it to a height of 6.5 mm. Epitheca thick, slightly striated longitudinally, with oblique transverse swellings, depressed towards talon. Calyx shallow, with sharp edges.

Transverse section. Calyx in ephebic stage round. Cardinal septum mostly reaching the axis, situated in an indistinct, grooved fossula whose wall is formed by long adjoining minor septa and axial ends of neighbouring metasepta. A characteristic triplet, with counterseptum somewhat thinner than adjoining minor septa, also reaches the axis. Major septa either fused and forming the stereocolumella or their axial ends form the stereotheca. Minor septa only slightly shorter than major septa, to which they adhere on the side of cardinal septum. A number of septa with a corresponding diameter is shown in Text-fig. 13. Their formula is as follows: $\frac{6 \mid 6}{8 \mid 8}+4$.

Longitudinal section. Epitheca thick, with periaxial tabulae adhering to it. Tabulae variously arranged in a quite mature corallite, they are thin, dense, with many accessory plates, after the rejuvenescence, in the distal part they are widely spaced and raised upwards. They are identically arranged in a young corallite. Axial tabulae are trapezoidal, along the axis, flattened or raised.

Variability, marked by a very wide range, is expressed in the length and thickness of septa, their arrangement, connection of axial ends and formation of stereocolumella or stereotheca and in particular in the structure of tabularium.

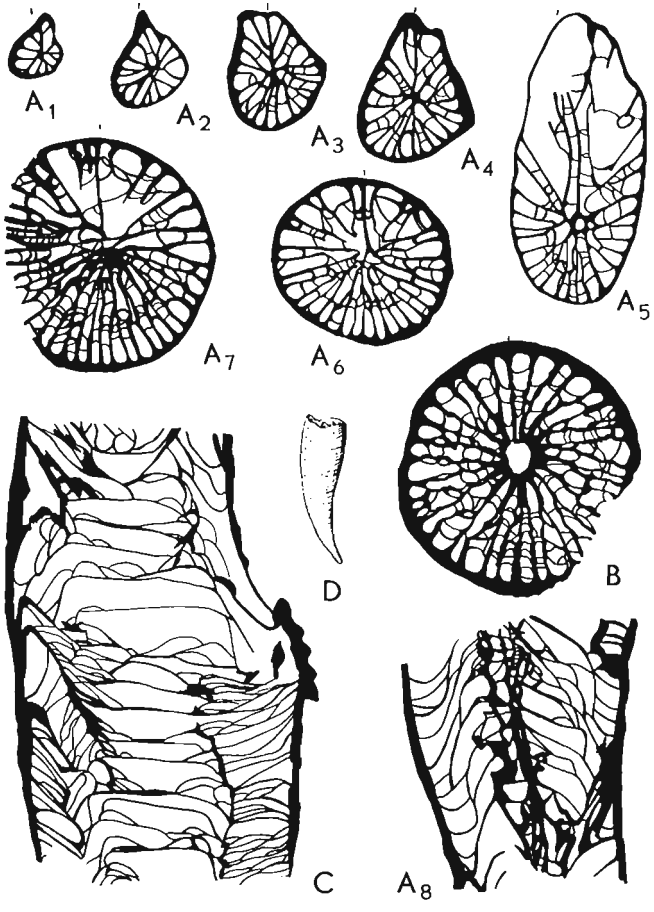

Fig. 12. — *Petraiella centralis* n.gen., n.sp.: A_1-A_5 serial transverse sections of a corallite, mid-neanic stage, A_6-A_7 late neanic stage, A_8 longitudinal section; cardinal septum long, counterseptum less strongly developed, both of them reaching axis (Z. Pal. P. Tc No. 3/943), holotype, × 3; *B* transverse section, ephebic stage, axial tube surrounded by stereotheca (No. 3/1180), × 3; *C* longitudinal section of a corallite with the rejuvenescence (No. 3/34), × 3; *D* diagrammatic drawing of a coral (No. 3/943), nat. size.

A-B,D Kadzielnia II, bed K; *C* Kadzielnia, bed G

Ontogeny (Text-fig. 12 A_1-A_7). In *Petraia semistriata* Münster ontogeny was described by Schindewolf (1931, p. 636). In principle it is similar to the ontogeny of *P. centralis* n.sp. The observation of septa in cardinal quadrants of the Famennian species is difficult because of the presence of talon, situated on the side of these quadrants. With the

extension of talon, some septa are subject to reduction and shortening. 1) *Nepionic and earliest-neanic stages* are not preserved in any specimen. 2) In the *early-neanic stage* coral is triangular in cross section which results from the appearance of talon. Number of septa — 13, longer diameter — 2 mm. Two minor septa adhere to cardinal septum. Counterseptum, together with neighbouring minor septa form a triplet, which persists to the end of the growth of the corallite. The arrangement of septa in four quadrants is according to the following formula: $\frac{2\,|\,2}{3\,|\,2}+4$.

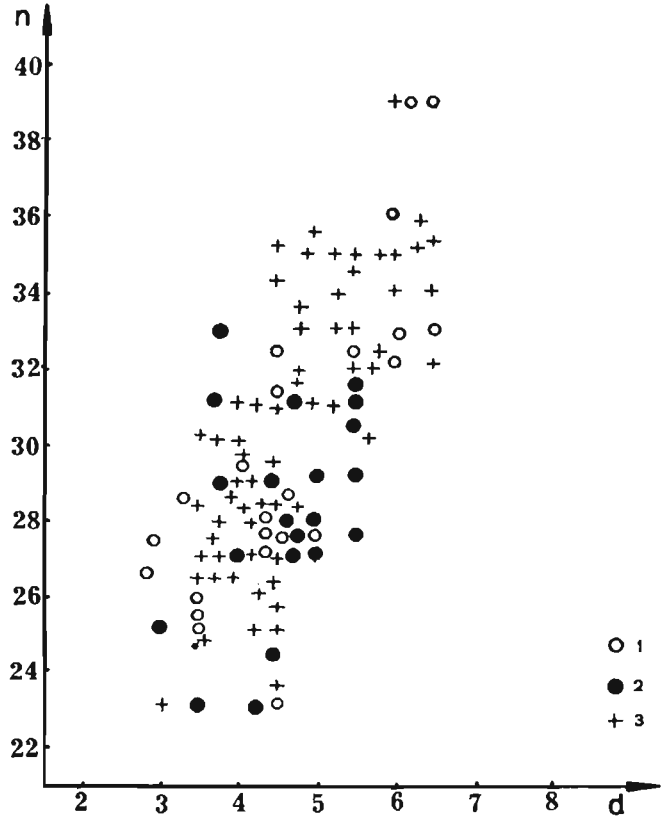

Fig. 13. — Scatter diagram of n/d: *1 Petraiella kielcensis* n.sp., *2 P. diffusa* n.sp., *3 P. centralis* n.sp.

3) In further cross section the diameter of the coral reaches 4.8 mm and number of septa — 24. Their formula in four quadrants is as follows: $\frac{3\,|\,4}{7\,|\,6}+4$. Two septa, which, in the previous stage, adhered to cardinal septum, have now extended towards the axis of corallite and one other new short septum, adheres once again to cardinal septum. In each countercardinal quadrant, below alar septa, there occurs a septum, which extends, reaches the axis and, then, short, true minor septa appear from

the side of the counterseptum and fuse with each older metaseptum on the side of cardinal septum. Minor septum does not appear simultaneously with the last major septum, but it appears with some retardation runs parallel to the last major septum, deflects towards the neighbouring, older major septum and fuses with it. 4) In the *next stage*, talon reaches its largest length, i.e. 7.7 mm. Cardinal septum is now free since neighbouring septa are inserted parallel, while other septa in cardinal quadrants become shortened or reduced. In countercardinal quadrants, there are 9 major and minor septa each. 5) In the *early-ephebic stage*, coral is round in cross section, 7 mm in diameter and has 40 septa of two different lengths with a clear predominance in countercardinal quadrants. Septa are arranged according to the following formula: $\frac{5 \mid 5}{13 \mid 13}+4$. In cardinal quadrants, there predominates a bilateral symmetry and in countercardinal ones — a radial symmetry.

Remarks. — Of the three species of *Petraiella* n.gen. which occur in the Lower Famennian of Poland, *P. centralis* n.sp. has the most compact structure resulting from the fact that its cardinal septa and countersepta are fused together along the axis during the entire ontogeny, much the same as those in the Silurian representatives of the genus *Petraia*.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposures G; I, bed 1; II, beds N, L and K; III, beds 50, 43, 41 and 16; Lower Famennian (*quadrantinodosa-crepida Zones*); Jabłonna, bed 2; Lower Famennian (*triangularis* Zone); Gałęzice (Besówka), bed 5; Upper Famennian (*velifera* Zone).

Petraiella kielcensis n.sp.

(Text-figs. 13, 14 *A-D*; Pl. II, Figs. 7-8)

Holotype: Specimen Z. Pal. P. Tc No. 3/961; Text-fig. 14 A.
Type horizon: Lower Famennian, *quadrantinodosa* Zone.
Type locality: Kielce (Kadzielnia quarry), exposure II, bed K.
Derivation of the name: *kielcensis* — after the city of Kielce which the holotype comes from.

Diagnosis. — A *Petraiella* with a septal index amounting to 40/6.6. In the neanic stage, cardinal septum is short situated in a wide fossula, in the ephebic stage — as long as the neighbouring metasepta or somewhat longer and situated in a narrow fossula.

Material. — Twenty eight poorly preserved or vestigial specimens of which 37 peels were made.

Description. — Slender subcylindrical, slightly bent specimens. Epitheca thick (to 0.5 mm). Fine growth wrinkles and rhythmically repeated swellings running obliquely towards talon and causing the formation of

folds, are visible on epitheca. Talon elongate, elliptical, situated on the convex side of corallite.

Transverse section. Corallite round in cross section, with a thick epitheca. Septal bases are mounted on triangular socles on the inner surface of epitheca. Septa reach the axis where, connected with each other by the deposit of stereoplasma, they form a stereocolumella or their thickened ends form, around the axis, a stereotheca. Cardinal septum may be equal to or slightly longer than other major septa and is situated in fossula. Together with two minor septa counterseptum forms a triplet. At the base of calyx, septa are shortened and arranged bilaterally. Cardinal septum deflected, fused with a neighbouring metaseptum and situated in an open fossula. Counterseptum somewhat longer than neighbouring minor septa. Acceleration, started in neanic stage, is continued in the ephebic stage. With a diameter of 6 mm, the septal formula for 35 septa in 4 quadrants is as follows: $\frac{7\,|\,7}{8\,|\,9}+4$.

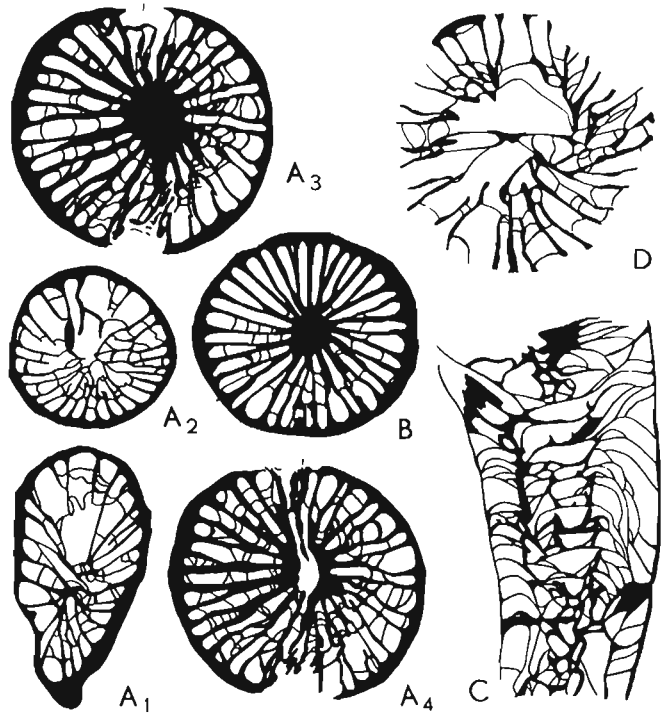

Fig. 14. — *Petraiella kielcensis* n.gen., n.sp.: A_1-A_2 sections of a coral, neanic stage, A_3-A_4 ephebic stage, with stereocolumella and with stereotheca around axial tube (Kadzielnia II, bed K; Z. Pal. P. Tc No. 3/961), a holotype; *B* transverse section of a mature individual similar to that in Fig. A_3 (Kadzielnia II, bed K; No. 3/1180); *C* longitudinal section (Kadzielnia G; No. 3/972); *D* transverse section through the bottom of calyx, septa retreated from axis (Kadzielnia I, bed I, No. 3/225).

All × 3.5

Longitudinal section. Axial tabulae trapezoidal, variously disposed near the axis, generally convex towards the top; many accessory plates.

Variability considerable: septa thick or thin, threadlike, arranged radially or combined to form systems; they may be connected with each other without the deposit of stereoplasma or form a conspicuous stereocolumella. In other cross sections, an axial tube with its wall-stereotheca may occur instead of stereocolumella. The arrangement of tabulae is also very variable.

Ontogeny. — 1) Text-fig. 14 A_1 represents a cross section through the proximal end of corallite with its talon in a *mid-neanic stage*. Longer diameter — 7 mm, number of septa — 26. Septa irregularly distributed. Cardinal septum considerably shortened, some other septa in cardinal quadrants also shortened or reduced. These quadrants are empty like those in *P. centralis* n.sp., except for the fact that cardinal septum in the last-named species is long and reaches the axis. 2) Text-fig. 14 A_2 represents the cross section through a corallite in the *early ephebic stage*. Corallite over talon is round in cross section, 4 mm in diameter and with 28 septa. Cardinal septum continues to be short, the same as neighbouring septa which do not reach the axis. Septa of countercardinal quadrants are crowded; counterseptum, longer than neighbouring minor septa, does not reach the axis and is free in the triplet. Axis of corallite devoid of septa. 3) The *ephebic stage* has been described above together with the transverse section.

Remarks. — *P. kielcensis* n.sp. primarily differs from *P. diffusa* n.sp. and *P. centralis* n.sp. in its ontogenetic development during which cardinal septum, at first very short, gradually elongates.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposures: II, beds L and K; III, beds 46, 43, 39 and 16.

Subfamily **Cyathaxoniinae** Milne-Edwards & Haime, 1850

Genera assigned: *Cyathaxonia* Michelin, 1847 with a subgenus *C.* (*Cyathocarinia*) Soshkina, 1928.

Stratigraphic and geographic range: Lower Famennian-Permian; N. America, Eurasia, Australia, Africa.

Diagnosis. — Corals with a metriophylloid ontogeny, with the stereotheca, around the axial area, surrounding a compact, pseudoseptal columella; septa smooth or carinated, with a trabecular microstructure; minor septa contratingent; tabulae complete, convex; dissepiments absent.

Remarks. — The metriophylloid ontogeny and a serial appearance of minor septa are a basis for assigning Cyathaxoniinae to Metriophyllidae. The presence of columella is a new adaptive character of this family.

Genus *Cyathaxonia* Michelin, 1847

(Type species: *Cyathaxonia cornu* Michelin, 1847)

1847. *Cythaxonia*; J. L. H. Michelin, Iconographie..., p. 257.
1940. *Cyathaxonia*; T. A. Dobroljubova, Korally Rugosa..., p. 10, *cum syn.*
1963. *Cyathaxonia;* G. E. de Groot, Rugose corals..., p. 25.
1968. *Cyathaxonia*; J. Fedorowski, Upper Viséan..., p. 210, *cum syn.*

Species assigned: *Cyathaxonia cornu* Michelin, 1847; *C. contorta* Vaughan, 1906; *C. tantilla* Miller, 1909; *C. arcuata* Weller, 1909; *C. angularis* Fomitshev, 1953; *C. lomonosovi* Fomitshev, 1953; *C. archangelskyi* Fomitshev, 1953; *C. tenuiseptata* Fomitshev, 1953; *C. cornu cantabrica* de Groot, 1963; *C. corisensis* de Groot, 1963. After the revision of holotypes, some of the species mentioned above may turn out to be synonyms.

Stratigraphic and geographic range: Lower Famennian-Permian; N. America, Eurasia, Australia, Africa.

Diagnosis. — See Hill (1956, p. F 264).

Remarks. — The history of studies on the genus *Cyathaxonia* is shown in detail by Fomitshev (1953). The ontogenetic development was described by Faurot (1909) and Grabau (1922). The skeletal elements were studied by Carruthers (1913), who found that tabulae did not occur often. A compact columella is mostly considered by the authors as independent of septa. Schouppé & Stacul (1961) prove that, in the early neanic stage, columella is of a septal origin and call it a pseudoseptal columella.

Diagnostic characters, on the basis of which many species were distinguished, are fairly variable because of a wide range of the intraspecific variability. The following features are mentioned by de Groot (1963) as diagnostic characters: 1) septal index n/d which is, however, treated by this author with a certain reservation due to the variability of the diameter of corallites and 2) length of minor septa which may be either short or reach the ring of stereoplasma around the columella and fuse there with major septa. Other characters such as size of corallites, thickness of skeletal elements, etc., depend on the environment.

Cyathaxonia (*Cyathaxonia*) aff. *cornu* Michelin, 1847

(Text-figs. 15 *A*-*C*, 16; Pl. II, Fig. 14; Pl. III, Fig. 2)

Material. — Twenty six incomplete specimens, isolated or embedded in limestone of which 21 peels were made, including transverse and longitudinal sections.

Description. — Specimens slender, subcylindrical, with proximal ends conical and slightly bent. Margin of calyx wavy. The length of the largest, damaged specimen amounts to 10 mm. Thick or, sometimes, delicate interseptal ridges, thin growth wrinkles and, widely spaced, transverse annulations or contractions occur on epitheca.

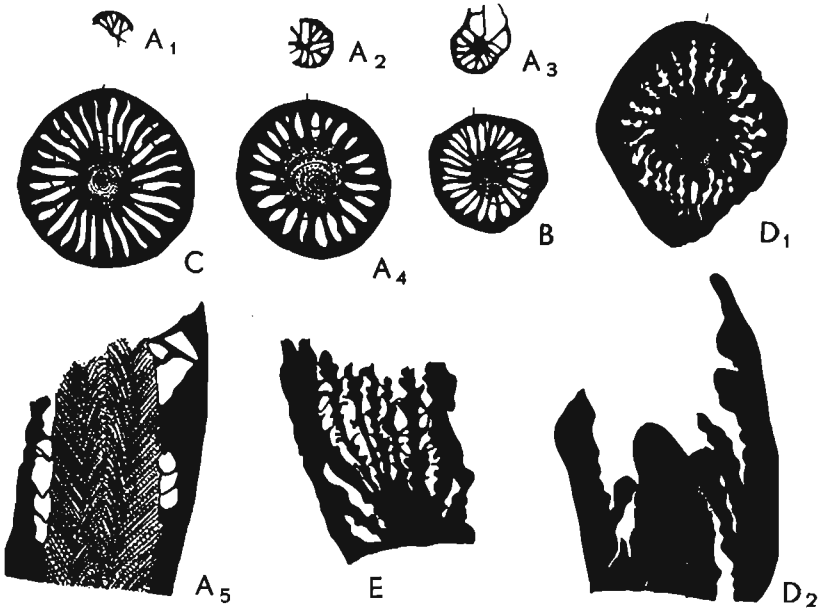

Fig. 15. — *A-C Cyathaxonia* (*Cyathaxonia*) aff. *cornu* Michelin: A_1-A_4 serial transverse sections of a coral, A_1-A_2 early neanic stage with septa fused together axially, A_3 neanic stage with axial tube and pseudoseptal columella, A_4 ephebic stage with a wide columella surrounded by stereotheca, A_5 longitudinal section, epitheca thick, tabulae thin, columella wide with two septa adhering to it (Gałęzice, bed 1; Z. Pal. P. Tc No. 3/2075), × 4; *B* transverse section, ephebic stage (Kadzielnia II, bed K; No. 3/1233), × 4; *C* transverse section, ephebic stage, cardinal septum slightly longer, counterseptum and two minor septa fused together (Kadzielnia II, bed K; No. 3/1939), × 4.
D-E Cyathaxonia (*Cyathocarinia*) *tuberculata* Soshkina: D_1 transverse section, ephebic stage, columella round, surrounded by stereotheca, septa with carinae, D_2 longitudinal section (Gałęzice, bed 1; No. 3/2017), × 5.4; *E* longitudinal-tangential section, septa with carinae (Gałęzice, bed 1; No. 3/2016) × 5.4.

Transverse section. Corallite round, with a thin epitheca and thick septotheca, the latter being formed by pentagonal, swollen bases of major and minor septa. The n/d index = 24-28/4 (Text-fig. 16*a*). Septa almost equal in thickness, connected in pairs and forming stereotheca around columella. Lateral walls smooth, with small roughnesses visible on them when they are weathered. Cardinal septum, slightly thicker and longer, situated in a narrow fossula. Two long minor septa adjoin the counterseptum and together form the triplet. Columella round and narrow, but thickened by stereotheca adhering to it. Columella together with stereotheca occupy 1/2 or 1/3 of the diameter of the coral. The c+st/d indices are given in Text-fig. 16*b*.

Longitudinal section. A thick wall and thin tabulae, raised towards the columella, are visible in the section. Columella raised over tabularium and consisting of domelike layers compactly overlying each other. The

plane of section passes through columella and two neighbouring major septa.

Variability is expressed in the thickness of septa and wall, as well as in the diameter of columella.

Ontogeny (Text-fig. 15 A_1-A_4). — Describing the ontogeny, Carruthers (1913) ascertains that up to a number of 6-8, septa are single and upwards of this number they occur in pairs, since minor septa appear serially and fuse with a corresponding major septum on the side of the cardinal septum. The following development stages have been found in the Famennian specimens: 1) With a diametr of 1.4 mm the number of septa amounts to (?)12. Septal pairs present. Septa fused together along the axis. Columella absent. 2) With a diameter of 1.8 mm, there are 16 septa,

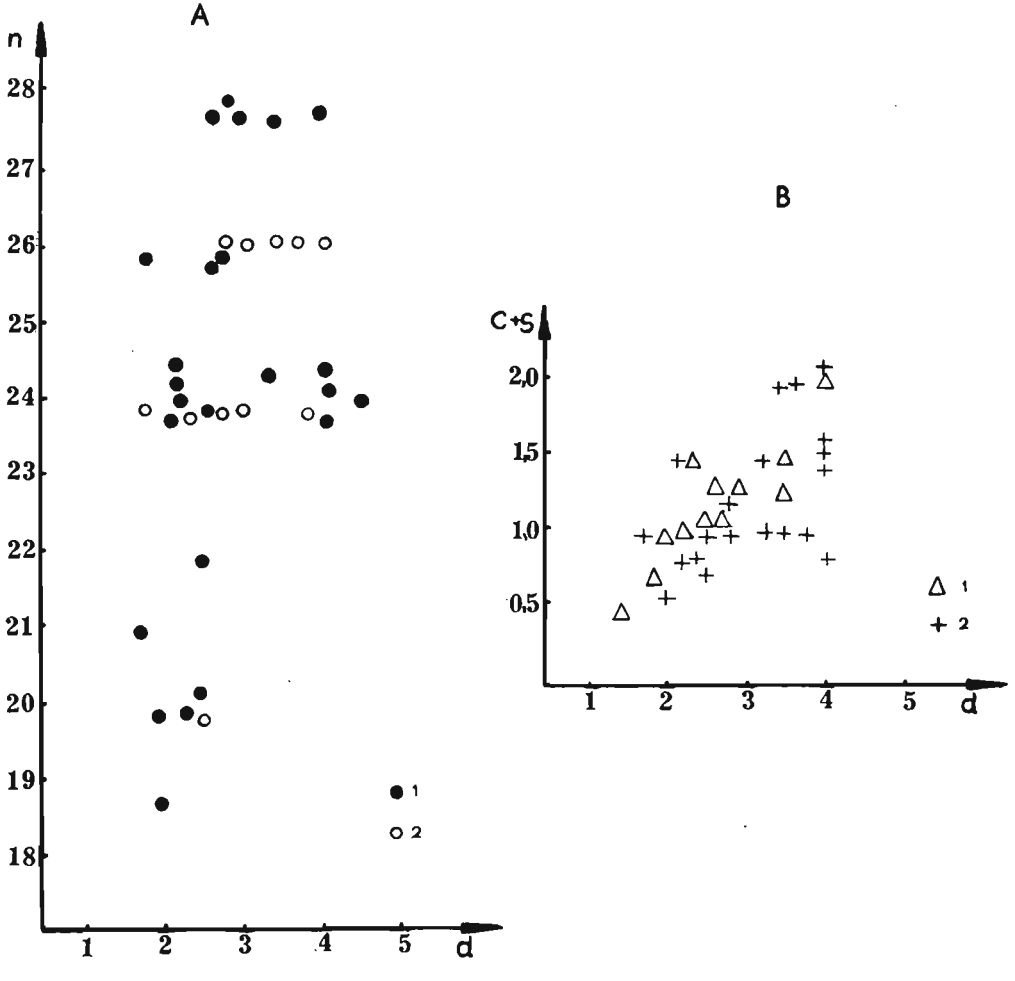

Fig. 16. — Scatter diagrams of: *A* n/d, *B* c+st/d; *1 Cyathaxonia* (*Cyathaxonia*) aff. *cornu* Michelin, *2 C.* (*Cyathocarinia*) *tuberculata* Soshkina.

which still are connected along the axis. Columella absent. 3) With a diameter of 2.0 mm, there are 16 septa, slightly retreated from the axis; stereotheca present, surrounding columella. 4) With a diameter of 4.0 mm, there are 24 septa. Structure thick, along the axis. This is an ephebic stage.

Remarks. — Famennian forms differ from Lower Carboniferous in a smaller number of septa and smaller dimensions of corallites.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposures: II, bed K; III, bed 43, Lower Famennian (*quadrantinodosa* Zone); Gałęzice (Besówka), beds 6, 5, 2, 1. Upper Famennian (*costatus-velifera* Zones); Kowala, trench III, Upper Famennian (*costatus* Zone).

Subgenus *Cyathaxonia* (*Cyathocarinia*) Soshkina, 1928

(Type species: *C.* (*Cyathocarinia*) *tuberculata* Soshkina, 1928)

1928. *Cyathaxonia* (*Cyathocarinia*) Soshkina; E. D. Soshkina, Nižnepermskie..., p. 375.
1932. *Cyathaxonia* (*Cyathocarinia*) Soshkina; E. D. Soshkina, Nižnepermskie..., p. 254 (*cum synon.*)
1936. *Cyathaxonia* (*Cyathocarinia*) Soshkina; T. A. Dobroljubova, Korally Rugosa..., p. 92.
1940. *Cyathaxonia* (*Cyathocarinia*) Soshkina; W. D. Lang, S. Smith & H. D. Thomas, Index..., p. 43.
1956. *Cyathocarinia* Soshkina; D. Hill, Rugosa..., p. F 264.
1962. *Cyathocarinia* Soshkina; E. D. Soshkina, T. A. Dobroljubova & N. V. Kabakovitsh, Podklass..., p. 333.

Species assigned: Cyathaxonia rushiana Vaughan, 1908; *Cyathaxonia* (*Cyathocarinia*) *tuberculata* Soshkina, 1928 and *Cyathaxonia* (*Cyathocarinia*) *rushiana* var. *multituberculata* Soshkina, 1932.

Stratigraphic and geographic range: Lower Famennian-Permian of Europe.

Diagnosis. — See Hill (1956, p. F264).

Remarks. — Vaughan (1908) was first to describe carinae in *Cyathaxonia rushiana* Vaughan. Carruthers (1913) did not recognize the presence of carinae to be a diagnostic character even of a species. Soshkina (1928) introduced, for *Cyathaxonia* having carinae, a new subgenus *Cyathocarinia*, to which she assigned two new species: *Cyathaxonia* (*Cyathocarinia*) *tuberculata* Soshkina and *C.* (*Cyathocarinia*) *multituberculata* Soshkina. According to Dobroljubova (1936), these species are synonyms of *C.* (*Cyathocarinia*) *rushiana* Vaughan. Lang, Smith & Thomas (1940) continue to acknowledge the subgenus *Cyathocarinia*. Hill (1956), as well as Soshkina, Dobroljubova and Kabakovitsh (1962), consider *Cyathocarinia* to be an independent genus. De Groot (1963) does not consider the presence of carinae to be a diagnostic character. The present writer is, however, of the opinion that, due to the presence of carinae, *Cyathocarinia* should be acknowledged as a subgenus.

Cyathaxonia (Cyathocarinia) tuberculata Soshkina, 1928

(Text-figs. 15, *D-E*, 16; Pl. III, Figs. 3-4)

1928. *Cyathaxonia (Cyathocarinia) tuberculata* Soshkina; E. D. Soshkina, Nižnepermskie..., p. 377, fig. 17.
1928. *Cyathaxonia (Cyathocarinia) multituberculata* Soshkina; E. D. Soshkina, *Ibid.*, p. 378.
1932. *Cyathaxonia (Cyathocarinia) rushiana* Vaughan var. *multituberculata* Soshkina; E. D. Soshkina, Nižnepermskie..., p. 254, Text-figs. 4-9.
1936. *Cyathaxonia (Cyathocarinia) rushiana* Vaughan; T. A. Dobroljubova, Korally Rugosa..., p. 92, Text-figs. 12, 13.
1956. *Cyathocarinia tuberculata* Soshkina; D. Hill, Rugosa..., p. F264, non Fig. 179, 10 a, b.
1962. *Cyathocarinia tuberculata* Soshkina; E. D. Soshkina, T. A. Dobroljubova & N. V. Kabakovitsh, Podklass..., p. 333.

Material. — Twenty two mostly strongly damaged specimens, of which 27 peels and 2 thin sections were made.

Description. — Corals slender, subcylindrical, slightly bent. Epitheca, if any present, with a delicate, transverse striation. The largest specimen is 12 mm long and, at its distal end, 4 mm in diameter.

Transverse section. Skeletal elements mostly strongly swollen, but there are also some specimens which have only a poor deposit of stereoplasma. Columella round or oval. Two or three sharp or rounded carinae occurring in zigzag bends are visible on the sides of septa. Minor septa are almost as long and thick as major septa, with which they fuse near columella. A few measurable characters are given in the following table:

Z. Pal. P. Tc No. 3/	Length in mm	n/d	d : c+st	Carinae	Stereoplasma	Columella
2006	0.5	24/3	3/1.4	3, strong	strong	round
2010	4.5	26/3.2	3/1.2	3, poor	strong	round
2016	6.7	20/3	3/1	sharp	poor	longitudinal
20	—	22/2.5	2.5/1	3	strong	round
2031	12.0	24/3.7	3.7/1.3	3, poor	strong	round
2395	—	24/3.8	2.8/1	3, sharp	poor	elongate
2582	—	24/3.2	3.2/1.1	3, sharp	poor	elongate
2768	—	20/2.7	2.7/1.5	round	strong	round

Longitudinal section. Wall thick, consisting of epitheca and septotheca. Conspicuous carinae, especially distinct in tangential section, occur on the sides of septa. Carinae may occur in the form of sharp thorns or rounded knobs. Calyx deep. Columella raised above the bottom. Tabulae thin, convex.

Variability is wide in range, concerns the thickness of skeletal elements and shape of carine. The diameter of corallite and its axial

structure are correlated with each other (Text-fig. 16*b*). Septal index n/d displays a fairly high amplitude of fluctuations. Number of septa increasing allometrically positively (Text-fig. 16*a*).

Remarks. — Due to a similar septal index, the present writer assigns the Famennian specimens from Poland to *Cyathaxonia* (*Cyathocarinia*) *tuberculata* Soshkina, 1928. The specimen, described by Soshkina from the Lower Permian of Central Ural, has 24 septa with a diameter of 4 mm. The Famennian specimens from Poland have a similar septal index, 24—26/4. Soshkina, Dobroljubova & Porfiriev (1941, p. 45) consider *C.* (*C.*) *tuberculata* to be a juvenile form and assign it to *C.* (*C.*) *multituberculata* Soshkina, 1928 although the last-named species has a higher septal index of n/d = 32/3.5.

Occurrence. — Poland: Gałęzice (Besówka), beds 6,2 and 1; Upper Famennian (*velifera-costatus* Zones); Kowala, trench III· Upper Famennian (*costatus* Zone). USSR, Lower Permian.

Family **Laccophyllidae** Grabau, 1928

Subfamilies assigned: Laccophyllinae Grabau, 1928; Guerichiphyllinae n. subfam.; Friedbergiinae n. subfam.

Stratigraphic and geographic range: Devonian-Carboniferous; N. America, Europe, Australia.

Diagnosis. — Solitary corals have a short-lasting (during early ontogeny) stereocolumella, which later is replaced by an axial tube with a phyllotheca or, less frequently, stereotheca. Minor septa inserted cyclically or absent; some forms have lonsdaleoid vesicles; sometimes, there occur major septa unequal in thickness and length.

Remarks. — After the exclusion of plexus *Syringaxon* Lindstroem, 1882 and the genus *Amplexocarinia* Soshkina, 1928 from the family Laccophyllidae, according to Hill (1956), only the genus *Trochophyllum* M. Edw.-H., 1850 would remain in the list of genera given by her (*l.c.*, p. F 258). According to Pickett (1966), the genus *Trochophyllum* M. Edw.-H., is similar to *Cyathaxonia* Michelin, 1847 in its columella which fills an axial tube having a stereothecal wall, but it has no minor septa. The three subfamilies mentioned above and which have ontogeny and structure characteristic of the Laccophyllidae are assigned by the present writer to this family.

Subfamily **Laccophyllinae** Grabau, 1928

Genera assigned: *Neaxon* Kullmann, 1965; *Hillaxon* n.gen.; *Czarnockia* n.gen.; *Crassiphyllum* Grove, 1935.

Stratigraphic and geographic range: Devonian-Carboniferous; N. America, Europe, Australia.

Diagnosis. — Corals laccophyllid in structure. In addition to the forms which have complete and strongly developed minor septa, there are genera having lonsdaleoid vesicles; in some of them minor septa are absent. Microstructure of the wall lamellar, of septa — trabecular.

Remarks. — The genus *Permia* Stuckenberg, 1895 was assigned to this subfamily by some authors (e.g. Grabau, 1928; Hill, 1956; Pickett, 1966). Observing thin section (brought kindly by Prof. R. F. Hecker from Kazań) during his stay in Moscow in 1968, Dr. J. Fedorowski (oral communication) found, however, that this coral has an aulophylloid structure (septa entering the interior of the axial tube, axial tabulae and dissepiments present in it). This phenomenon was also observed by Stuckenberg (1895, Pl. 2, Fig. 6c). Soshkina, Dobroljubova & Kabakovitsh (1962) correctly consider the genus *Permia*(?) Stuckenberg as a junior synonym of the genus *Aulophyllum* M. Edw.-H., 1850. In the present writer's opinion, species assigned so far to the genus *Permia* belong as a matter of fact to *Neaxon* Kullmann, 1965 or to *Syringaxon* Lindstroem, 1882.

Genus *Neaxon* Kullmann, 1965

(Type species: *Neaxon regularis* Kullmann, 1965)

1934. *Laccophyllum* (*Barandeophyllum*); S. Vojnovskij-Krieger, Nižnekamennougolnye..., p. 20.
1944. *Permia*; R. G. S. Hudson, Lower Carboniferous..., p. 359, partim.
1965. *Neaxon*; J. Kullmann, Rugose Korallen..., p. 81.

Species assigned: *Laccophyllum* (*Barrandeophyllum*) *spinosum* Vojnovskij-Krieger. 1934; *Permia caverna* Hudson, 1944; *Neaxon regularis* Kullmann, 1965; *N. tenuiseptatus* n.sp.; *N. bulloides* n.sp.: *N. subcylindricus* n.sp.

Stratigraphic and geographic range: Lower Devonian-Lower Carboniferous of Europe.

Diagnosis. — See Kullmann (1965, p. 81). Microstructure of septa trabecular, with nodules on axial margins; septa sharply wedged in a lamellar-undulated epitheca.

Remarks. — *Neaxon* Kullman, 1965 is strongly similar to *Syringaxon* Lindstroem, 1882. Minor septa in *Syringaxon* occur, however, serially and in *Neaxon*, cyclically and, therefore, they are not homologous which in fact was ascertained by Kullmann (*l.c.*, p. 80). Despite this fact, in addition to genera with a doubtful assignment, Kullmann included in the synonymy also such genera whose minor septa appear serially. On account of the presence of phyllotheca and trabecular carinae on the septa the subgenus *Laccophyllum* (*Barrandeophyllum*) Vojnovskij-Krieger, 1934 is included by the present writer to the synonymy of *Neaxon*. Such knobs abundantly occur in the Famennian specimens, this fact being also mentioned by Kullmann (1965, p. 85). Unfortunately, no

minor septa occur in *L.* (*Barrandeophyllum*) *spinosum* Voynovskij-Krieger. Since minor septa occur in this genus late (in *Neaxon*, as late as the ephebic stage), maybe this specimen is too young to have them. Because of a late appearance and cyclical insertion of minor septa, the species *Permia caverna* Hudson, 1944 is also assigned by the present writer to the genus *Neaxon*. In this species, the stereocolumella is, however, long-lasting. Due to its contratingent minor septa, *Permia cylindrica* Pickett, 1966 belongs to the genus *Syringaxon*. For the same reason, *Permia* sp., described by Sutherland (1958), should be assigned to the genus *Syringaxon*.

Neaxon tenuiseptatus n.sp.

(Text-figs. 17 *A-G*, 18 *F*, 19 *B*; Pl. II, Fig. 11; Pl. VIII, Fig. 10)

Holotype: Specimen Z. Pal. P. Tc No. 3/2428; Text-fig. 17 B.
Type horizon: Upper Famennian, *costatus* Zone.
Type locality: Gałęzice (Besówka), bed 2.
Derivation of the name: Lat. *tenuis* = thin, after thin septa.

Diagnosis. — A widely conical, slightly bent *Neaxon* with a deep calyx and with a talon. The n/d index equalling 19/9.6. Conspicuous carinae. A long-lasting phyllotheca during the ontogeny.

Material. — About 130 mostly damaged specimens. Proximal end and calyx preserved in few, exceptional cases. About 140 peels and 23 thin sections were made.

Description. — Corallites horn-shaped with a rapidly increasing diameter. Calyx deep, with sharp edges. Epitheca smooth, lustrous, with dense growth wrinkles. High reaching talon.

Z. Pal. P. Tc No. 3/	Diameter of corallite	Diameter of axial tube	Number of septa	Height of corallite	Depth of calyx	Number of tabulae per 2 mm of the height	
						axial	periaxial
2132	0.6	0.3	—	—	—	—	—
2153	14.0	—	—	12.5	—	4	—
2179	7.2	—	16	—	—	—	—
2263	12.0	—	—	13.0	—	—	—
2366	12.0	—	—	15.0	12.0	3	5
2428	8.4	3.2	19	—	—	—	—
2448	6.7	2.5	18	—	—	—	—
2470	7.5	2.0	22	—	—	—	—
2462	—	—	—	12 0	—	4	7
2488	—	—	—	12.0	6.0	—	—
2506	5.5	1.8	16	—	—	—	—
2519	7.0	3.0	18	—	—	—	—

Transverse section. Coral round in transverse section, wall thick (to 0.8 mm). Major septa wavy, mostly with distinct, pearl-like nodules on the sides. Axial ends of septa, bent towards the side, form a phyllotheca. Here and there, they are thickened and connected with each other by stereoplasma to form a stereotheca. Cardinal septum, situated in an indistinctly outlined fossula, is slightly thinner and longer than the

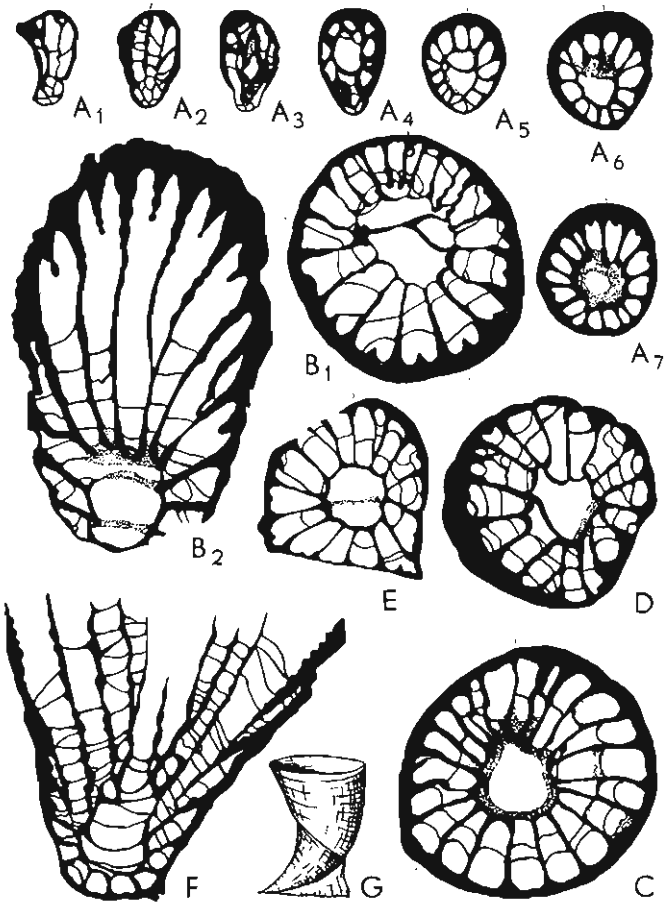

Fig. 17. — *Neaxon tenuiseptatus* n.sp.: A_1-A_6 transverse sections, A_1 earliest neanic stage, protosepta partly fused axially A_2-A_3 early-neanic stage with axial tube, A_4-A_6 late neanic stage, axial tube oval, A_7 ephebic stage round in transverse section and with minor septa (Z. Pal. P. Tc No. 3/2795); B_1 transverse section of a mature individual, axial tube surrounded by phyllotheca and, here and there, by stereotheca, B_2 oblique section, trabecular nodules on septa, horizontal tabulae in tube (No. 3/2428), a holotype; *C* transverse section of a mature individual (No. 3/2470); *D* transverse section of a mature individual (No. 3/2179); *E* transverse section, early-ephebic stage flattened on the side of talon (No. 3/2506); *F* longitudinal-oblique section, nodular septa, axial tabulae concave and thin periaxial-raised (No. 3/2162); *G* diagrammatic drawing of a corallite with talon (No. 3/2839).

A, *G* Kowala II; *B*-*F*, Gałęzice, bed. 2; *A*-*F* × 2.5, *G* nat. size.

adjoining metasepta. Acceleration is observed in the insertion of septa in countercardinal quadrants. Minor septa enter the lumen of corallite as late as in the mature stage (with about 16—20 septa) and are very short. Wall of axial tube is here and there thickened by the deposit of stereoplasma. Numerical data (in mm) are given in the table on p. 59.

Longitudinal section. Axial tube occupies 1/2—1/3 of the diameter. Its wall is raised above the bottom of calyx. Axial tabulae concave, periaxial denser, descending towards the wall.

Variability considerable, observed in more or less swollen skeletal elements and in the structure of tube wall. Septa straight or zigzagging. Trabecular carinae conspicuous or almost invisible.

Ontogeny (Text-fig. 17*A*) was studied in a few specimens. 1) *Early-neanic stage* — proximal end, situated on the margin of talon, is 1.5 mm in diameter, its axial tube 0.4 mm in diameter, number of septa — 6. Separated from talon by a wall. Talon 2.4 mm long. 2) *Mid-neanic stage* — the disappearance of a wall which separates proximal end from talon, talon penetrated by 6 septa. 3) *Late-neanic stage* — 12 septa. Axial tube elongate, occupying axial part of corallite, 0.8 mm in diameter. Shorter diameter of corallite amounts to 2.4 mm. 4) *Final-neanic stage* — corallite diameter amounting to 3 × 4 mm, number of septa 14, their formula may be $\frac{2\,|\,2}{3\,|\,3}+4$. 5) *Early-ephebic stage* — corallite 6.5 mm in diameter, 16 septa, their formula may be $\frac{3\,|\,2}{4\,|\,3}+4$. Minor septa entering the lumen of corallite.

Remarks. — The new species is most similar to *N. regularis* Kullmann from Emsian(?) of Spain in structure and n/d index (18/8 as compared with 18/7 in Famennian corals), but there are the following differences: 1) Famennian corallite is horn-shaped and has a talon; 2) minor septa in *N. tenuiseptatus* n.sp. enter the lumen of tabularium when the diameter amounts to 6.5 mm, whereas those in *N. regularis* enter it even with 5 mm; 3) the new species has generally stronger trabecular carinae. *N. tenuiseptatus* n.sp. differs from *N. bulloides* n.sp. in: 1) an elongate, horn-shaped form; 2) minor septa appear in it somewhat later than in *N. bulloides* n.sp.; 3) phyllotheca persists in *N. tenuiseptatus* n.sp. almost throughout the ontogeny, and in *N.bulloides* n.sp. the stereotheca is predominant; 4) in *N. tenuiseptatus* n.sp. septa are thin, undulated and in *N. bulloides* n.sp. — short, thick and straight. From the related species *N. subcylindricus* n.sp. it differs in a horn-shaped form and a narrow axial tube.

Occurrence. — Poland: Gałęzice (Besówka), beds 1-8, Upper Famennian *costatus-quadrantinodosa* Zones; Kowala, Upper Famennian, *costatus* Zone; Kadzielnia — dump, Lower Famennian, Lower *quadrantinodosa*(?) Zone.

Neaxon subcylindricus n.sp.
(Text-fig. 20 C)

Holotype: Specimen Z. Pal. P. Tc 3/2169; Text-fig. 20 C.
Type horizon: Upper Famennian, *costatus* Zone.
Type locality: Gałęzice (Besówka), bed 2.
Derivation of the name: Lat. *subcylindricus* — after a subcylindrical shape.

Diagnosis. — A *Neaxon* shaped like a bent, subcylindrical cone, with wide axial tube, whose diameter is more than a half of the diameter of the corallite. Wide, axial tabularium. Septa equal in length; continuous phyllotheca. With a diameter of 5 × 8 mm, there are 16 septa.

Material. — Four, incomplete specimens, of which 4 peels and a thin section were made.

Transverse section. In a section somewhat oblique the coral is oval. Septal index n/d = 16/5×8. Wall thick; septa uniform in length (maybe, the specimen examined was not yet mature). No minor septa visible in wall. Septa short, thick and straight. Lumen of axial tube wide, the ratio of its diameter to the diameter of the corallite amounts to 3:5.

Longitudinal section. Corallite at first horn-shaped, proximal end passing higher up into a subcylindrical. Wall of corallite thick (0.4 mm), that of tube thin (0.2 mm). Axial tabulae complete, subparallel, horizontal, 2—3 of them over a stretch of 2 mm; periaxial tabulae thin, threadlike, widely spaced, descending towards the wall. Axial tube uniform in thickness over a stretch of 6 mm, keeping a diameter of 4.4 mm.

Remarks. — The species described above differs from other representatives of this genus in its subcylindrical shape and a wide axial tube. Both *N. tenuiseptatus* n.sp. and *N. bulloides* n.sp. are strongly horn-shaped, their axial tubes having, in a longitudinal section, a shape of a suddenly extending cone.

Occurrence. — Poland: Gałęzice (Besówka), bed 2; Upper Famennian, *costatus* Zone.

Neaxon bulloides n.sp.
(Text-fig. 18 *A-E*, G; Pl. II, Fig. 12; Pl. VII, Fig. 3)

Holotype: Specimen Z. Pal. P. Tc No. 3/2010; Text-fig. 18 *E*.
Type horizon: Upper Famennian, *costatus* Zone.
Type locality: Gałęzice (Besówka), bed 1.
Derivation of the name: Lat. *bulla* = bubble, after nearly spherical shape of the coral.

Diagnosis. — A spherical *Neaxon*, with a diameter of 5 mm, has 14—16×2 septa, which are almost straight, thick, carinate.

Material. — Fourteen corallites, some of them separated from the rock. Seven peels of transverse and longitudinal sections.

Description. — Corallites small, subspherical, 11 mm long, with proximal end preserved, with a diameter of 10—15 mm at the distal end. In the holotype, proximal end and margin of calyx are situated almost in the same plane. Epitheca smooth, lustrous, with fine, dense growth wrinkles. Cardinal septum on the convex side. Below are numerical data of a few corallites:

Z.Pal.P. Tc No. 3/	Length of specimen (in mm)	Longest diameter (in mm)	Shape of corallite
2345	11	12	spherical
2442	17	15	spherical
2609	12	10	spherical
2790	10	9	bent
2798	10	10	conical
2755	18	21	spherical

Transverse section round. Minor septa appear when the corallite is 5 mm in diameter and has 14 major septa. These are short slats occurring on the internal surface of the wall. Peripheral ends of septa are spindlelike and pressed in epitheca. Septa carinate over their entire length, particularly in peripheral part. Their axial ends are either bent to the adjoining septa and form a phyllotheca or, more frequently, are swollen and forming a thick stereotheca. Septa are thick and fairly straight. Cardinal septum, somewhat predominant over the adjoining septa, may be situated in a fossula. Lumen of axial tube narrow and, in addition, contracted by a thick deposit of sclerenchyma. Sections of periaxial tabulae are visible. Numerical data (in mm) of a few corallites are given below:

Z.Pal.P. Tc No. 3/	Lumen of tube	Diameter of corallite	Number of septa	Thickness of:	
				outer wall	wall of tube
2010	1.7	5.0	16×2	0.3	0.4
2345	0.2	4.5	15	0.8	0.8
2609	0.5	3.9	12	0.2	0.2
2758	0.7	5.0	16×2	0.7	0.6
2767	—	4.5	16×2	0.5	0.4

Longitudinal section. In transverse oblique section, axial tabulae are widely spaced and periaxial thin and dense.

Ontogeny (Text-fig. 18 *A-D*). — 1) *Early-neanic stage.* In a section slightly oblique, corallite 0.8 mm in diameter, about 5 septa discernible, tube lumen wide. 2) *Mid-neanic stage.* Diameter — 2 mm; 11 septa, including 6 proto- and 5 metasepta. Septal formula: $\frac{2\,|\,2}{1\,|\,0}+6$. Metasepta,

first appear in cardinal quadrants, later on one of them appears between the alar and counter lateral septum (the other metaseptum is somewhat delayed). Tube lumen wide. 3) *Late-neanic stage*. Diameter — 2.3 mm, number of septa — 11. 4) *Early-ephebic stage*. Diameter — 5 mm, number of septa — 15. Septal formula $\frac{3|2}{2|2}+6$. Tube lumen very narrow.

Variability not very large, limited mostly to the shape which may be completely hemispherical or conical. Slightly variable is also the thickness of skeletal elements. Number of major septa is correlated with the diameter of the corallite and probably does not exceed 18.

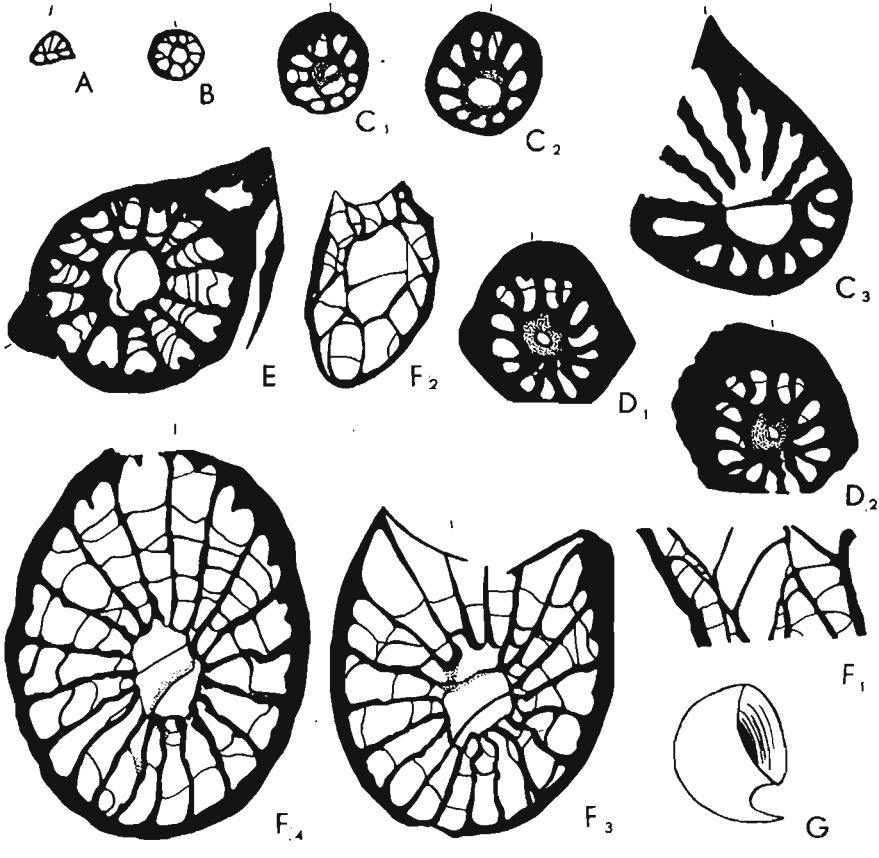

Fig. 18. — *A-E,G Neaxon bulloides* n.sp.: *A-B* a series of transverse sections; *A* earliest neanic stage, *B* early neanic stage, axial tube present (Z. Pal. P. Tc No. 3/2798); C_1-C_2 transverse sections of a coral, neanic stage, C_3 slightly transverse section, ephebic stage, major septa with trabecular nodules,minor septa present (No. 3/2491); D_1-D_2 successive neanic stages with cardinal septum in fossula (No. 3/2345); *E* transverse section of a mature coral with minor septa (No. 3/2010), a holotype, *G* diagrammatic drawing of a corallite (No. 3/2345). *F Neaxon tenuiseptatus* n.sp.: F_1 longitudinal-oblique section, F_2 transverse, slightly oblique section, thin skeletal elements, axial tube surrounded by phyllotheca (No. 3/2188), F_3-F_4 serial transverse sections of a mature individual (No. 3/2188a).

A-B Kowala II, *C-D*, *F-G* Gałęzice, bed 2, *E* Gałęzice, bed 1; *A-F* × 3.4, *G* × 1.4

Remarks. — Similarities and differences in relation to other species have been given with the description of *N. tenuiseptatus* n.sp. (p. 61). The corallite illustrated by Różkowska (1967, Pl. 1, Fig. 2 A, B) belongs to the species described above.

Occurrence. — Poland: Gałęzice (Besówka), beds 5 and 3—1, Upper Famennian, *velifera-costatus* Zones; Kowala, trenches V and I, Upper Famennian, *costatus* Zone.

Genus *Hillaxon* n.gen.

(Type species, by monotypy: *Hillaxon vesiculosus* n.sp.)

Derivation of the name: named in honour of Professor Dorothy Hill, Sidney Australia.

Stratigraphic and geographic range: Upper Famennian of the Holy Cross Mountains.

Diagnosis. — Corals horn-shaped. Tabulae flat, incomplete, vesiculate; periaxial tabulae disposed obliquely, descending towards epitheca. Dissepiments normal and lonsdaleoid. Septa short, incomplete. Axial tube not continuous, in young stages surrounded by phyllotheca. Microstructure of wall lamellar, of septa — trabecular.

Remarks. — The remains of corals of this genus are frequent in the organodetritic limestone at Gałęzice. They display a fairly wide range of variability. A horn-shaped form, not continuous axial tube, which in young stages is surrounded by phyllotheca and a vesicular internal structure, make *Hillaxon* n.gen. similar to *Czarnockia* n.gen. from which it differs, however, in a nearly horizontal arrangement of tabulae, very wide, horizontal calyx and in particular, in the occurrence of normal and lonsdaleoid dissepiments.

Hillaxon vesiculosus n.sp.

(Text-fig. 19A, *C-H*; Pl. II, Fig. 13)

Holotype: Specimen Z. Pal. P. Tc No. 3/2566; Text-fig. 19A.

Type horizon: Upper Famennian, *costatus* Zone.

Type locality: Gałęzice (Besówka), bed 2.

Derivation of the name: *vesiculosus*, Lat. *vesicula* = vesicle, after a vesicular structure of tabularium and dissepimentarium.

Diagnosis. — Identical with that of the genus.

Material. — Seventeen fragmentary specimens and a few corals which are included in limestone in the longitudinal section. Many fragments of the edges of calyx with a lonsdaleoid dissepimentarium. Thirty two peels and two microscopic slides were made.

Description. — Corallites low, widely conical, slightly bent, 12 mm

long and 15 mm in the longest, although not full, diameter. Wide, flat interseptal ridges, separated by furrows and delicate, dense growth wrinkles are visible on the surface.

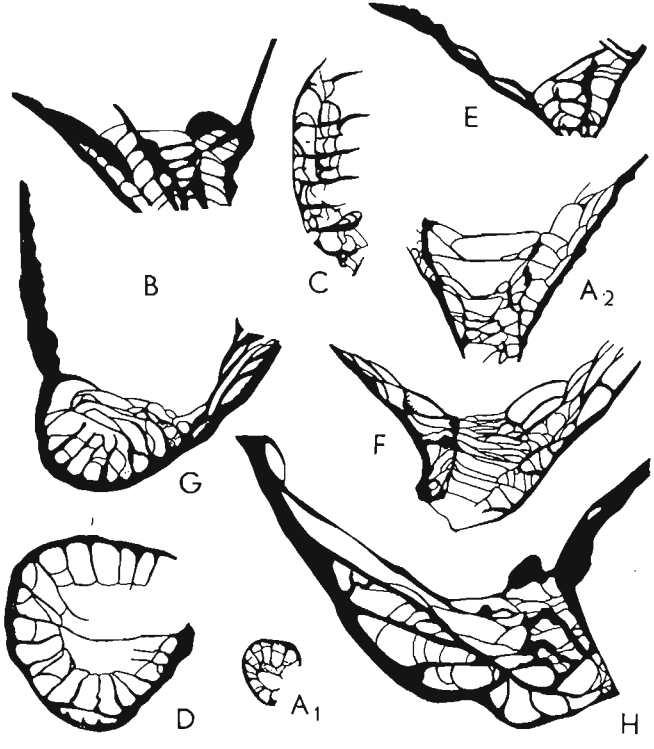

Fig. 19. — *A Hillaxon vesiculosus* n.gen., n.sp. A_1 transverse section of a coral, neanic stage, axial tube surrounded by phyllotheca, A_2 longitudinal section, discontinuous wall of axial tube and dissepiments (Z. Pal. P. Tc No. 3/2566), holotype.

B Neaxon tenuiseptatus n.sp., longitudinal-axial section of a corallite, axial tube raised over the bottom of calyx, horizontal, axial tabulae and oblique periaxial tabulae (No. 3/2153.

C-H Hillaxon vesiculosus n.gen., n.sp.: *C* transverse section of the edge of calyx with normal and lonsdaleoid dissepiments (No. 3/2556); *D* transverse section of an ephebic stage with a lonsdaleoid vesicle and a few minor septa (No. 3/2297); *E* longitudinal section of a corallite with a wide and oblique calyx having lonsdaleoid vesicles; horizontal tabulae in a discontinuous axial tube, close to them periaxial tabulae (No. 3/2129); *F* longitudinal section, axial tabulae complete, flat or vesicular, gathered in systems, periaxial tabulae oblique, higher up normal and lonsdaleoid dissepiments, calyx wide (No. 3/2552); *G* longitudinal section (No. 3/2565); *H* longitudinal section, calyx very wide, tabulae vesicular, few lonsdaleoid vesicles (No. 3/2599).

Gałęzice, bed 2. All × 1.5

Transverse section. Epitheca thick, septa short, thin, forming phyllotheca or, here and there, cyatotheca. With a diameter of 10 mm, there are about 20 major septa. Normal and lonsdaleoid dissepiments, as well

as peripheral ends of major and minor septa which are discontinuous (Text-fig. 19) occur on the edge of calyx.

Longitudinal section. Calyx widely open. Tabularium low; axial tabulae dense, flat or vesicular; periaxial tabulae thin, convex or flat, descending obliquely. Along the walls, there occur dissepiments which are particularly characteristic above the bottom of calyx. Wall thick.

Ontogeny (Text-fig. 19 A_1). — The diameter of the section of the corallite, in the youngest neanic stage found, amounts to 3×4 mm. The number of septa amounts to 14. Cardinal septum is situated in a wide fossula. Axial ends of septa, inflected towards each other, form a phyllotheca.

Remarks. — Fragments of corallites, and in particular those of the edges of calyx, are frequent in organodetritic limestone. Their assignment to *H. vesiculosus* n.sp. is confirmed by both the microstructure (a lamellar-wavy wall and peripheral spindlelike ends of trabecular septa mounted in it) and a lonsdaleoid structure of the dissepiments.

Occurrence. — Poland: Gałęzice (Besówka), beds 5,2 and 1, *velifera* and *costatus* Zones; Kowala, trench III, *costatus* Zone; Jabłonna, bed 31, *costatus* Zone.

Genus *Czarnockia* n.gen.

(Type species: *Czarnockia obliqua* n.sp.)

Derivation of the name: Named in honour of the late Professor Jan Czarnocki, Warsaw, Poland.

Species assigned: *Czarnockia obliqua* n.sp. and *Cz. simplex* n.sp.

Stratigraphic and geographic range: Upper Famennian of the Holy Cross Mountains.

Diagnosis. — Corallites bent, horn-shaped, with a vertically disposed, wide calyx. Major septa complete, long, here and there forming a phyllotheca or freely terminate on the tabulae. Minor septa appear in the ephebic stage in the form of short slats. Axial tabulae vesicular, vertically disposed, periaxial — horizontal. Microstructure of wall lamellar, of septa — trabecular.

Remarks. — *Czarnockia* n.gen., having a phyllotheca and trabecular septa, belongs — together with *Neaxon* Kullmann, 1965 and *Hillaxon* n.gen. — to the same group of genera. A late and cyclical appearance of minor septa is also their common character. *Czarnockia* n.gen. differs, however, from *Hillaxon* n.gen. in its complete septa and lack of lonsdaleoid dissepiments. In addition, its tabularium and calyx are vertically disposed. From *Neaxon*, it differs in a vertical calyx and tabularium and in presence of the wide, discontinuous axial tube.

Czarnockia obliqua n.sp.
(Text-fig. 20B; Pl. VII, Fig. 14)

Holotype: Specimen I. G. No. 163d, II, 62, from the collections of the Geological Institute in Warsaw (Text-fig. 20*B*).

Type horizon: *Wocklumeria* beds (according to a label, prepared by J. Czarnocki).

Type locality: Kowala near Kielce.

Derivation of the name: Lat. *obliquus* = oblique, on account of a very oblique position of calyx.

Diagnosis. — *Czarnockia* with a bilateral symmetry, shaped like a strongly bent cone with a very wide calyx and septal index = 26×2/14. Axial tabulae vesicular, vertical, periaxial, developed on one (convex) side only, vesicular and horizontal.

Material. — Four rather poorly preserved specimens. Two well-preserved with its proximal end in the neanic stage and with calyx. The rests are only edges of calyxes or periaxial tabularia. Eleven peels were made.

Description. — Coral horn-shaped, 30 mm long· 18 mm in longest diameter. Calyx 22 mm deep on the concave side. Fine growth wrinkles are visible on the surface. On the convex side the edge of calyx raised high and, on the concave side, descends as low.

Transverse section. Section was made 9 mm above the proximal end on the concave side of the coral. In this place, 26 septa of two different length occur with a diameter of 14 mm. Major septa are long on the convex side. In some places, major septa are connected together to form a phyllotheca and in some others, a cyatotheca of a rather narrow axial tube. Minor septa, appearing late and cyclically, occur in the form of narrow slats on the convex side, whereas they are not yet visible on the concave side.

Longitudinal section. Periaxial tabulae horizontal, vesicular, forming a wide zone on the convex side and hardly visible on the concave side. On the boundary between the axial and periaxial tabularium, they have a thick deposit of stereoplasma. Axial tabulae vertical, vesicular, varying in size with globular accessory plates.

Ontogeny. — Two polished sections of young, early-neanic development stages were examined. With a diameter of 2.3 mm, about 6 protosepta bent around the axis and forming a phyllotheca, are discernible in the holotype. In another specimen (No. Tc-3/2605), 14 septa, arranged according to the formula $\frac{2\,|\,2}{2\,|\,2}+6$ are discernible on a thin section 4.3 mm in diameter. In this specimen, there are already two metasepta each in the cardinal and countercardinal quadrants. Axial tube 1.3 mm in lumen is surrounded by phyllotheca.

Remarks. — The species described above differs from *Czarnockia simplex* n.sp. in larger dimensions, a more complex internal structure

and a thick deposit of sclerenchyma on the boundary between axial and pariaxial tabulae.

Occurrence. — Poland: Gałęzice (Besówka), beds 2 and 1; Kowala, trench III; *Wocklumeria* beds, Upper Famennian, *costatus* Zone.

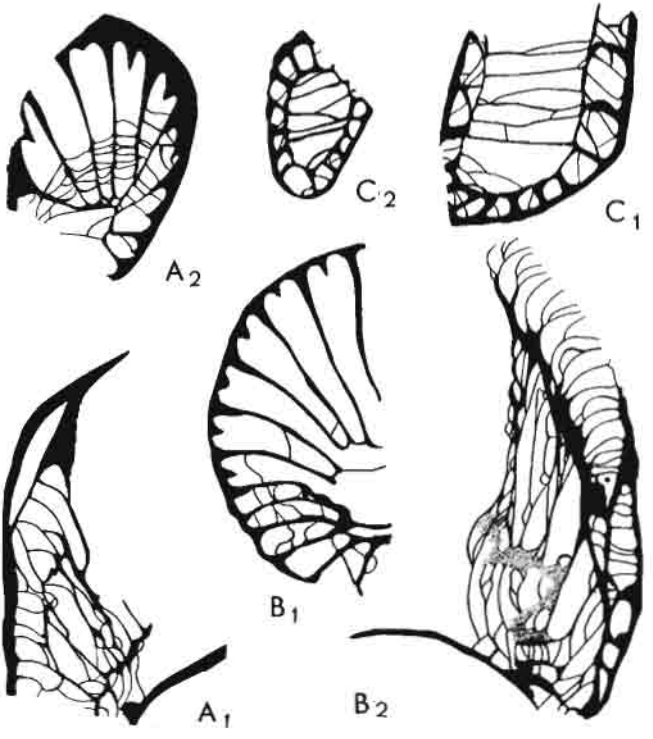

Fig. 20. — *A Czarnockia simplex* n.gen., n.sp.: A_1 longitudinal section with a discontinuous axial tube, vesicular, strongly oblique tabulae, A_2 transverse-oblique section with complete major and minor septa and phyllotheca (Gałęzice, bed 2; Z.Pal.P. Tc No. 3/2176), holotype.

B Czarnockia obliqua n.gen., n.sp.: B_1 transverse, slightly oblique section of a half of corallite, complete major and minor septa, a discontinuous phyllotheca around axial tube, B_2 longitudinal section with a wide, vertical axial tubularium, with a thick internal wall separating periaxial tabularium, having horizontally arranged, vesicular tabulae, from axial tabularium (Kowala; I. G. No. 163d, II, 62), holotype.

C Neaxon subcylindricus n.sp.: C_1 longitudinal section with a wide axial tube, C_2 transverse oblique section with phyllotheca around the tube (Gałęzice, bed 2; Z.Pal.P. Tc No. 3/2169).

All × 2

Czarnockia simplex n.sp.

(Text-fig. 20*A*)

Holotype: Specimen Z.Pal.P.Tc No. 3/2176; Text-fig. 20*A*.

Type horizon: Upper Famennian, *costatus* Zone.

Type locality: Gałęzice (Besówka), bed 2.

Derivation of the name: Lat. *simplex* = simple, after a simple internal morphology.

Diagnosis. — Axial tube discontinuous; axial tabulae irregular, steeply arranged; periaxial widely spaced, horizontal; major septa long, minor — very short.

Material. — Three very poorly preserved specimens. Three peels.

Description. — Corallites horn-shaped, 25 mm long, proximal end not preserved. Calyx vertical, its bottom flat and wide, edges sharp.

Transverse section. A thick wall is visible in a fragmentary section. Major septa long, their axial ends bent to each other. Minor septa in the form of short, sharp slats. Numerous sections of thin tabulae.

Longitudinal section. Tabularium vertical, particularly in the distal part of corallite; periaxial tabulae horizontal. Walls thick, axial tube discontinuous.

Remarks. — This species differs from *C. obliqua* n.sp. in smaller dimensions, less complex structure, by the lack of thick coating of stereoplasma on the inner row of periaxial tabulae.

Occurrence. — Poland: Gałęzice (Besówka), bed 2; Kowala, trench II, Upper Famennian, *costatus* Zone.

Subfamily **Guerichiphyllinae** n.subfam.

Genera assigned: *Blothrophyllum* Billings, 1859, in Gürich, 1896; *Guerichiphyllum* n.gen.

The subfamily is named after the typical genus.

Stratigraphic and geographic range: Middle Devonian-Famennian of Poland.

Diagnosis. — See Fedorowski (1965, p. 345). The present author adds to his diagnosis that the microstructure of the wall is lamellar-wavy and that of septa — lamellar.

Remarks. — The present author erected a new subfamily, Guerichiphyllinae. Due to a similar ontogeny during which a stereocolumella occurs in early stages and is replaced later by a phyllotheca surrounding the axial tube and persisting, if only partly, up to the ephebic stage inclusively, this group is assigned to the family Laccophyllidae Grabau. A Givetian species *Blothrophyllum skalense* Gürich was assigned by Fedorowski (1965) to the subfamily Blothrophyllinae Stumm, 1949. The ontogeny of the latter subfamily is unknown, whereas that described by Fedorowski (1965, pp. 347—348) is in principle identical with the ontogeny, traced by the present author in *G. kowalense* n.sp. The Givetian corals, described as *Blothrophyllum* Gürich non Billings, belong, therefore, also to the subfamily Guerichiphyllinae n.subfam.

Genus *Guerichiphyllum* n.gen.

(Type species: *Guerichiphyllum skalense* (Gürich, 1896))

1896. *Blothrophyllum*; G. Gürich, Das Palaeozoicum..., p. 173.
1965. *Blothrophyllum*; J. Fedorowski, Lindstroemiidae..., p. 346 (*cum synonymy*).

Derivation of the name: named after Georg Gürich, who greatly contributed to the knowledge of the palaeontology of the Holy Cross Mountains.

Species assigned: *Blothrophyllum skalense* (Gürich, 1896); *B. skalense vesiculatum* Fedorowski, 1965; *Guerichiphyllum kowalense* n.sp.; *G. parvum* n.sp.; *G. concavum* n.sp.

Stratigraphic and geographic range: Middle Devonian-Famennian of Poland.

Diagnosis. — As in the subfamily Guerichiphyllinae n.subfam.

Remarks. — Pedder (1967, p. 113) believes that a certain similarity exists between *Blothrophyllum* Billings and *Blothrophyllum* sensu Gürich, but that it is caused by the phenomenon of homeomorphy rather than by the relationship.

Guerichiphyllum kowalense n.sp.

(Text-fig. 21)

Holotype: Specimen I.G. No. 163h, II, 62; Text-fig. 21.

Type horizon: Upper Famennian, *Wocklumeria* beds (according to J. Czarnocki).

Type locality: Kowala near Kielce.

Derivation of the name: *kowalense* — after the village of Kowala where the holotype was found.

Diagnosis. — *Guerichiphyllum* with a septal index n/d = 22/15. Septa short and, during the ontogeny, thickened particularly on the counter-septum side. Minor septa reduced to slats. Cardinal septum, shortened during the ontogeny to a small fragment, is situated in cardinal and tabular fossula. Lonsdaleoid vesicles and dissepiments widely spaced, vertically disposed.

Material. — One well-preserved specimen, of which 16 peels were made, and one fragmentary specimen.

Description. — A solitary coral conical, slightly bent, several times contracted (as a result of rejuvenescence), 24.3 mm long, 16 mm in diameter at the distal end and attached with a widened proximal end. In addition to fine growth wrinkles, strong, transverse annulations are visible on the surface. Calyx not preserved.

Transverse section. In the ephebic stage, with a diameter of 15 mm, the number of septa amounts to 22. They are short, thin, in some places thickened and interrupted by wide lonsdaleoid vesicles. Minor septa occur, in the form of slats, in the septotheca. Wall undulated. Probably, due to local destructions of wall, the very short cardinal septum is invisible.

Longitudinal section. Tabulae wide, axially flat, trapezoid. Additional plates are visible on the bend. Marginal vesicles and dissepiments in 1-2 rows vertical.

Ontogeny (Text-fig. 21 *a-h*). — Development slow with ephebic stage realized 10 mm above the base. 1) *Nepionic stage.* Structure obscured by an amorphous stereoplasma. 2) In the *next stage* (on a damaged corallite), only bent axial ends of septa, forming phyllotheca, are visible.

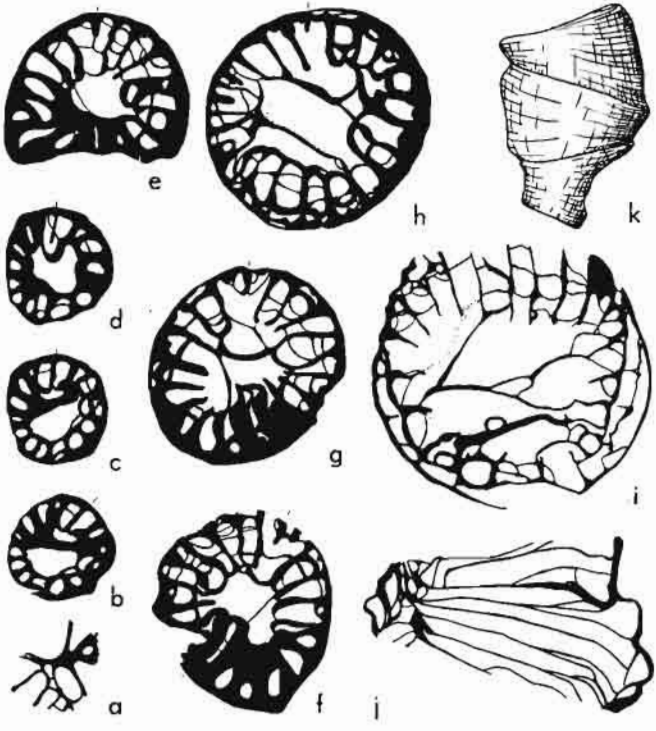

Fig. 21. — *Guerichiphyllum kowalense* n.gen., n.sp.: *a-d* serial transverse sections, neanic stage, with complete major septa (minor septa lacking) and a thin cardinal septum situated in fossula; *e-h* transverse sections, ephebic stage with short cardinal septum, lonsdaleoid vesicles and minor septa; *i* transverse section of a late ephebic stage with large lonsdaleoid vesicles; *j* longitudinal section with trapezoidal tabulae and vertical vesicles; *k* a diagrammatic drawing of a shape of coral (Kowala, *Wocklumeria* zone; I. G. No. 163h, II, 62), holotype.
a-j × 1.5, *k* nat. size

3) With a diameter of 6 mm, 16 septa make up a phyllotheca. Septa of countercardinal quadrants short, all parts of corallite thickened. Cardinal septum, as long as adjoining metasepta, situated in a wide cardinal fossula and tabular fossula. 4) All skeletal elements continue to be thick except for a thin cardinal septum. Septal and tabular fossulae distinct. With a diameter of 6.7 mm, there are 16 septa. 5) Diameter — 8 mm, 16 septa. Cardinal quadrants more progressive, partly free of stereo-

plasma. Cardinal septum short. 6) Diameter — 11 mm, 21 septa. Cardinal septum yet more shortened. Phyllotheca still present. Septa of countercardinal quadrants short. 7) Diameter — 11 mm, 21 septa. Further reduction of stereoplasma and shortening of cardinal septum. The first lonsdaleoid vesicles appearing. Knobs of minor septa visible. 8) Diameter— 12 mm, 22 septa. Phyllotheca still present in countercardinal quadrants. Cardinal septum in the form of a short slat. Lonsdaleoid vesicles. Minor septa.

Remarks. — Since in the nepionic stage, there is probably a stereocolumella and, later on, axial tube, the morphogenesis is on the whole similar to that of Givetian *G. skalense* (Gürich) described by Fedorowski (1965). In the specimens described by Fedorowski, during the early ontogeny, the phyllotheca occurs for a very short time, and then is replaced by the stereotheca, whereas in the Famennian specimens, the phyllotheca persists almost over the entire morphogenesis. The bend of axial ends of septa, inflected to each other, is visible in some places even in the ephebic stage. *G. kowalense* n.sp. differs from *G. skalense* (Gürich) and its variety, *G. skalense vesiculosum* (Fedorowski) in the following characters: 1) in the Famennian specimen, minor septa are considerably atrophied and in the Givetian specimens — still conspicuous; 2) the deposit of stereoplasma in Givetian specimens is predominant in cardinal quadrants and in the Famennian specimen — in countercardinal quadrants.

Occurrence. — Poland: Kowala, *Wocklumeria* beds, Upper Famennian; Kielce (Kadzielnia quarry), exposure II, bed K, Lower Famennian, *quadrantinodosa Zone.*

Guerichiphyllum parvum n.sp.
(Text-fig. 22 *A-C*; Pl. III, Fig. 1)

Holotype: Specimen Z.Pal.P.Tc No. 3/832; Text-fig. 22 *B*.
Type horizon: Lower Famennian, *quadrantinodosa* Zone.
Type locality: Kielce (Kadzielnia quarry), exposure II, bed D.
Derivation of the name: Lat. *parvus* = small, after small dimensions of the corallites.

Diagnosis. — *Guerichiphyllum* with a septal index of 16/5. Minor septa not entering the lumen. Lonsdaleoid vesicles widely spaced. Axial ends of septa slightly thickened.

Material. — Sixteen fragments of specimens, without calyx and mostly without proximal end. Fifty two peels of longitudinal and transverse sections were made.

Description. — Corallites small, bent at an obtuse angle, with a smooth epitheca and wide talon. The holotype, damaged at its distal end, is 7 mm long, 7 mm in longest diameter. Talon 5 mm in longer diameter.

Transverse section. Specimens oval in transverse section. Major septa long but not reaching axis. Their axial ends are bent towards each other form a discontinuous phyllotheca, and are somewhat thickened. Cardinal septum, slightly shortened, is situated in a wide, open fossula. Minor septa strongly reduced, embedded in the wall.

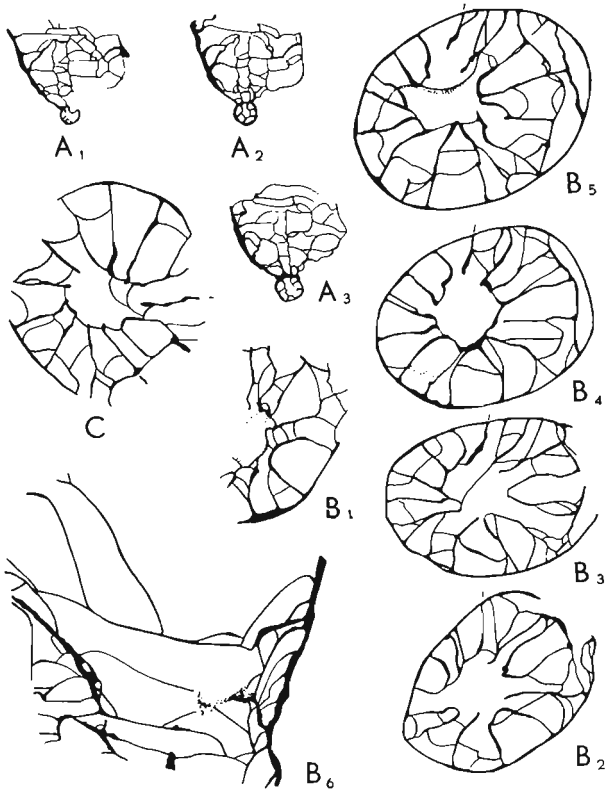

Fig. 22. — *Guerichiphyllum parvum* n.gen., n.sp.: A_1-A_3 successive transverse sections, early-neanic stage, protosepta fused by pairs to form a phyllotheca, talon wide (Kadzielnia II, bed K; Z. Pal. P. Tc No. 3/1084), × 1.5; B_1-B_5 successive transverse sections, ephebic stage, cardinal septum gradually shortening, fossula present, phyllotheca discontinuous, B_6 longitudinal section, tabulae trapezoidal, vesicles lonsdaleoid (Kadzielnia II, bed D; No. 3/832), holotype, × 3; *C* transverse section of a mature individual (Kadzielnia II, bed K; No. 3/957), × 3.

Longitudinal section. Section far from complete, but diagnostic characters visible. Axial tabulae flat, on the margins mildly bent downwards, with accessory plates. Periaxial tabulae vesicular. Marginal vesicles and dissepiments widely spaced, vertical.

Variability range very wide, expressed in different lengths of septa, more or less continuous phyllotheca, length of cardinal septum, as well as size and number of lonsdaleoid vesicles.

Ontogeny (Text-fig. 22*A*, B_1-B_5). — *Nepionic stage* not preserved. In the early-neanic stage talon wide, large. Close to it, the proximal end of corallite 0.9 mm in diameter, round in cross section, surrounded by a thick wall. Six protosepta, connected in pairs, form a discontinuous phyllotheca. The next continually *early-neanic stage* has already 8 septa which form a discontinuous aulos. Proximal end is continually separated from talon by a thick wall. In a series of successive cross sections of the *ephebic stage*, the following changes may be observed: 1) marginal vesicles appear gradually and increase their size; 2) cardinal septum, situated in a wider and wider fossula, gradually shortens.

Remarks. — *G. parvum* n.sp. differs from *G. kowalense* n.sp. in the following characters: major septa are thin, bent and slightly longer; minor septa yet more atrophied, all skeletal elements poorly developed, bent, thin.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure II, beds N, L, K and D and a dump; exposure III, beds 41 and 26, Lower Famennian, *quadrantinodosa* Zone.

Guerichiphyllum concavum n.sp.
(Text-figs. 23 *A-D*, 24 *A*, *C*, *D*; Pl. VIII, Figs. 8, 11)

Holotype: Specimen Z.Pal.P. Tc No. 3/1392; Text-fig. 23 *A*.
Type horizon: Lower Famennian, *quadrantinodosa* Zone.
Type locality: Kielce (Kadzielnia quarry), exposure II, bed K.
Derivation of the name: Lat. *concavum* = concave, after concave tabulae.

Diagnosis. — A subcylindrical or horn-shaped *Guerichiphyllum*, with septal index of 18/10 and almost completely reduced minor septa. Lonsdaleoid vesicles strong, in some cases less strongly developed. Axial tabulae somewhat concave, periaxial tabulae and lonsdaleoid dissepiments vertical.

Material. — Twenty one corals, mostly without proximal ends and with a damaged calyx. Thirty three peels and 2 thin sections were made.

Description. — Corallites solitary, subcylindrical, mostly wide, horn-shaped, irregularly bent, displaying rejuvenescence. Elongate interseptal ridges visible through a horizontally striated epitheca. Talon small, proximal end slightly deflected. Calyx bell-like, with a sharp edge and plano-convex bottom.

Transverse section. Epitheca thin, with lonsdaleoid vesicles, different in size and occurring in one or, here and there, in three verticils. Septal indices: 20/10, 18/9.6 and 18/10. There are septa of only one length which in some places are set on the wall, in some others are separated from it or form only short crests on the internal ring of lonsdaleoid vesicles. Minor septa are almost completely reduced. Axial ends of septa may be

slightly thickened, inclined to each other and here and there forming a phyllotheca. Cardinal septum does not distinguish itself in length.

Longitudinal section. Bottom of calyx flat and wide or narrow because of tabulae which may be either flat or concave. Lonsdaleoid vesicles and dissepiments arranged in 1-3 vertical rows. Accessory plates occur on tabulae.

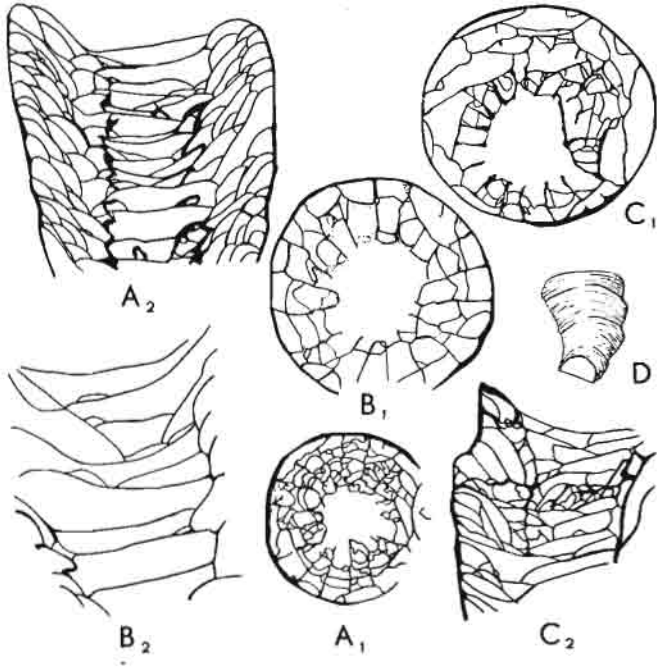

Fig. 23. — *Guerichiphyllum concavum* n.sp.: A_1 transverse section with many lonsdaleoid vesicles, crowded sections of dissepiments and traces of minor septa, A_2 longitudinal section with a wide dissepimentarium and narrow tabularium (Kadzielnia I, bed 1; Z. Pal. P. Tc No. 3/1392), holotype, × 1.5; B_1 transverse section, B_2 longitudinal section (Kadzielnia I, bed 3; No. 3/640), × 1.5; C_1 transverse section with a wide verticil of lonsdaleoid vesicles, C_2 longitudinal section with an irregularly arranged tabularium (Kadzielnia G; No. 3/220), × 1.5.

Variability range very wide. The shape of corals and all skeletal elements are variable. Specimens may be either slender, subcylindrical or short, wide, irregularly bent. The number and size of lonsdaleoid vesicles, length of septa and spacing of axial and periaxial tabulae are also variable. Some tabularia are markedly concave, some others similar to those in *Guerichiphyllum parvum* n.sp.

Ontogeny (Text-fig. 24 A_1-A_4). — 1) *Early-neanic stage.* Diameter — 2 mm, 8 septa; a small, damaged aulos. 2) *Mid-neanic stage.* Diameter — 4 mm, 12 septa, discontinuous aulos and incipient talon. 3) *Ephebic stage* — as in the description of the transverse section (p. 75).

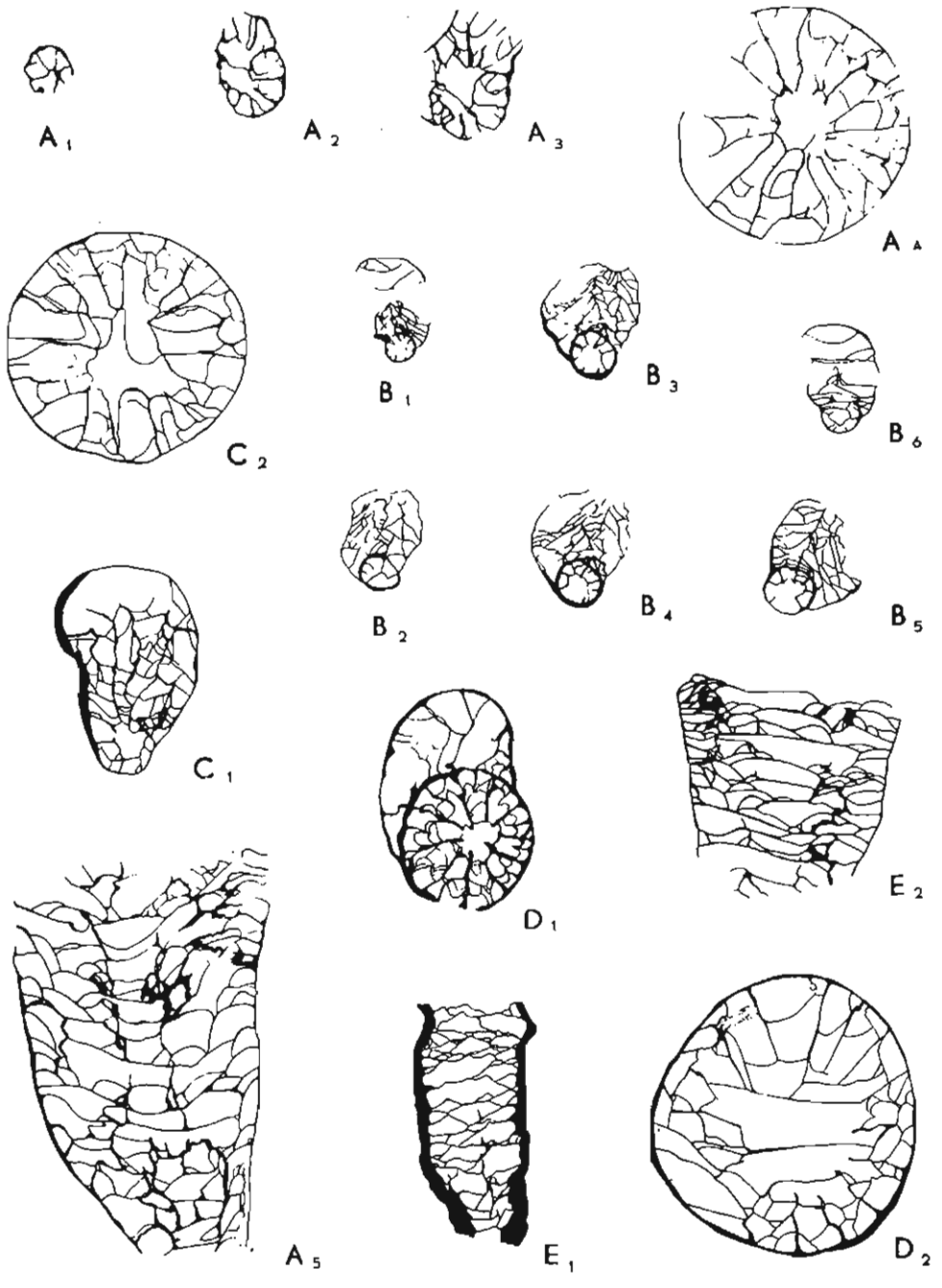

Fig. 24. — *A*, *C-D Guerichiphyllum concavum* n.gen., n.sp.: A_1-A_4 a series of successive ontogenetic stages, A_1 early neanic stage, A_2-A_3 neanic stage with a talon, A_4 ephebic stage, A_5 longitudinal section (Z. Pal. P. Tc No. 3/1392), holotype, × 3; C_1 transverse section, late neanic stage, C_2 transverse section, ephebic stage (No. 3/1381), × 3; D_1 transverse section of a talon overgrowing *Kozlowskinia flos* n.sp., D_2 transverse section, ephebic stage (No. 3/1496), × 3.

B Gorizdronia profunda tenuis n.gen., n.subsp.: B_1-B_6 a series of successive ontogenetic stages (No. 3/1786), × 2.

E Kielcephyllum sp.: E_1 longitudinal-tangential section, E_2 longitudinal section, (No. 3/1496), × 3.

A, *C-E* Kadzielnia II, bed K; *B* Kadzielnia III, bed 43

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposures G; I, beds 3-1; II, beds M, L and K; III, beds 48, 46 and 43; dump: Lower Famennian, *quadrantinodosa* Zone.

Subfamily **Friedbergiinae** n.subfam.

Derivation of the name: after the genus *Friedbergia* n.gen.
Genera assigned: one genus only, *Friedbergia* n.gen.
Stratigraphic and geographic range: Upper Famennian of the Holy Cross Mountains.

Diagnosis. — The same as that of the unique genus.

Remarks. — Due to the presence of axial tube which, in the neanic stage, is surrounded by phylotheca, the genus described is assigned by the present writer to the family Laccophyllidae. The introduction of the new subfamily is justified by its characteristic morphogenesis.

Genus *Friedbergia* n.gen.
(Type species, by monotypy: *Friedbergia bipartita* n.sp.)

Derivation of the name: in honour of the late Professor Wilhelm Friedberg, Poznań, Poland.
Species assigned: one species only, *F. bipartita* n.sp.
Stratigraphic and geographic range: Upper Famennian, Kowala near Kielce.

Diagnosis. — Solitary corallites which, in their youth, have thick septa in cardinal quadrants and thin, bent around the axis and forming aulos — in countercardinal quadrants. Countercardinal quadrants are separated from cardinal quadrants by a partition formed by thick alar septa. Cardinal septum short, thick, situated in an open fossula, countercardinal septum long, thin and also in an open fossula. In the ephebic stage, cardinal septum elongate, thin and in an open fossula and countercardinal septum equalling other septa of countercardinal quadrants and forming, together with them, aulos or stereotheca. Bilateral symmetry persists throughout the morphogenesis. Minor septa embedded in the wall. Microstructure of the wall lamellar, of septa — lamellar fibrous.

Remarks. — The specimen, which makes up a basis for the new subfamily and the new genus, has an aulos which, on the side of countercardinal quadrants, persists throughout the morphogenesis. A similar aulos occurs in *Guerichiphyllum* n.gen. (*G. kowalense* n.sp. and *G. parvum* n.sp.). The following differences are, however, observed between these two genera: 1) in *Guerichiphyllum* n.gen. the thickened septa are those in countercardinal quadrants, whereas in *Friedbergia* n.gen. — those in cardinal quadrants; 2) *Guerichiphyllum* n.gen. has

lonsdaleoid vesicles and *Friedbergia* n.gen. — complete septa; 3) in *Guerichiphyllum* n.gen., during the ontogeny, cardinal septum is an element which becomes shortened and in *Friedbergia* — countercardinal septum; 4) in *Guerichiphyllum* n.gen., coral is not divided into two parts by long, thick alar septa. In having some stronger septa, protosepta and metasepta, this genus is similar to such representatives of the family Polycoeliidae Roemer, 1883 as *Pycnocoelia* Schindewolf, 1952 and *Majchelasma* Fomitshev, 1953, which however, have stronger cardinal, countercardinal and alar septa, whereas in *Friedbergia* n.gen. all major septa in cardinal quadrants and alar septa are stronger.

Friedbergia bipartita n.sp.
(Text-fig. 25)

Holotype: I.G. No. 163 i, II, 62; Text-fig. 25.

Type horizon: *Wocklumeria* beds (according to J. Czarnocki), Upper Famennian, *costatus* Zone.

Type locality: Kowala near Kielce.

Derivation of the name: Lat. *bipartita* = bipartite, after a distinct separation of cardinal quadrants from countercardinal ones.

Diagnosis. — A *Friedbergia* which with a diameter of 8.2 mm has 26 septa.

Material. — One well-preserved and one fragmentary specimen.

Description. — A subcylindrical coral with talon. Calyx deep, with sharp edges. Proximal end slightly inclined towards talon. Narrow septal grooves are visible on a somewhat worn off epitheca. Length 12.6 mm, longest diameter 7.8×8.5 mm.

Transverse section oval. Wall thick, minor septa slightly projecting from it. Major septa thick, particularly in countercardinal quadrants, having rhopaloid axial ends which form a stereo- or phyllotheca, especially in countercardinal quadrants. Septal index, 24/7.8×6.5. A distinct acceleration is marked in countercardinal quadrants. Septal formula: $\frac{3\,|\,3}{6\,|\,6}+6$. Cardinal septum longer than others but thin and situated in an open fossula. Alar septa also slightly stronger than the remaining major septa. Counterseptum equalling adjoining septa. Sections of a few tabulae are visible.

Ontogeny (Text-fig. 25 *a-f*) very complex, was examined in 25 serial peels. The entire morphogenesis took place up to a height of 7.6 mm above the base. 1) Diameter of the coral — 3.2 mm, talon wide. Only two septa are visible in countercardinal quadrants, i.e. a counterseptum and a counterlateral septum. Septa long, parallel. 2) Diameter — 5.8 mm. Cardinal quadrants transversally elongate. Thick, short, macelike septa are visible. These are: a cardinal septum slightly longer than the adjoin-

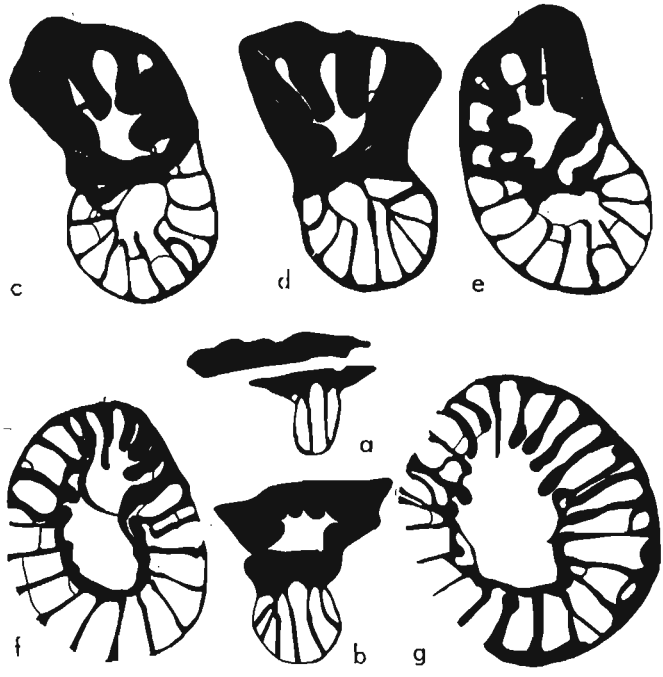

Fig. 25. — *Friedbergia bipartita* n.gen., n.sp.: *a-g* a series of successive sections; *a* nepionic stage with counterseptum and counterlateral septum, with a wide talon overgrowing some rodlike object; *b-e* neanic stage, a long and thin counterseptum situated in a wide fossula, phyllotheca present, in cardinal quadrants thick septa, cardinal septum in fossula, *f-g* ephebic stage with a long cardinal septum in fossula (Kowala, *Wocklumeria* beds; I. G. No. 163i, II, 62), holotype; × 3.5.

ing ones, next to each of them two metasepta and long alar septa which separate cardinal from countercardinal quadrants. In countercardinal quadrants, there are visible thin, long septa: two counterlateral septa, parallel to the counter septum and, already existing, one and two metasepta. Counterseptum situated in a wide fossula. 3) Diameter — 8.3 mm. Cardinal quadrants elongate. Septa elongate likewise. Cardinal septum accentuated by adjoining septa which slightly deflected, form a wide fossula. Alar septa continue to form a barrier between cardinal and countercardinal quadrants. Septa of countercardinal quadrants thin and long. Counterseptum long, situated in an open fossula; adjoining septa with axial ends bent to each other form a continuous aulos. 4) Diameter — 8.1 mm. The reduction of stereoplasma progressing in cardinal quadrants and particularly on alar septa. Cardinal septum somewhat longer. 5) Longer diameter — 7 mm, 22 septa; continuous reduction of stereoplasma on alar septa and cardinal quadrants. Feathery arrangement of septa in cardinal and radial in countercardinal quadrants. Aulos persisting in countercardinal quadrants, counterseptum shortens. 6) Longer diameter —

8.3 mm, 24 septa. Axial tube and its wall in the form of aulos or stereotheca exist continuously. Only septa of cardinal quadrants partly free. Cardinal septum long, situated in an open septal fossula. An outline of tabular fossula is also visible.

Remarks. — The corallite illustrated by Różkowska (1967, Pl.1, Fig. 8) belongs to the described species.

Occurrence. — Poland: Kowala, *Wocklumeria* horizon, *costatus* Zone, Upper Famennian.

Family **Amplexocariniidae** Soshkina, **1941** emend.

Genera assigned: *Amplexacarinia* Soshkina, 1928; *Nalivkinella* Soshkina, 1939; *Gorizdronia* n.gen.

Diagnosis. — Solitary, rarely budding corals with an axial tube whose wall makes up a cyatotheca formed by axial or periaxial tabulae. Microstructure of wall lamellar-wavy, of septa — lamellar.

Remarks. — Corals, whose septa reach cyatotheca, i.e. the wall of axial tube formed by axial or periaxial tabulae, are assigned by the present author to this family. Cyatotheca either may occur throughout the ontogeny (in *Amplexocarinia*) or disappears, in the late-neanic stage, on the side of cardinal quadrants (in *Nalivkinella*); in *Gorizdronia* n.gen., it occurs only in the early- and mid-neanic stages, its traces are only observed above.

Genus *Amplexocarinia* Soshkina, 1928
(Type species: *Amplexocarinia muralis* Soshkina, 1928)

A detailed synonymy, given by Schouppé & Stacul (1959, p. 294) is supplemented below by the present writer by new items and those, from Polish and Soviet literature, which were unknown to these authors.

1841. *Amplexus*; J. Phillips, Figures..., p. 8.
1896. *Diphyphyllum*; G. Gürich, Das Palaeozoicum..., p. 187.
1904. *Diphyphyllum*; D. Sobolev, Devonskie otloženija..., p. 45.
1941. *Amplexocarinia*; E. D. Soshkina, T. A. Dobroljubova, & G. Porfiriev, Permskie..., p. 92, *partim*.
1959. *Amplexocarinia*; A. v. Schouppé & P. Stacul, Säulchenlose..., p. 293, *partim*.
1960. *Amplexocarinia*; W. J. Sando, A description..., p. 166.
1960. *Depasophyllum*; E. C. Stumm, New rugose corals..., p. 162.
1962. *Amplexocarinia*(?); H. Flügel & B. Free, Laccophyllidae..., p. 242.
1962. *Amplexocarinia*; E. D. Soshkina, T. A. Dobroljubova & N. V. Kabakovitsh, Podklass..., p. 321.
1963. *Amplexocarinia*; S. Smith & H. D. Thomas, On *Amplexus*..., p. 161.
1963. *Amplexocarinia*; G. E. de Groot, Rugose corals..., p. 15.
1964. *Amplexocarinia*; C. L. Rowett & P. K. Sutherland, Wapanucka..., p. 23.
1965. *Amplexocarinia*; J. Fedorowski, Lindstroemiidae..., p. 350.

Species assigned: Since the authors mostly do not present the morphogenesis and inaccurately determine the structure of the wall of axial tube, it is difficult to state which of the species, assigned so far to *Amplexocarinia*, certainly belong to this genus. In addition to the type species, i.e. *A. muralis* Soshkina, 1928, the present writer assigns to it the following species: *A. tortuosa* (Phillips, 1841); *A. jonkeri* Koker, 1924; *A. heimoi* Heritsch, 1936; *A. geyeri* Heritsch, 1939; *A. subtilis* Schouppé & Stacul, 1959; *A. composita* Schouppé & Stacul, 1959; *A. wagneri* de Groot, 1963.

Stratigraphic and geographic range: An accurate range is given by de Groot (1963, p. 15). In Poland, *Amplexocarinia* occurs in Givetian and Famennian of the Holy Cross Mountains.

Diagnosis. — See Schouppé and Stacul (1959, p. 294). Microstructure of the wall and of the septa is lamellar.

Remarks. — Schouppé & Stacul (1959) present an exhaustive discussion of the structure of the wall of axial tube. This wall is a cyatotheca of a basal origin. Determining it as an aulos is incorrect (Heritsch, 1933; Schindewolf, 1942; Wang, 1950; Hill, 1956). *Amplexocarinia* is similar to *Nalivkinella*, but there are also the following differences:

Genus	Shape of corallite	Proximal end	Septa	Periaxial tabulae	Cyatotheca
Nalivkinella Soshkina, 1939	concave on the side of proximal end	inclined to talon	in the late-neanic stage, axial ends free	horizontal, vesicular	formed by periaxial tabulae
Amplexocarinia Soshkina, 1928	convex on the side of proximal end	deflected from talon	axial ends free as far as in calyx	straight, obliquely descending towards wall	formed by axial tabulae

Amplexocarinia muralis Soshkina, 1928

(Text-figs. 26 *A-G*; 27-29; Pl. III, Figs. 5, 8, 9; Pl. VIII, Fig. 6)

Material. — About 230 specimens, free or embedded in limestone. Many of them well-preserved, but proximal end together with the nepionic stage preserved only in few cases. 109 peels and 28 thin sections.

Description. — The largest specimens reach 18 mm in length and, on the average, 7-8 mm in diameter. These are mostly dumpy, bent corallites, with talon raised high along the wall. Calyx with a sharp edge, steep walls and bottom flat or raised axially in the form of a ring. On the convex side, proximal end is shaped like a spur, strongly deviating from talon. Talon elliptical or groovelike. Its longer diameter is equalling the

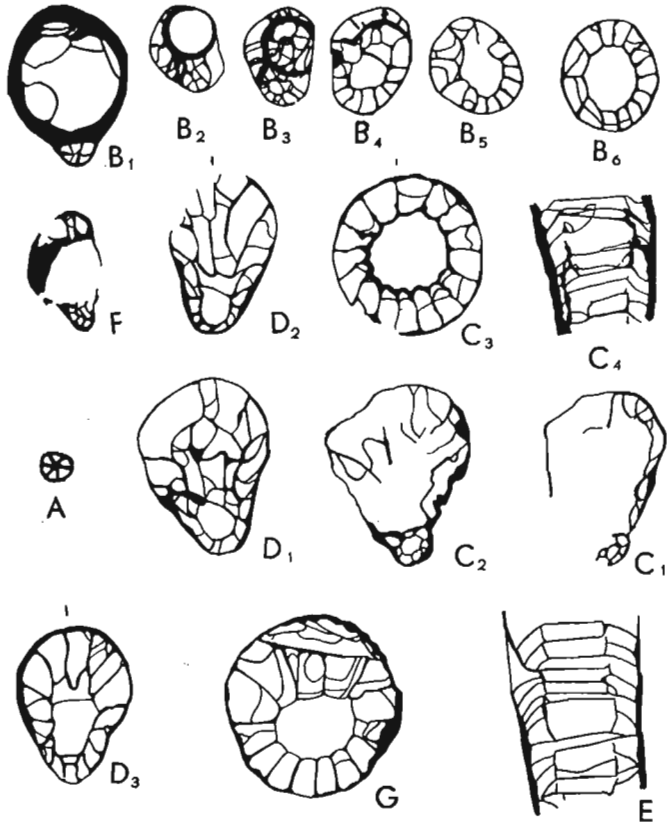

Fig. 26. — *Amplexocarinia muralis* Soshkina: *A* nepionic stage, protosepta fused axially (Kadzielnia I, bed 3; Z. Pal. P. Tc No. 3/819), × 6; B_1-B_6 a series of transverse sections presenting the ontogenetic development of a coral which overgrows another coral, B_1 nepionic stage, B_2-B_3 early-neanic stage, B_4-B_5 late-neanic stage, B_6 ephebic stage (Kadzielnia G; No. 3/15), B_1 × 5.4, B_2-B_6 × 2.6; C_1-C_2 transverse sections, early-neanic stage, C_3 ephebic stage, C_4 longitudinal section with axial tube surrounded by cyatotheca (Kadzielnia I, bed 2; No. 3/579) × 2.7; D_1-D_2 transverse sections, mid-neanic stage, D_3 late-neanic stage with a wide talon (Kadzielnia I, bed. 2; No. 3/402), × 3.4; *E* longitudinal section with a typical structure of tabularium, axial tabulae rectangularly broken, periaxial obliquely descending outwards (Kadzielnia I, bed 2; No. 3/542), × 3.4; *F* early neanic stage with a wide talon (Kadzielnia, the dump, No. 3/1665, × 2; *G* transverse section of a corallite with a peripheral budding started, a new epitheca of the bud and coenogenetic vesicles situated on the periphery (Kadzielnia G; No. 3/25), × 2.7.

diameter of the distal end in the ephebic stage. Horizontal, periodically repeated annulations, running obliquely towards talon, are only visible on a smooth, thick epitheca. After getting detached of epitheca, broader and narrower furrows are visible which correspond to septa with two different lengths. Cardinal septum is situated on the side of talon, minor septa appear cyclically.

Transverse section in the ephebic stage. Corallite round, epitheca thickened by the deposit of stereoplasma on the internal surface. Major

septa thin, have triangular bases of the epithecal origin. Their length equals about a half of the radius. Minor septa rarely enter the lumen. Cyatotheca thin and, in the place of its contact, with axial end of septa, concave. Septal index given in Text-fig. 29*A*. The ratio of the diameter of axial tube to that of corallite amounts to about 2:1 (Text-fig. 29*B*.

Longitudinal section. Axial tabulae trapezoidal, bent at a right or obtuse angle and resting on underlying tabulae or, less frequently, complete and resting with its peripheral end on the wall. Periaxial tabulae obliquely inclined downwards and outwards. They are differently spaced. There are 4-7 axial and 5-8 periaxial tabulae distributed over a stretch of 5 mm.

Variability. — Despite a very simple structure, there is a considerable variability. Corallite may be slender or dumpy with a high or low and wide or narrow talon. Variable are also the length and thickness of major septa, degree of the conspicuousness of minor septa and diameter of axial tube.

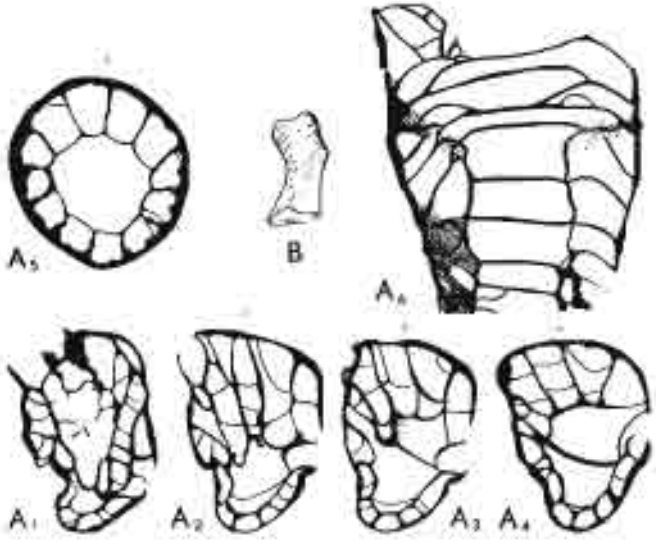

Fig. 27. — *Amplexocarinia muralis* Soshkina: A_1-A_6 successive transverse sections, A_1 mid-neanic stage, A_2-A_4 late-neanic stage, A_5 ephebic stage with short minor septa, A_6 longitudinal section (Kadzielnia G; Z. Pal. P. Tc No. 3/3), × 3; *B* a diagrammatic drawing of a coral (Kadzielnia G; No. 3/402), nat. size.

Ontogeny was studied in many specimens (Text-fig. 26 *A, B, C*$_1$-*C*$_3$, *D, F*). The following stages were distinguished: 1) *Nepionic stage*. Six protosepta contact stereocolumella. Diameter of proximal end amounts to 0.7 mm. Talon absent. 2) *Early-neanic* stage. Diameter of proximal end — 1.3×2.3 mm, longer diameter of talon — 6 mm, diameter of axial

tube — 0.6 mm, number of septa — 6-8. Between proximal end and talon wall is continuous. 3) *Mid-neanic stage*. The wall separating talon from proximal end disappears, but cyatotheca persists. Diameter of proximal end — 2.3-3.0 mm, of axial tube — 1.4 mm, longer diameter of talon — 4 mm, number of septa — 9-11. 4) *Late-neanic stage*. Axial tube extends and occupies part of talon. Its diameter amounts to 3.5 — 5 mm, length of proximal end together with talon — to 7 mm, number of septa — to 14-15. 5) *Final-neanic stage*. Talon continues to occur and, consequently the cross section through the corallite is elongate, elliptical. Wall of axial tube closed. Diameter of coral — 4.2×5 m or even 4.5×6 mm. Diameter of tube — 2.5×3 mm. Number of septa — 14-15. 6) *Early-ephebic stage* was presented together with the description of the transverse section (p. 83). Morphogenesis, progressing slowly, persists up to a height of 4 mm.

When the larva overgrows another corallite and does not excrete an elongate talon, the development becomes arrested since stage 3 is not formed and, sometimes, stage 4 is lacking.

Budding is a rare phenomenon (Text-fig. 26*G*) which was found in 8 specimens only. Bud is developed on the side of talon. A new wall separates it from the budding corallite. A "cenogenetic" dissepimental tissue appears in the separated part.

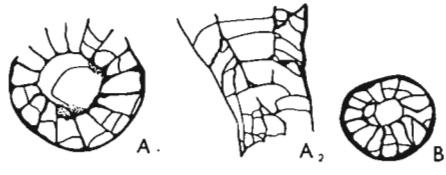

Fig. 28. — *Amplexocarinia muralis* Soshkina: A_1 transverse section, A_2 longitudinal section of a coral with long septa and narrow tabularium (Kadzielnia I, bed 3; Z. Pal. P. Tc No. 3/415), × 2.7; *B* transverse section of a mature individual with long septa and narrow tabularium (Kadzielnia G; No. 3/86), × 2.7.

Remarks. — T. A. Dobroljubova, whom Famennian specimens were shown by J. Fedorowski during his stay in the U.S.S.R., found that they were conspecific with *A. muralis* Soshkina, a species from Permian of Ural. Famennian and Permian specimens have a similar septal index of n/d = 15:5. In Permian specimens, axial tube is slightly narrower, but so small a difference falls within limits of an intraspecific variability, the more so as in Famennian there also exist corals of this species which have a narrow tube (Text-fig. 28).

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure I, beds 4-1; exposure II, beds N, L, K, J and A; exposure III, bed 46, Lower Famennian, *quadrantinodosa* Zone; Gałęzice, bed 2; Kowala, trench IV, Upper Famennian, *costatus* Zone; U.S.S.R., Ural, Lower Permian.

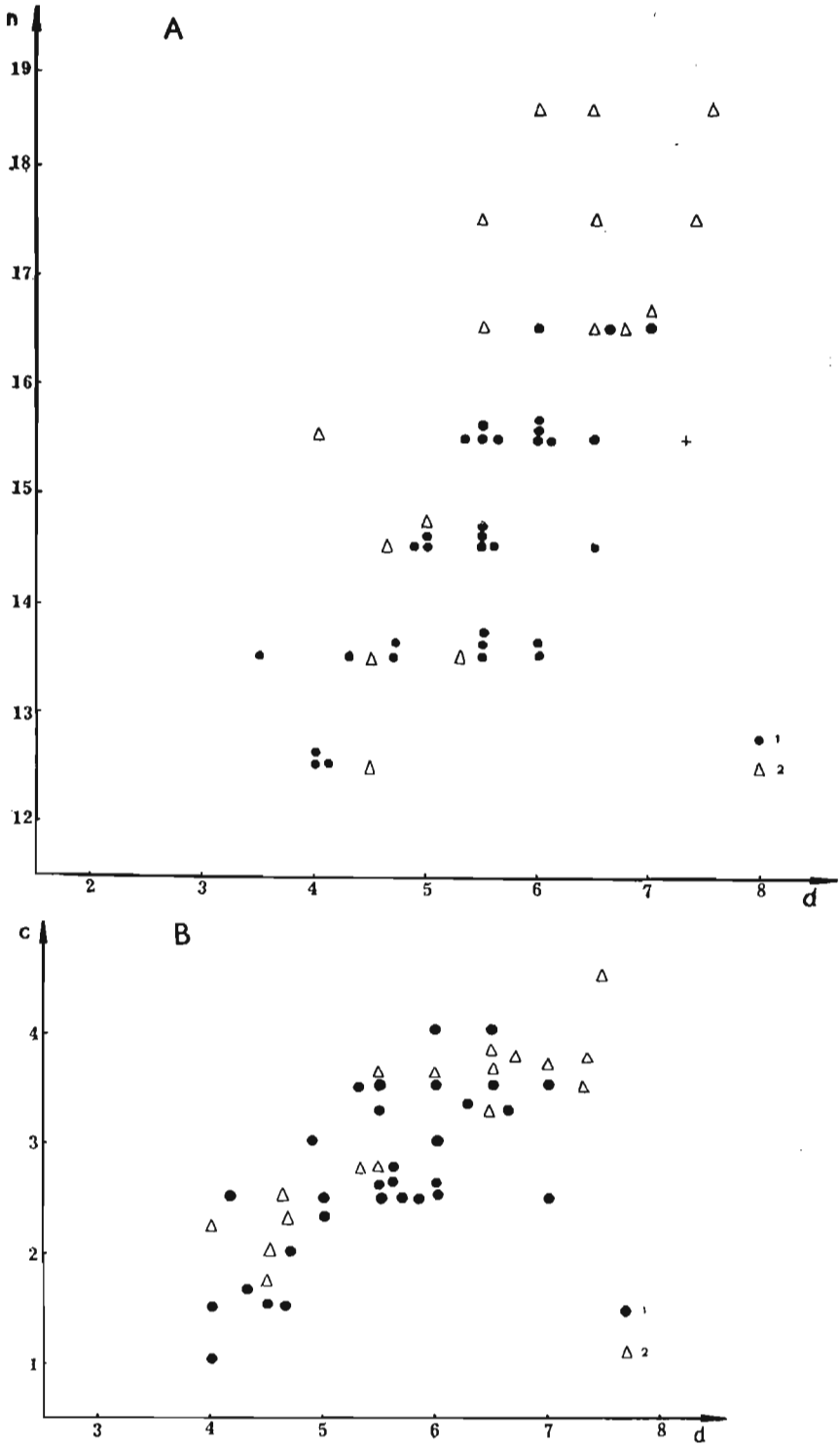

Fig. 29. — Scatter diagrams of: *A* n/d, *B* c/d; *1 Amplexocarinia muralis* Soshkina, *2 A. obliqua* n.sp.

Amplexocarinia obliqua n.sp.

(Text-fig. 30 *A-G*; Pl. III, Figs. 6-7; Pl. VII, Fig. 10)

Holotype: Specimen Z.Pal.P. Tc No. 3/465; Text-fig. 30 *C*.

Type horizon: Lower Famennian; *quadrantinodosa* Zone.

Type locality: Kielce (Kadzielnia quarry), exposure I, bed 2.

Derivation of the name: Lat. *obliquus* = oblique, after obliquely disposed calyx and tabularium.

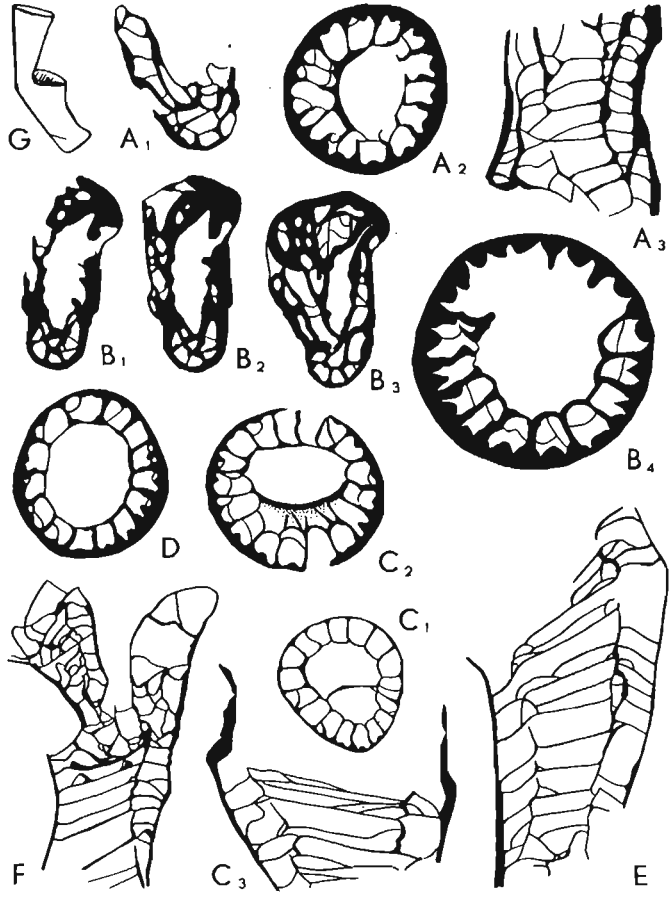

Fig. 30. — *Amplexocarinia obliqua* n.sp.: A_1 transverse section, mid-neanic stage, A_2 ephebic stage with thick major and conspicuous minor septa, A_3 longitudinal section (Kadzielnia I, bed 3; Z. Pal. P. Tc No. 3/716), × 3.4; B_1-B_2 transverse sections, mid-neanic stage, B_3 late-neanic stage with a long, rectangular talon, B_4 transverse section of calyx with thick major and minor septa (Kadzielnia I, bed 3; No. 3/667), × 4.6; C_1 transverse section, early-ephebic stage, C_2 ephebic stage, C_3 longitudinal section, axial tabulae oblique (Kadzielnia II, bed 2; No. 3/465), holotype, × 2.7; *D* transverse section of a mature individual with strong skeletal elements (Kadzielnia II, bed 2, No. 3/596), × 3.4; *E* longitudinal section of an individual typical of this species with oblique calyx and tabularium (Kadzielnia G; No. 3/220, × 2.7; *F* longitudinal section of a corallite with a bud vertically projecting from an oblique tabularium (Kadzielnia I, bed 1; No. 3/338), × 2.7; *G* a diagrammatic drawing of a corallite with an oblique calyx and a bud growing from the periphery (Kadzielnia I, bed 2; No. 3/618, × 0.6.

Diagnosis. — An *Amplexocarinia* with a maximum length of 25 mm and maximum diameter of 12 mm; number of septa — 19 × 2 with a diameter of 7-8 mm. Minor septa conspicuous. Calyx deep, oblique; tabularium oblique.

Material. — Twenty one, mostly strongly damaged, specimens. Fifteen peels of transverse and longitudinal sections were made.

Description. — Corallites slender, subcylindrical, slightly bent, with proximal end deflected from talon. Talon elongate, elliptical or round. Epitheca thick, with periodically repeated striae, running obliquely towards talon. Calyx round, deep, situated obliquely in relation to the longer axis of the corallite (at an angle of 35°). The longest diameter amounts to 12.5×12 mm, the most frequent — to 6-7 mm. Tabular or peripheral budding is a fairly frequent phenomenon.

Transverse section. Wall mostly thick (to 0.6 mm), major and minor septa also thick, particularly in the ephebic stage. Septal index shown in Text-fig. 29*A*, n/d mostly amounting to 16-18/6-8 mm. Axial tube wide, rarely occupying more than a half of the diameter (Fig. 29*B*).

Longitudinal section. Dense axial tabulae, sometimes combined in systems, bent at a right angle and resting on an underlying tabula. Less frequently, they are complete and reach both or one wall only. Periaxial tabulae are also spaced regularly and closely. At a height of 5 mm, their number amounts to 6-9.

Variability — as judged by few specimens — seems to be fairly large. Major septa thin or very thick and with nodes on the sides; minor septa strongly projecting from epitheca or, here and there, lacking. Wall of axial tube is thin and its diameter (c) may amount to: $c = 1/2$ d, $c < 1/2$ or $c > 1/2$ d. The most variable are the spacing and shape of tabulae.

Ontogeny is identical with that in *A. muralis* Soshkina. Preserved are only *mid-neanic stages* (Text-fig. 30 B_1-B_2), in which septa of the proximal end already enter talon, *late-neanic stages*, in which axial tube extends and occupies part of the lumen of talon (Text-fig. 30 B_3) and an *ephebic stage* (Text-fig. 30 B_4) with a round cross section of the corallite, which is caused by the fact that talon is not present. The *ephebic stage* was presented with the description of the transverse section. On the other hand, in the cross section through the base of calyx, septa occur only in the form of slats on one side of the corallite.

Budding (Text-fig. 30 *F, G*). Bud mostly grows out of the axial part of tabularium, is 6 mm high and raised above a high edge of calyx; periaxial tabulae reach as far as the distal edge of calyx.

Remarks. — The new species is most similar to *A. muralis* Soshkina from which it differs, however, in several characters indicated below:

Species	Calyx	Septal index n/d	Thickness of skeletal elements	Length of minor septa	Tabulae
Amplexocarinia obliqua n.sp.	oblique	16-18/6-8	thick	conspicuous	dense, oblique
Amplexocarinia muralis Soshkina	horizontal	13-16/6	thin	invisible, here and there, nodules on epitheca	widely spaced, horizontal

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure G; exposure I, beds 3, 2, 1; exposure II, bed L; Lower Famennian, *quadrantinodosa* Zone.

Genus *Gorizdronia* n.gen.

(Type species: *Nalivkinella profunda* Soshkina, 1951, non Soshkina, 1939)

Derivation of the name: Named in memory of the late Professor Zenaida Gorizdro-Kulczycka, Warsaw, Poland.

Species and subspecies assigned: *G. profunda profunda* (Soshkina, 1951), *G. profunda longiseptata* n.subsp., *G. breviseptata* (Ivania, 1965), *G. profunda tenuis* n.subsp., *G. geniculata* n.sp.

Stratigraphic and geographic range: Frasnian of Kuzbass, Eifelian(?) Famennian of Ural and of the Holy Cross Mountains.

Diagnosis. — Solitary corallites, displaying the phenomenon of rejuvenescence, reaching a considerable diameter (to 22 mm), and having, in their youth, a short-lasting axial tube; septa complete, long or short; minor septa more or less reduced; tabulae mostly complete; near periphery conical, accessory plates. Microstructure of the wall and septa — lamellar.

Remarks. — Specimens with a structure, described in the diagnosis, were assigned by Soshkina (1951, p. 33; 1952, p. 66) to the genus

Genus	Septa	Axial tube	Tabulae
Gorizdronia n.gen.	amplexoid	short-lasting	mostly complete, with accessory, conical plates
Nalivkinella Soshkina, 1939	nonamplexoid	although discontinuous, occurs yet at the base of calyx	incomplete; axial and periaxial, without accessory plates

Nalivkinella Soshkina. The present writer introduces a new genus, *Gorizdronia*, with a type species *Nalivkinella profunda* Soshkina, 1951 (Pl. 1, Figs. 1-5), but maintains the genus *Nalivkinella* with a type species *Nalivkinella profunda* Soshkina, 1939 non 1951. The differences between both genera are indicated on p. 89.

Gorizdronia is also similar to *Amplexus* Sowerby, 1814. Major septa of both these genera are amplexoid, minor septa poorly developed and tabulae mostly complete. The ontogeny of the genus *Amplexus* is, however, unknown. In the present writer's opinion, *Amplexus* is a primitive form, whereas *Gorizdronia* n.gen. represents a final phase of evolution of some stock of Amplexocariniidae.

Gorizdronia profunda profunda (Soshkina, 1951, non 1939)

(Text-figs. 31 *A-E*, 34; Pl. IV, Figs. 1-2)

non 1939. *Nalivkinella profunda* Soshkina; E. D. Soshkina, Verchnedevonskie..., p. 44, Pl. 11, Figs. 91-95.

1951. *Nalivkinella profunda* Soshkina; E. D. Soshkina, Pozdnedevonskie..., p. 33, Pl. 1, Figs. 1-5; Text-fig. 15.

1952. *Nalivkinella profunda* Soshkina; E. D. Soshkina, Opredelitel..., Pl. 2, p. 66.

Diagnosis. — A cylindrical *Gorizdronia* which, with a diameter of 18 mm, has 20-28 septa. Major septa short, amplexoid, minor septa embedded in epitheca.

Material. — About 70, mostly broken, worn off and recrystallized specimens, with axial ends and calyces only exceptionally preserved.

Description. — Corallites medium- and large-sized, cylindrical, with a smooth epitheca. Talon elliptical, elongate, with proximal end on its side or tucked up under tabularium. Proximal end together with talon have a total diameter almost equalling that of the distal end of corallite. Beside cylindrical, thin corallites, there are also cylindrical but thick ones. Calyx flat, contracted, flat-bottomed.

Transverse section. Corallites pauciseptal. Number of septa correlated with diameter of the coral. Due to the destruction of septa, their number is difficult to count. Wall of the coral smooth or undulated. Major septa short, straight or wavy, complete. Minor septa are visible only in some places and, in addition, only in corals with a large diameter.

Longitudinal section. Tabulae as regular as ladder rungs or incomplete — convex or flat and complete. Accessory, conical plates occur on them.

Variability range very wide. Considerable differences in the arrangement of skeletal elements occur even in a single specimen.

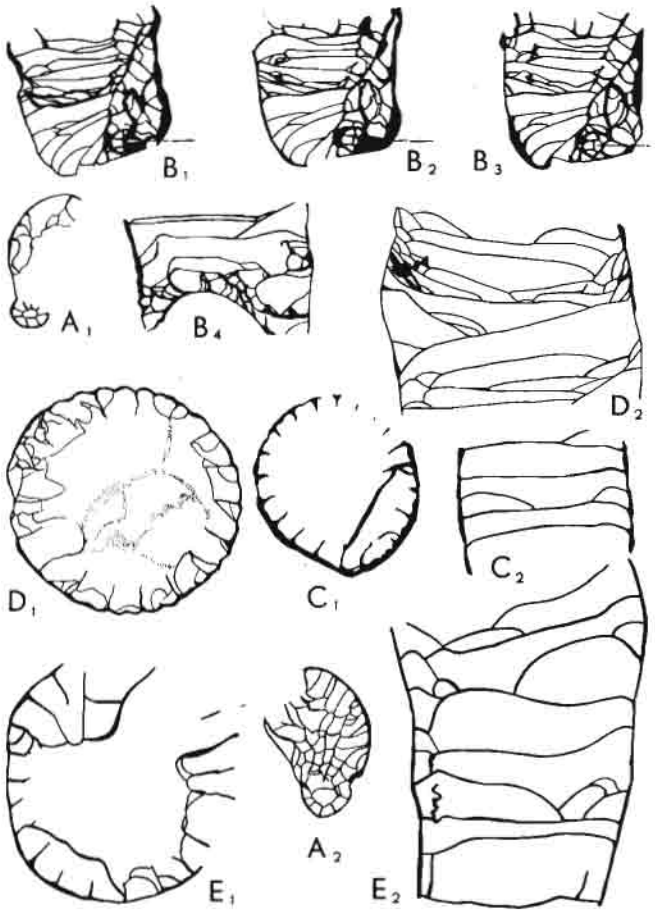

Fig. 31. — *Gorizdronia profunda profunda* (Soshkina): A_1 early-neanic stage, A_2 late-neanic stage with a wide talon (Kadzielnia II, bed L; Z. Pal. P. Tc No. 3/1314); × 1.5; B_1-B_3 a series of longitudinal tangential sections showing the ontogenetic development of a corallite, B_1 nepionic stage of proximal end (under talon, close to a longitudinally sectioned tabularium), four uncovered protosepta fused axially, B_2-B_3 early neanic stage with axial tube and wall around proximal end, B_4 longitudinal axial section (Kadzielnia I, bed 1, No. 3/367a), × 2; C_1 transverse section, C_2 longitudinal section of a simple structure (Kadzielnia, the dump; No. 3/1628), × 1.5; D_1 transverse section, D_2 longitudinal section with a more complex tabularium (Kadzielnia G; No. 3/19), × 1.5; E_1 transverse section, E_2 longitudinal section (Kadzielnia III, bed 44; No. 3/1816), × 1.5.

Ontogeny (Text-fig. 31 *A-B*). — 1) *Nepionic stage.* Larva of the specimen attached itself to a crinoid and excreted proximal end 1.2 mm in diameter and six protosepta connected axially. 2) *Early-neanic stage.* Proximal end 1.5 mm in diameter, axial tube — 0.5 mm. Diameter of the whole coral amounts at the proximal end to 10 mm and the diameter of distal end — to 9 mm. Coral subcylindrical. 3) *Early-neanic and mid-*

-neanic stages of a coral with a large talon. In early stagos, ontogeny is identical with that in the genus *Nalivkinella* (Text-fig. 6).

Remarks. — The present writer believes that *G. profunda profunda* (Soshkina) from Famennian of the Holy Cross Mountains is conspecific with the specimens, described by Soshkina (1951, 1952) from Famennian of Ural. With a corresponding diameter of corallite, the number of septa is almost identical: n/d = 22-28/7-15 mm in the specimen from Ural as compared with n/d = 18-22/7-15 mm in the specimen from Kadzielnia. In addition, they are similar in shape and internal structure.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure G, exposure I, beds 3-1; exposure II, beds N, M and L; exposure III, beds 47-43, 26 and the dump; Lower Famennian, *quadrantinodosa* Zone. U.S.S.R.: Ural, Famennian, (?)Eifelian.

Gorizdronia profunda longiseptata n.subsp.
(Text-fig. 32 *A-E*; Pl. IV, Fig. 4 *a*, *b*; Pl. VIII, Fig. 12)

Holotype: Specimen Z.Pal.P. Tc No. 3/1037; Text-fig. 32 *D*.
Type horizon: Lower Famennian, *quadrantinodosa* Zone.
Type locality: Kielce (Kadzielnia quarry), exposure II, bed K.
Derivation of the name: Lat. *longiseptata* — after long major septa.

Diagnosis. — A large-sized *G. profunda*. Major septa long, minor vestigial. With a diameter of 7.5 mm, there are 14-19 septa. Tabulae densely arranged, with many accessory conical plates.

Material. — Forty six damaged specimens without calyces, but with proximal end only exceptionally preserved, 20 peels of transverse and longitudinal sections were made, 2 thin sections.

Description. — In addition to large corallites, 13.2 mm in diameter, there are smaller specimens — 9 mm in diameter. Corallites cylindrical, with a smooth, only transversally striated epitheca. Talon elliptically elongate. Vertical rejuvenescence.

Transverse section. Epitheca thickened on the internal side, extended in the form of tiny, triangular socles on which septa are mounted. Septa long, bent, not always reaching epitheca (a result of the destruction). Minor septa appear only below the base of calyx. Between septa, the tissue of tabulae is concentrated. Round, cross sections of accessory plates are visible. The number of septa with a corresponding diameter of the corals is given in Text-fig. 34.

Longitudinal section. Corallite straight, subcylindrical, with a marginal vertical rejuvenescence. Tabulae mostly complete, flat, with many accessory plates occurring on the periphery. Many tabulae correspond to long septa.

Variability range wide as displayed in a specimen overgrowing the coral *Guerichiphyllum parvum* n.sp. and having septa varying in length. They are short as in *G. profunda profunda* and later become long and

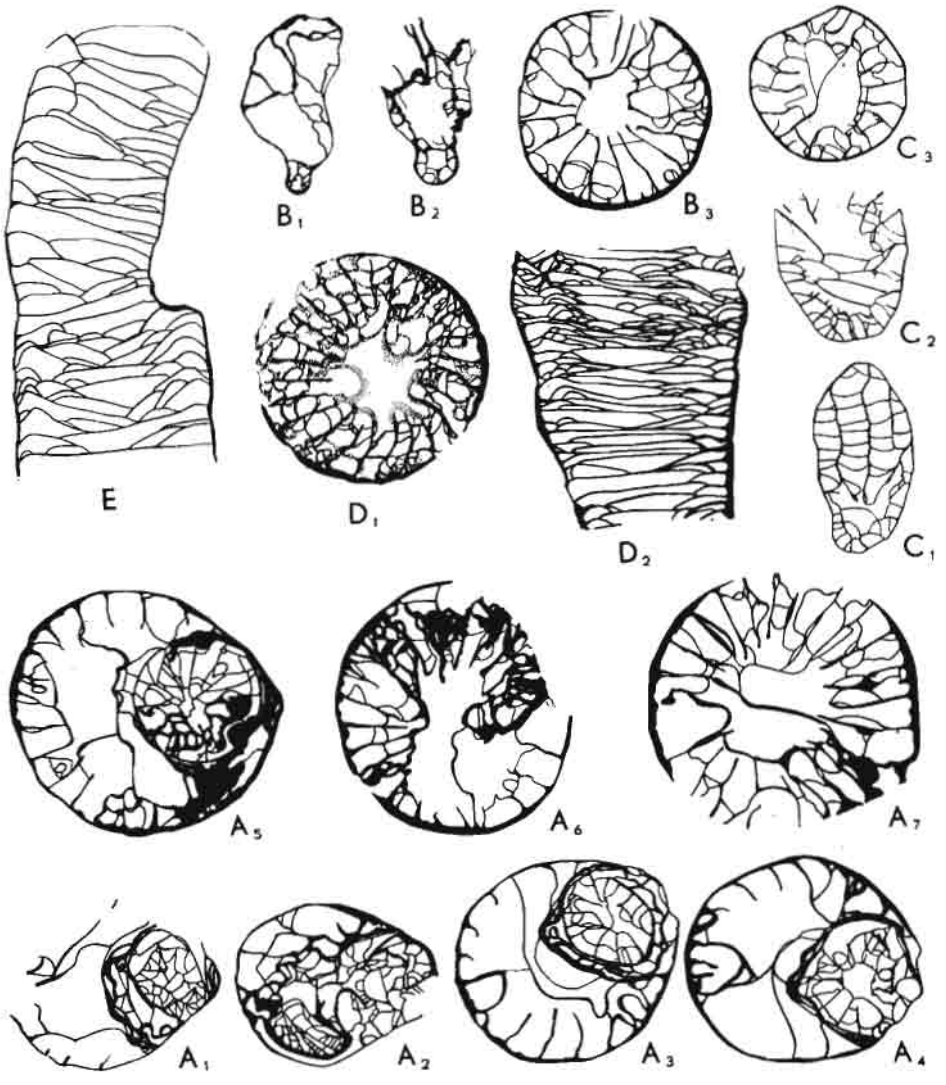

Fig. 32. — *Gorizdronia profunda longiseptata* n.subsp.: A_1-A_7 successive transverse sections showing the development of a coral overgrowing *Guerichiphyllum parvum* n.sp., A_1-A_8 septa gradually extending, A_7 long septa (Kadzielnia II, bed K; Z. Pal. P. Tc No. 3/1017), × 0.7; B_1-B_3 serial transverse sections, B_1 early neanic stage, B_2 midneanic stage with septa forming cyatho-phyllotheca and with a wide talon, B_3 ephebic stage of a coral with long major and short minor septa (Kadzielnia G; No. 3/1601), × 1.5; C_1-C_3 transverse sections, C_1-C_2 late-neanic stage, C_3 ephebic stage (Kadzielnia II, bed L; No. 3/1381), × 1.5; D_1 transverse section, D_2 longitudinal section illustrating the structure of a coral with long septa, crowded tabulae and vesicular accessory plates (Kadzielnia II, bed K; No. 3/1037), holotype, × 0.75; *E* longitudinal section of a coral displaying the phenomenon of rejuvenescence (Kadzielnia, the dump; No. 3/1707), nat. size.

typical of this subspecies. The density of tabularium also varies in different species.

Ontogeny (Text-fig. 32 *A-C*). — 1) *Nepionic stage* destroyed. 2) *Early-neanic stage.* Corallite with proximal end 1.2 mm in diameter, axial tube 0.4 mm in diameter, talon 9.8 mm long and 6 septa connected with the wall of axial tube. The proximal end is separated, by its own wall, from talon. 3) *Mid-neanic stage.* The mid-neanic stage appears 0.1 mm above the early-neanic stage and persists up to a height of 0.7 mm. Diameter of proximal end amounts to 1.2 mm, of axial tube — to 0.7 mm, talon 9.8 mm long. Since the wall surrounding the proximal end on the side of talon is reduced, septa pass to talon. 4) *Late-neanic stage.* Diameter of talon and proximal end amounts to 8 mm. Axial tube open towards talon. 5) *Final-neanic stage.* The longer diameter of talon and proximal end amounts to about 8 mm. As long as talon exists, there are also the remains of axial tube on the side of proximal end. 6) *Early-ephebic stage.* All septa amplexoid, their axial ends free. Minor septa lacking. Corallite 9 mm in diameter. The ontogenetic development of the genera *Nalivkinella* and *Gorizdronia* n.gen. is similar until the late-neanic stage. The differentiation of the structure takes place in the early-ephebic stage (Text-fig. 6).

Remarks. — The differences that occur between particular subspecies and species are given in the following table (dimensions in mm):

Species and subspecies	Shape and max. diameter	Minor septa appearing with a diameter of corallite	Number of septa with coral diameter of 7.5 mm	Length of major septa
G. profunda profunda (Soshkina)	Cylindrical, 22.0	7.2	16-18	$S<\frac{1}{2}r.$
G. profunda longiseptata n.subsp.	Cylindrical, 23.0	10.0	14-19	$S>\frac{1}{2}r.$
G. profunda tenuis n. subsp.	Cylindrical, 7.5	lacking	16	$S>\frac{1}{2}r.$
G. geniculata n.sp.	Geniculate 15.0	6.0	16-18	$S<\frac{1}{2}r.$

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure G, exposure I, beds 3-1; exposure II, beds N-K; exposure III, bed 46 and dump; Lower Famennian, *quadrantinodosa* Zone.

Gorizdronia profunda tenuis n.subsp.

(Text-figs. 24 *B*, 33, 34)

Holotype: Specimen Z.Pal.P. Tc No. 3/1859; Text-fig. 33.
Type horizon: Lower Famennian, *quadrantinodosa* Zone.
Type locality: Kielce (Kadzielnia quarry), exposure III, bed 46.
Derivation of the name: Lat. *tenuis* = thin.

Diagnosis. — Coral shaped like a thin stalk, with a diameter of 7 mm has 16 septa uniform in length. Septa long, undulated. Minor septa invisible. Tabulae flat, complete, with accessory plates.

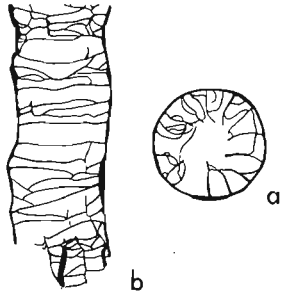

Fig. 33. — *Gorizdronia profunda tenuis* n.subsp.: *a* transverse section, *b* longitudinal section (Kadzielnia III, bed 46; Z. Pal. P. Tc No. 3/1859), holotype; × 2.

Material. — Six damaged corallites, devoid of calyx and proximal end. Seven peels were made.

Description. — Specimens cylindrical, the proximal and distal end excluded, their length amounts to 18 mm. Epitheca thick, transversally striated. Diameter of both ends, 18 mm distant from each other, amounts to 7 mm.

Transverse section. In transverse section corallite round, pauciseptal. Septal index n/d indicated in Text-fig. 34. Septa long, slightly bent. Transverse sections of tabulae and accessory plates are visible between septa.

Longitudinal section. Tabulae mostly complete, flat. Accessory plates are, in some places, conical, a shape characteristic of *Gorizdronia*.

Ontogeny (Text-fig. 24 *B*). — 1) The youngest *nepionic stage* — not preserved. 2) In the *early-neanic stage* axial tube has a discontinuous cyatotheca. Proximal end is separated by a thick wall from a wide talon.

Remarks. — Differences in relation to other subspecies and the species *G. geniculata* n.sp. are shown in table (p. 94). The corals illustrated by Różkowska (1967, Pl. 1, Fig. 10 A, B) belong to the above described species.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure I, beds 3-1; exposure III, bed 46; Lower Famennian, *quadrantinodosa* Zone.

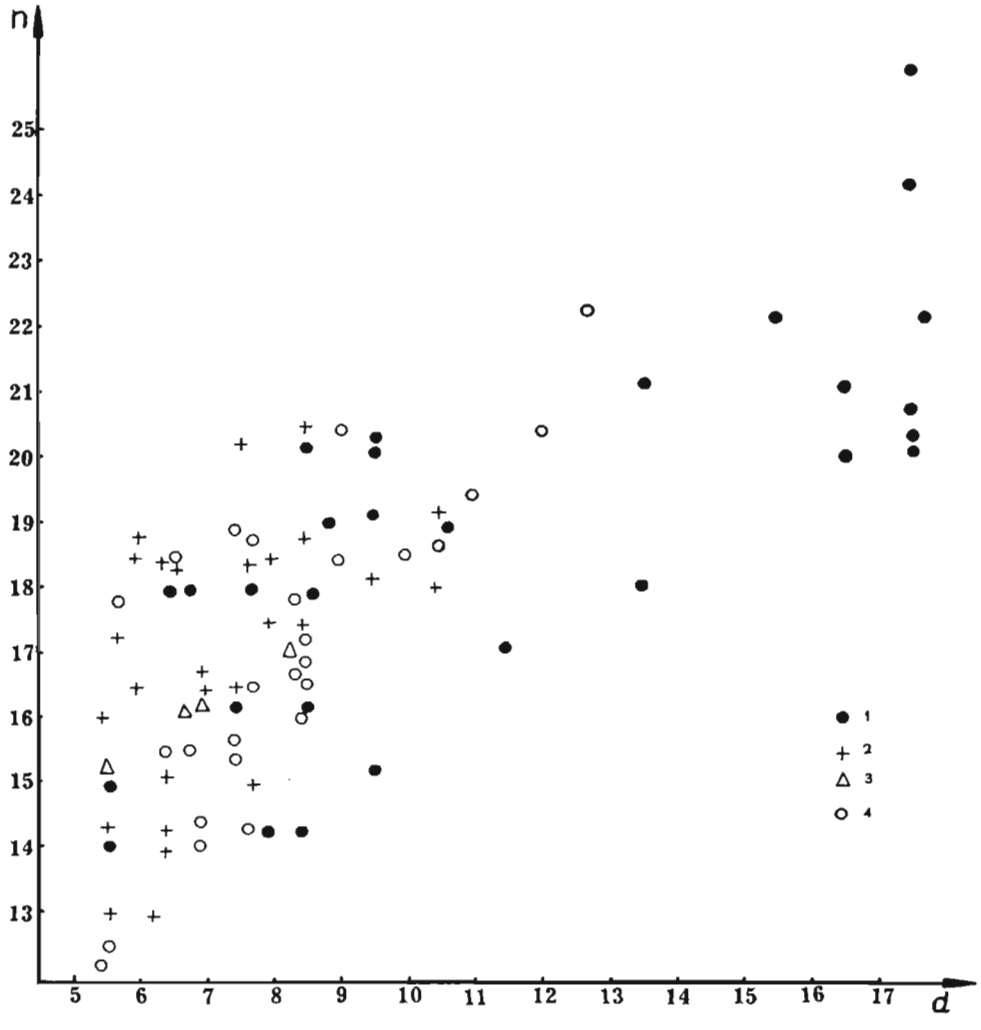

Fig. 34. — Scatter diagram of n/d (n — major septa): *1 Gorizdronia profunda profunda* (Soshkina), *2 G. geniculata* n.sp., *3 G. profunda tenuis* n.subsp., *4 G. profunda longiseptata* n.subsp.

Gorizdronia geniculata n.sp.

(Text-fig. 35 *A-G*; Pl. IV, Fig. 3; Pl. VIII, Fig. 2)

Holotype: Specimen Z.Pal.P. Tc No. 3/1630; Text-fig. 35 *B*.
Type horizon: Lower Famennian, *quadrantinodosa* Zone.
Type locality: Kielce (Kadzielnia quarry), dump.
Derivation of the name: Lat. *geniculatus* = geniculate, after the shape of coral.

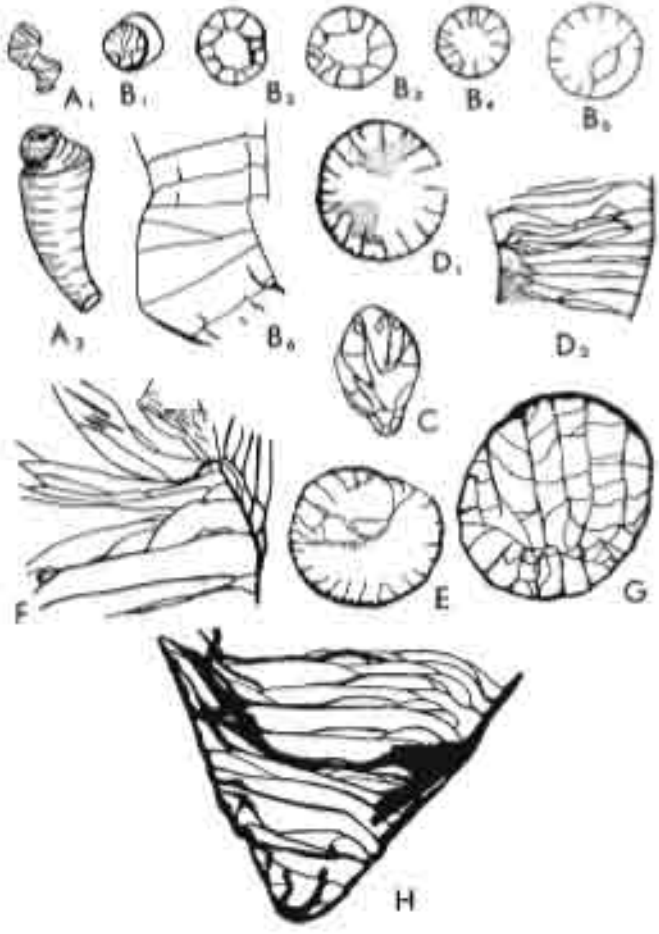

Fig. 35. — *A-G Gorizdronia geniculata* n.gen., n.sp.: A_1-A_2 diagrammatic drawings of rejuvenated corallites (Kadzielnia, the dump; Z. Pal. P. Tc No. 3/1631), $A_1 \times 0.37$, $A_2 \times 0.5$; B_1-B_5 ontogenetic development of a specimen with a small talon, B_1 early-neanic stage with a cyatho-phyllotheca not closed, B_2-B_3 mid-neanic stage with a closed cyatho-phyllotheca, B_4-B_5 ephebic stage with short, free septa, B_6 longitudinal section with a characteristic, geniculate bend (Kadzielnia, the dump; No. 3/1630), holotype, B_1-B_6, $B_6 \times 2.5$, B_4-$B_5 \times 1.5$; *C* transverse section, mid-neanic stage with a large talon (Kadzielnia II, bed L; No. 3/1378), $\times 2$; *D*, transverse section, short major and rudimentary minor septa, D_2 longitudinal section, tabulae with vesicular accessory plates (Kadzielnia I, bed 1; No. 3/242), $\times 2$; *E* transverse section of a corallite (Kadzielnia G; No. 3/24), $\times 2$; *F* longitudinal section of a corallite cut through its geniculate bend, tabulae crowded, with accessory plates (Kadzielnia, the dump; No. 3/1640), $\times 1.5$; *G* transverse section cut through its bend (Kadzielnia G, No. 3/24), $\times 4$; *H Gorizdronia* sp.(?): longitudinal section (Gałęzice, the dump; No. 3/2260), $\times 3$.

Diagnosis. — Corallites 40 mm in maximum length, 15 mm in longest diameter and with a diameter of 10 having 18-19×2 septa. With a diameter of 6 mm minor septa enter the lumen. A characteristic rejuvenescence takes place at an angle of 90-120°.

Material. — Forty seven damaged corals, 23 peels, 5 thin sections.

Description. — Corallites low, widely conical or elongate, slender, slightly bent. A characteristic, geniculate bend of corallite may occur very early at a height of 7 mm, or late with a length of 28 mm. In each case, calyx is obscured by epitheca and a rejuvenated individual grows marginally. Epitheca thick, smooth, only transversally striated. Calyx shallow, with a narrow, flat bottom. Some corallites have a long, elliptical talon, in some others talon is hardly visible.

Transverse section. Corals round in transverse section, with a thick epitheca. Septa short, having two different lengths. Minor septa appear early and with a diameter of 6 mm already enter tabularium. Number of septa with a corresponding diameter is shown in Text-fig 35. Growing of septa allometrically positive. In the place of the bend, long septa are overlapping the underlaying part of corallite.

Longitudinal section. Structure of tabularium considerably variable. Tabulae may be as regular as ladder rungs, widely spaced or concentrated and having many accessory plates. In the place, where corallite is bent, tabulae are concentrated, incomplete and with many accessory plates. Between part of corallite overlapping the underlaying part, there is only a single epitheca and tabularium is of the nalivkinelloid type.

Variability range very wide. Variable are the shape of corallite, the phenomenon of rejuvenescence and the length of major and minor septa. Likewise, tabularium has frequently a very variable structure.

Ontogeny (Text-fig. 35 B_1-B_5, *C*). — 1) *Nepionic stage* is visible in a weathered proximal end of the specimen No. Tc-3/776. In this stage, diameter of coral amounts to 0.8 mm and number of septa, combined to form a stereocolumella, six. 2) *Early-neanic stage.* With a diameter of 1.5 mm, coral has about 8 septa. Axial tube, 1 mm in diameter is surrounded by a discontinuous cyatotheca. Talon narrow, semilunar. 3) *Mid-neanic stage* being higher, 1.8 mm above the base. Diameter of coral amounts to 2.5 mm, number of septa — to 12. Cyatotheca closed and surrounding axial tube 1.6 mm in diameter. 4) *Early-ephebic stage* begins at a height of 2.4 mm above the base. Diameter — 2.5 mm, 12 septa. Minor septa and cyatotheca lacking.

Remarks. — The geniculate shape, budding and early appearance of minor septa are characters of this species. Measurable characters are given in table (p. 94).

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure G, exposure I, beds 3-1; exposure II, beds N-K, F, C and A; exposure III, beds 45-43, 28 and 16. Lower Famennian, *quadrantinodosa* Zone. The specimen, found by J. Czarnocki and labelled by him "*Wocklumeria* beds", comes from Kowala, Upper Famennian, *costatus* Zone.

(?)*Gorizdronia* sp.
(Text-fig. 35 *H*)

Material. — Two specimens of which four peels were made.

Description. — Corallites widely conical. One of the specimens is 13 mm high and, at distal end, 12 mm in diameter. Tabulae are frequently complete, flat and, on the periphery, with accessory plates. On the basis of a fragmentary transverse section, it has been found that there were only short septa uniform in length.

Remarks. — Neither the ontogeny nor a complete transverse section being known, the present writer tentatively assigns these two specimens to the genus *Gorizdronia*.

Occurrence. — Poland: Gałęzice (Besówka), bed 6 and the dump; Upper Famennian, *velifera* Zone.

Genus *Nalivkinella* Soshkina, 1939
(Type species: *Nalivkinella profunda* Soshkina, 1939)

1939. *Nalivkinella;* E. D. Soshkina, Verchnedevonskie..., p. 44.
non 1951. *Nalivkinella*; E. D. Soshkina, Pozdnedevonskie..., p. 31.
non 1952. *Nalivkinella*; E. D. Soshkina, Opredelitel..., p. 66.
1956. *Nalivkinella*; D. Hill, Rugosa..., p. F258.
1962. *Nalivkinella*; E. D. Soshkina, T. A. Dobroljubova & N. V. Kabakovitsh, Podklass..., p. 321.
non 1964. *Nalivkinella*; W. A. Oliver; A new species..., p. 866.
non 1965. *Nalivkinella*; J. Kullmann, Rugose Korallen..., p. 100.
non 1965. *Nalivkinella*; V. A. Ivania, Devonskie korally..., p. 19.

Species assigned: *Nalivkinella profunda* Soshkina, 1939; *N. rariseptata* n.sp.

Stratigraphic and geographic range: Famennian of Ural and of the Holy Cross Mountains.

Diagnosis. — See Soshkina (1939, p. 43). Microstructure of wall laminar-wavy, of septa — lamellar.

Remarks. — A peripheral, vertical row of flat, vesicular, periaxial tabulae, which form cyatotheca is, in the present writer's opinion, a main diagnostic character. This character was emphasized by Soshkina (1939, pp. 44 and 59) who, however, later (1951, 1952) changed the diagnosis, determining tabulae as complete. In the Famennian material from Poland, there are, however, the following two types of similar corals: 1) corallites with a structure in conformity with Soshkina's (1939) diagnosis, having incomplete tabulae (periaxial, vesicular and forming cyatotheca) and considered by the present writer to be *Nalivkinella*; 2) corallite, which mostly have complete tabulae and a short lasting cyatotheca and assigned by the present writer to new genus *Gorizdronia*. On the basis of these two forms, the present writer considers all forms, described in literature and which having their morphology in conformity

with that of the type species *N. profunda* Soshkina, 1939, as belonging to the genus *Nalivkinella*. The species *N. echoense* Oliver, 1964, having different ontogeny and lonsdaleoid dissepiments, does not belong to *Nalivkinella*, the same as *N. pauciseptata* Kullmann, 1965 is not a representative of this genus, since its tabulae are complete and trapezoidal. *N. breviseptata* Ivania, 1965 having complete septa and tabulae is perhaps a representative of the genus *Gorizdronia* n.gen.

Nalivkinella profunda Soshkina, 1939

(Text-figs. 36, 37 *D*, *E*, 38 *F*, 39; Pl V, Fig. 1; Pl. VII, Fig. 11)

1939. *Nalivkinella profunda* Soshkina; E. D. Soshkina, Verchnedevonskie..., p. 44, Pl. 11, Figs. 91-95.

1956. *Nalivkinella profunda* Soshkina; D. Hill, Rugosa..., p. F258, Figs. 174, 10 a-c.

1962. *Nalivkinella profunda* Soshkina; E. D. Soshkina, T. A. Dobroljubova & N. Kabakovitsh, Podklass..., Figs. 62 a, b.

non 1951. *Nalivkinella profunda* Soshkina; E. D. Soshkina, Pozdnedevonskie..., p. 33, Text-fig. 15; Pl. 1, Figs. 1-5.

non 1952. *Nalivkinella profunda* Soshkina; E. D. Soshkina, Opredelitel..., p. 66, Pl. 2.

Material. — Thirty nine specimens, 32 peels and 3 thin sections. All specimens strongly damaged.

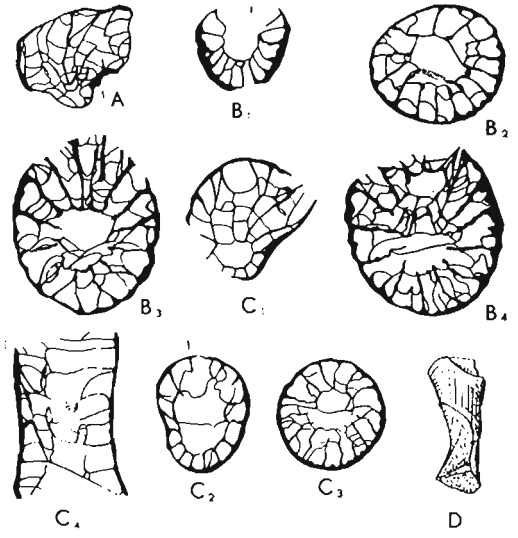

Fig. 36. — *A-D Nalivkinella profunda* Soshkina: *A* proximal end with talon, late-neanic stage (Kadzielnia G; Z. Pal. P. Tc No. 3/95), × 2; B_1 transverse section, final neanic stage, B_2 ephebic stage, B_3-B_4 ephebic stage with a peripheral bud (Kadzielnia G; No. 3/27), × 2.5; C_1-C_3 successive stages of the ontogenetic development, C_1 mid-neanic stage, C_2 final neanic stage, C_3 ephebic stage, C_4 longitudinal section (Kadzielnia I, bed 2; No. 3/461), × 4; *D* diagrammatic drawing of a coral (Kadzielnia I, bed 3; No. 3/757), nat. size.

Description. — Specimens subcylindrical, slightly bent, covered with a thick epitheca which has transverse, ridgelike swellings. The phenomenon of rejuvenescence occurs along with a less frequent budding. Calyx broken off in all specimens, talon, preserved in some of them, is narrow- or wide-elliptical. The best-preserved specimen is 14 mm long and 9 mm in diameter. The longest diameter met with amounts to 12 mm.

Transverse section. In transverse section, coral suboval or round. Epitheca thick. Triangular bases of septa are of the epithecal origin. Major septa long (equalling 1/3 of the diameter), thin, here and there bent in a zigzag manner. Their peripheral and axial ends are slightly thickened. In countercardinal quadrants septa are more concentrated than in cardinal quadrants. In some, mature specimens cyatotheca is continuous, in others- only in countercardinal quadrants. Septa inserted in an allometrically positive way (Text-fig. 39). Minor septa appear cyclically as short slats, slightly more conspicuous in countercardinal quadrants.

Longitudinal section is in conformity with Soshkina's illustration (1939, Pl. 11, Fig. 95). Widely spaced, flat, axial tabulae rest with their edges against the peripheral row of vesicular tabulae. Vesicles are more densely distributed and horizontal. Their periaxial walls form a more or less continuous cyatotheca.

Variability range is little-known, this fact being due to a scarce and strongly damaged material. Mature specimens have a variable thickness of skeletal elements, variable length of septa, continuity of axial wall; density and arrangement of tabulae.

Ontogeny (Text-figs. 36 A,B_1-B_2, C_1-C_3; 37C). — 1) *Mid-neanic stage* is the youngest preserved in the material examined. Axial tube is 1 mm in diameter. There are 12 septa and a wide talon. 2) *Final-neanic stage* of a coral 3.1 mm in diameter, with densely arranged major septa, which reach axial tube on the side of countercardinal quadrants and with widely spaced septa in cardinal quadrants.

Budding (Text-fig. 36 B_3-B_4). Serial sections depict the development of the corallite from the final-neanic to the ephebic stage; with 5 mm in diameter, it develops a bud on the periphery, on the side of cardinal septum and amidst a dense tabular tissue.

Remarks. — *N. profunda* from Famennian of the Holy Cross Mountains is conspecific with the form from Ural, which was found by the present writer after she compared them with the photographs of the holotype of *N. profunda* (taken by J. Fedorowski during his visit to Moscow). The similarity is observed in shape, septal index, structure of septa and tabularium. *N. profunda* differs from *N. rariseptata* n.sp. in a more continuous axial tube, longer major septa (major septum $> 1/2$ r). In *N. rariseptata* septa are very short (major septum $< 1/2$ r).

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure G, exposure I, beds 4-1; exposure II, beds N-K and A; exposure III, bed 46 and the dump; Lower Famennian, *quadrantinodosa* Zone. U.S.S.R.: Eastern slopes of the Ural Mountains; Famennian.

Nalivkinella rariseptata n.sp.
(Text-figs. 37 *A-C, F*, *38 A-E*, 39; Pl. VII, Fig. 9; Pl. VIII, Fig. 5)

Holotype: Specimen Z. Pal. P. Tc No. 3/39; Text-fig. 38 *A*.
Type locality: Kielce (Kadzielnia quarry), exposure G.
Type horizon: Lower Famennian, *quadrantinodosa* Zone.
Derivation of the name: Lat. *rarus* — after rare septa.

Diagnosis. — A *Nalivkinella* reaching 17 mm in length and having, with a diameter of 8 mm, 18 short major septa and hardly visible minor septa. Cyatotheca poorly developed.

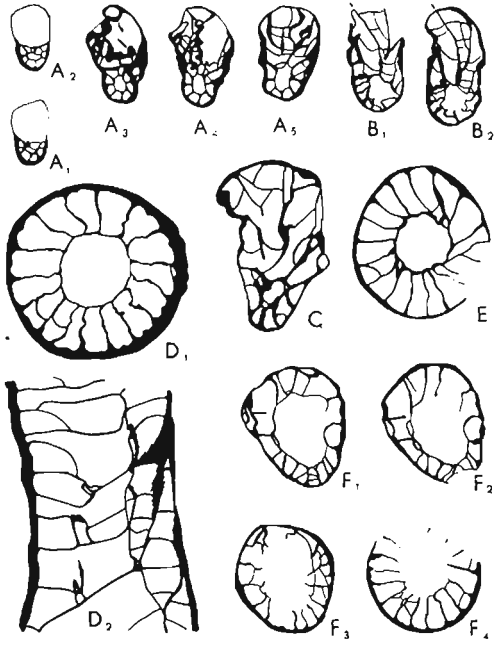

Fig. 37. — *A-C, F Nalivkinella rariseptata* n.sp.: A_1-A_5 successive stages of the ontogenetic development, A_1 early-neanic stage, A_2-A_5 mid-neanic stage (Kadzielnia I, bed 3; Z. Pal. P. Tc No. 3/758), × 2.5; B_1-B_2 further mid-neanic development stages (Kadzielnia III, bed 46; No. 3/1873), × 2.5; *C* mid-neanic stage with a long talon (Kadzielnia II, bed K; No. 3/1106), × 4; F_1-F_3 successive transverse sections, final neanic stage; F_4 ephebic stage (Kadzielnia G; No. 3/59) × 2.25.
D-E Nalivkinella profunda Soshkina: D_1 transverse section of a mature individual with axial tube closed (Kadzielnia I, bed 2; No. 3/633), × 3.5; D_2 longitudinal section (Kadzielnia I, bed 2; No. 3/461 × 3.5; *E* transverse section of a corallite with axial tube closed (Kadzielnia G; No. 3/59), × 2.25.

Material. — About 200 fragmentary, mostly recrystallized specimens, 30 per cent of them represented by very small remains. Calyx not preserved, nepionic stage lacking likewise. Fourty eight peels of transverse and longitudinal sections, 5 thin sections.

Description. — Corallites small, subcylindrical. Talon varying in shape from large, elliptical to narrow, fissurelike, depending on an object to which it is attached (brachiopods or corallites). Epitheca thick, contracted, with contractions oblique to talon. The phenomenon of rejuvenescence frequent, budding less so. Proximal end spurlike, and inclined towards talon.

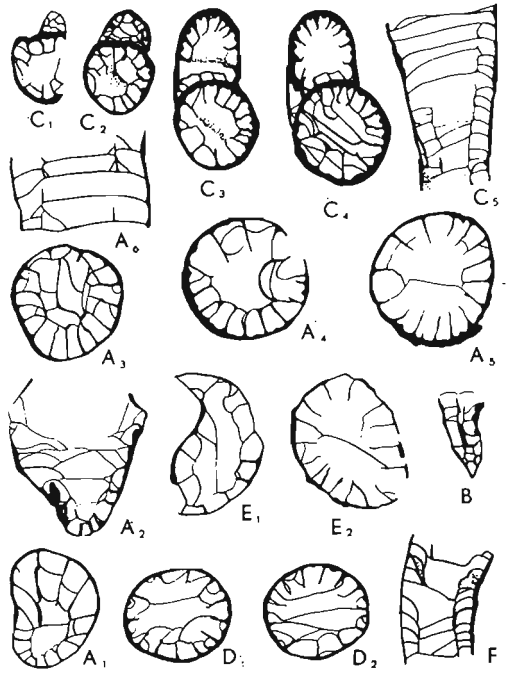

Fig. 38. — *A-E Nalivkinella rariseptata* n.sp.: A_1-A_6 successive transverse sections showing the ontogenetic development, A_1-A_2 late neanic stage, A_3-A_4 early ephebic stage, A_5 ephebic stage, A_6 longitudinal section (Kadzielnia G; Z. Pal. P. Tc No. 3/39), × 2.5; *B* a corallite in the early neanic stage with a long, grooved talon (Kadzielnia, the dump; No. 3/1666), × 3; C_1-C_5 successive stages of the ontogenetic development of a coral attached to *N. rariseptata* n.sp., *C* early neanic stage, C_2-C_4 neanic stage, C_5 longitudinal section with cyatotheca, here and there with complete tabulae (Kadzielnia I, bed 3; No. 3/756), × 2.5; D_1-D_2 transverse sections of a mature individual (Kadzielnia I, bed 3; No. 3/758), × 2; E_1 late-neanic stage, E_2 final neanic stage (Kadzielnia I, bed 3; No. 3/833), × 2.25.

F Nalivkinella profunda Soshkina, longitudinal section with an almost closed cyatotheca (Kadzielnia G; No. 3/1), × 2.

Transverse section. Epitheca thick, with triangular knobs on its inner surface which make up bases of septa. Major septa thin, very short, mostly freely terminated axially. If such is the case, cyatotheca is lacking.

Minor septa, appearing cyclically, are scanty and only in some places enter the lumen. The n/d index for a few specimens is given in Text--fig. 39.

Longitudinal section. Axial tabulae spaced, horizontal, leaning with their margins against vesicular periaxial tabulae. Tabulae are here and there complete.

Variability range wide. The index n/d very variable (Text-fig. 39). Septa varying in length and thickness. The structure of tabularium is also variable.

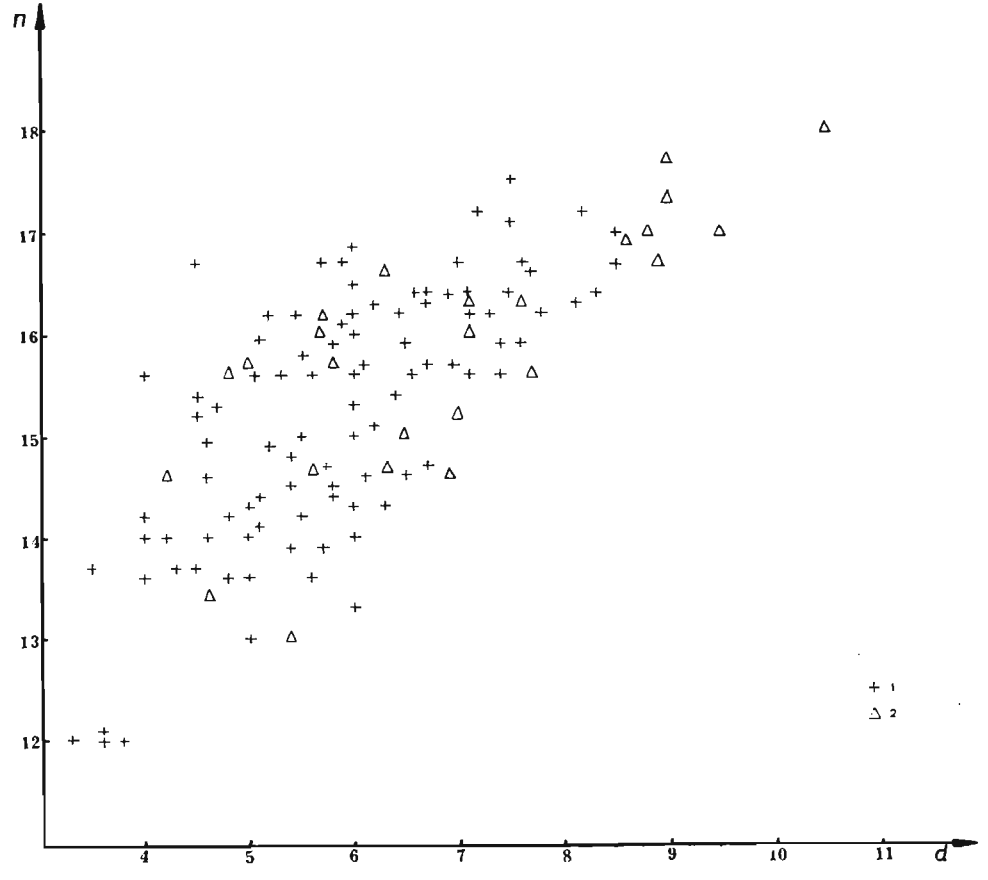

Fig. 39. — Scatter diagram of n/d (n — major septa): *1 Nalivkinella rariseptata* n.sp., *2 N. profunda* Soshkina.

Ontogeny was traced on a corallite which was probably attached directly to the sea bottom. (Fig. 37 *A-C,F*; 38 A_1-A_5, *B*,C_1-C_4,*E*). 1) *Nepionic stage.* Proximal end 0.5 mm in diameter, 6 protosepta combined to form a stereocolumella. This stage is visible on a few corallites and disappears after a slight polishing of proximal end. 2) *Early-neanic stage.*

A wide talon is separated by the wall from proximal end, 6-8 septa reach the cyatotheca of tube which is 0.5-0.6 mm in diameter. 3) *Mid-neanic stage*. The wall, separating proximal end from talon, disappears, axial tube extends, septa enter talon. 4) *Late-neanic stage*. The cross section through coral and talon is wide, triangularly-oval, axial tube occupies large part of corallite and talon, its longer diameter amounting to 3 mm and number of septa — to 14. 5) *Early-ephebic stage*. Coral slightly oval in cross section, cyatotheca persisting but discontinuous on the side of the cardinal quadrants. Since there are no stages 3 and 4 when the larva attaches to another corallite the ontogenetic development is abbreviated.

Remarks. — *N. rariseptata* n.sp. has several characters in common with *Gorizdronia profunda* (Soshkina), such as complete and strongly atrophied major and minor septa and a cyatotheca which almost does not occur in the ephebic stage. Differences may be observed in the early-ephebic stage when cyatotheca occurs yet on the side of countercardinal quadrants and in longitudinal sections in which a vertical row of periaxial tabulae forming cyatotheca is locally visible. The coral illustrated by Różkowska (1967, Pl. 1, Fig. 4 A-C) belongs to the species described above.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure G, exposure I, beds 4-1; exposure II, beds N-K, D and A; exposure III, beds 46, 43, 41 and 25; Lower Famennian, *quadrantinodosa* Zone.

Family **Kielcephyllidae** n.fam.

Derivation of the name: after the genus *Kielcephyllum* n.gen.
Genera assigned: *Kielcephyllum* n.gen., *Kozlowskinia* n.gen.
Stratigraphic and geographic range: Lower Famennian, Kielce, Holy Cross Mountains.

Diagnosis. — Solitary corals with hexacoralloid characters, covered with rings of epitheca or an epitheca reaching under the base of arcuate, raised, distal ends of septa. Major septa complete or lonsdaleoid; minor septa either occur or are reduced. Dissepimentarium consisting of some rows of vesicles which grow vertically upwards; axial tabularium formed by horizontally arranged, flat or vesicular tabulae, periaxial tabularium, horizontal or oblique plates. Development of the metriophylloid-nalivkinelloid type. Axial tube, surrounded by a cyato-stereotheca, disappears early or reaches as far as under the base of calyx. Microstructure of epitheca laminar, of septa — trabecular.

Remarks. — On account of the presence of axial tube, surrounded by cyatotheca, this family is most similar to Amplexocariniidae, but displays a fundamentally different plan structure, which differs it from all other

families of the superfamily Lindstroemiicae. This is a hexacoralloid structure, expressed in the structure of epitheca and in the growing of septa and dissepiments which display a vertical tendency. Phillipsastraeicae Roemer are other corals with the hexacoralloid structure which occur in Famennian. They were common in the Middle and Upper Devonian and, in particular, in Frasnian. Their last representatives, altogether four specimens passed to Famennian.

Genus *Kielcephyllum* n.gen.

(Type species: *Kielcephyllum cupulum* n.sp.)

Derivation of the name: *Kielcephyllum*, after the city of Kielce, Poland.

Species assigned: *Kielcephyllum cupulum* n.sp., *K. confluens* n.sp., *K. densum* n.sp.

Stratigraphic and geographic range: Lower Famennian of the Holy Cross Mountains.

Diagnosis. — Solitary, large, cylindrical corals having only major septa and mostly of the lonsdaleoid type. Distal edge of septa arcuate and raised above epitheca or flat. Tabularium and dissepimentarium dense, vesicular, with many accessory plates. Microstructure of septa trabecular.

Remarks. — The following characters differ *Kielcephyllum* n.gen. from *Kozlowskinia* n.gen.:

Genus	Epitheca	Axial tube	Major septa	Minor septa
Kielcephyllum n.gen.	reaching the base of arcuate distal ends of septa	round, disappearing early	lonsdaleoid	completely atrophied
Kozlowskinia n.gen.	rings	rosettelike, reaching the base of calyx; septa entering it	complete	well-developed

The hexacoralloid type of structure is a character in which *Kielcephyllum* n.gen. differs from other Famennian genera with lonsdaleoid septa, such as, *Guerichiphyllum* n.gen., *Hillaxon* n.gen., *Tabulophyllum* Fenton & Fenton and *Smithiphyllum* Birenheide (Text-fig. 6).

Kielcephyllum cupulum n.sp.

(Text-figs. 40 *A-F*, 41; Pl V, Figs. 2-3; Pl. VII, Fig. 2; Pl. VIII, Fig. 9)

Holotype: Specimen Z.Pal.P. Tc No. 3/1605; Text-fig. 40 *C*.

Type horizon: Lower Famennian, *quadrantinodosa* Zone.

Type locality: Kielce (Kadzielnia quarry), the dump.

Derivation of the name: Lat. *cupulum* = small vault, after distal ends of septa raised high above the epitheca.

Diagnosis. — *A Kielcephyllum* with high distal ends of septa which, with a diameter of 16 mm, has 24 septa. Dissepimentarium convex, descending steeply towards the periphery. Tabularium plano-convex, concentrated by many accessory plates. Calyx narrowed.

Material. — Fifty, mostly strongly damaged, specimens. Distal end preserved as an exception, nepionic stage never preserved. Eighty peels with transverse and longitudinal sections and 27 thin sections were made.

Description. — Corals elongate, subcylindrical, with sharp-edged, transverse collars. The surface of epitheca smooth with visible growth wrinkles. Distal ends of septa, raised high, embrace a cavity which is narrow since calyx is contracted. Talon elongate, elliptical, when larva was directly attached to the bottom. Sometimes, larvae were attached to other corallites and in such cases talons grew around them.

Transverse section. Corallites round in transverse section, with a thin epitheca, where the latter is lacking septocostae are visible. Only major septa are present. Septa, complete or lonsdaleoid, may be separated from the wall by 1-8 rings of vesicles. Peripheral and axial ends of septa sometimes are slightly thickened and, together with tabulae, may form a not continuous stereo-cyatotheca around the axis. Dissepiments are either axially convex or parallel to the sides of septa. The index n/d is shown in Text-fig. 41. Number of septa increasing in an allometrically positive way. The ratio of the diameter of axial tube and that of corallite (c:d) is shown in Text-fig. 41. The diameter of tube increasing in an allometrically negative way and equalling about 1/3 of the diameter of the coral.

Longitudinal section. Dissepiments and vesicles raised high and, subsequently, steeply sloping outwards and to the wall. Tabularium narrower or wider, horizontal, considerably condensed. Axial tube indistinct.

Variability range extensive, displayed in the structure of septa, spacing of lonsdaleoid vesicles and tabulae and width of tabularium.

Ontogeny (Text-fig. 40 *A-B*). — 1) *Early-neanic stage.* Proximal end 1.5 mm in diameter, with 6 protosepta and a closed axial tube 0.5 mm in diameter, separated from talon by a continuous wall. Talon wide, elliptical, 10 mm long. 2) The individual development of a coral overgrowing by talon *Nalivkinella rariseptata* n.sp. is shown in Text-figs. 40*B*. Proximal coral end invisible, only the talon which gradually embraces *N. rariseptata* n.sp. around its circumference. In a cross section cut higher up, *N. rariseptata* n.sp., which serves as a substratum, is already invisible since its calyx is obscured by a dense tissue of talon.

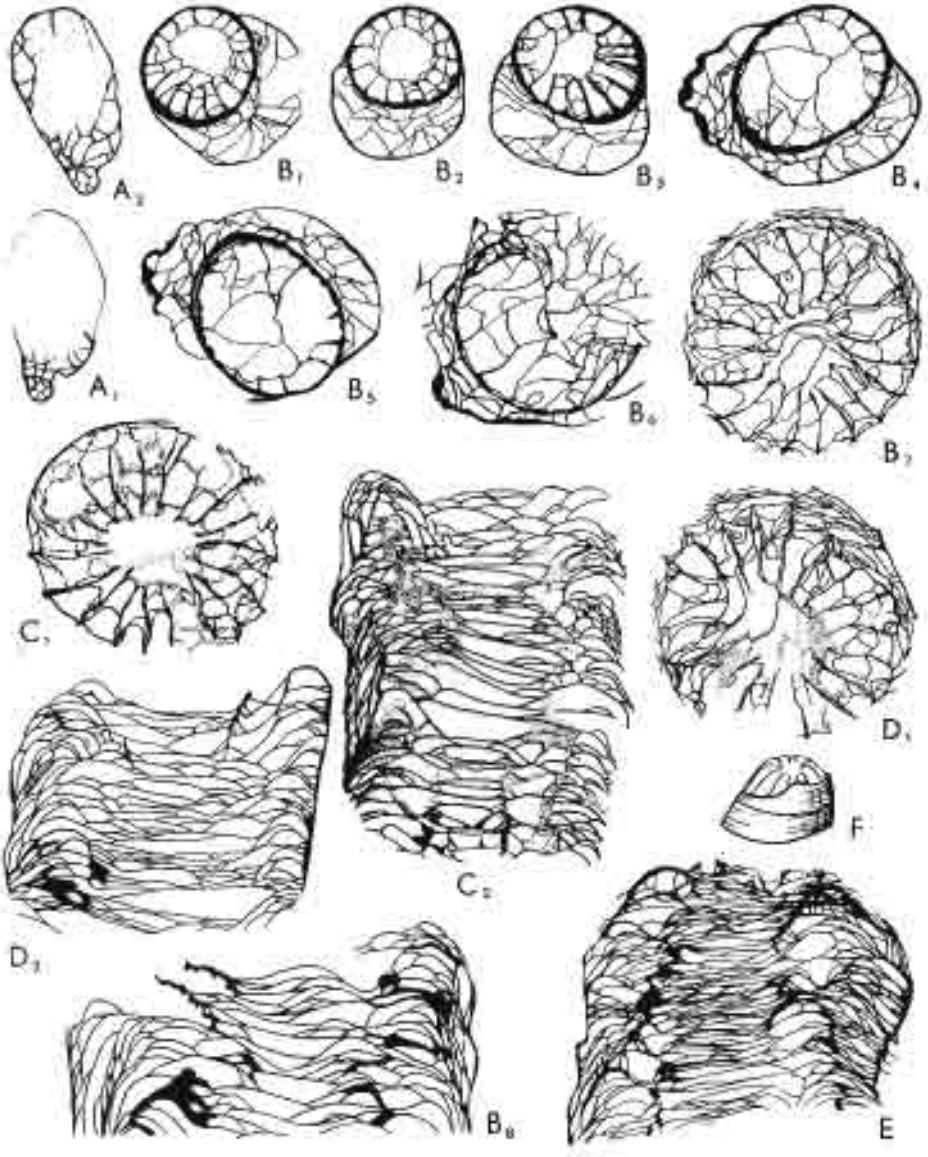

Fig. 40. — *Kielcephyllum cupulum* n.gen., n.sp.: A_1-A_2 transverse sections of a coral, in the early-neanic stage, with a small proximal end and large talon (Kadzielnia, the dump; Z. Pal. P. Tc No. 3/1601), nat size; B_1-B_8 successive stages of the ontogenetic development of a coral overgrowing *Nalivkinella rariseptata* n.sp., B_1-B_4 talon overgrowing around the coral, B_5 talon obscuring calyx, B_7 ephebic stage, B_8 longitudinal section (Kadzielnia III, bed 46; No. 3/1861), B_1-B_3 × 1.25, B_5-B_7 nat. size, B_8 × 1.5; C_1 transverse section, C_2 longitudinal section (Kadzielnia, the dump; No. 3/1805), holotype, nat. size; D_1 transverse section, the peripheral ends of septa in the form of costae, vesicles lonsdaleoid, D_2 longitudinal section, axial tabularium wide, vesicular, periaxial domelike, vesicular (Kadzielnia III, bed 46; No. 3/1870), nat. size; *E* longitudinal section of a coral with a very dense and flat axial tabularium, periaxial convex sloping outwards (Kadzielnia, the dump; No. 3/1678), nat. size; *F* a diagrammatic drawing of distal end of a coral having a narrow cavity of calyx, distal ends of septa raised to this cavity in a domelike manner and with epitheca terminating low (Kadzielnia III, bed 43; No. 3/1789), × 0.5.

Remarks. — The species described above is most similar to *K. confluens* n.sp. but reaches larger dimensions, has septa raised higher up at the distal end and its dissepimentarium is more convex. Axial tube is wider and less markedly delimited. It differs from *Kozlowskinia flos* n.sp. in the presence of lonsdaleoid vesicles and absence of minor septa, but is similar to this species in a general shape.

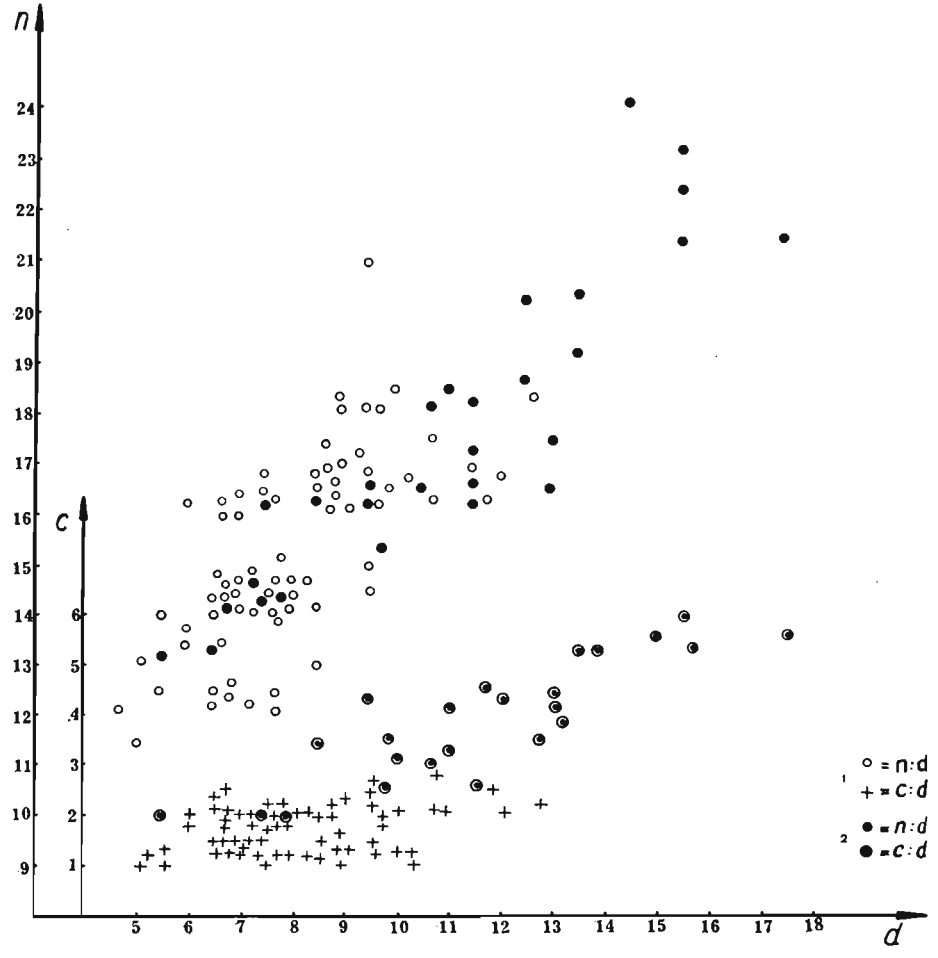

Fig. 41. — Scatter diagram of n/d and c/d: *1 Kielcephyllum confluens* n.sp., *2 K. cupulum* n.sp.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure G; exposure I, beds 3-1; exposure II, beds N, M, L, K and D; exposure III, beds 46-43 and dump; Lower Famennian, *quadrantinodosa* Zone.

Kielcephyllum confluens n.sp.
(Text-figs. 41, 42; Pl. V, Figs. 4-6; Pl. VIII, Fig. 7)

Holotype: Specimen Z.Pal.P. Tc No. 3/309; Text-fig. 42 *A*.
Type horizon: Lower Famennian, *quadrantinodosa* Zone.
Type locality: Kielce (Kadzielnia quarry), exposure I, bed 1.
Derivation of the name: Lat. *confluere* — after septa confluent around the axis.

Diagnosis. — Corals in which the phenomenon of rejuvenescence occurs frequently. Epitheca reaching the base of calyx, which has low arcuate ascending distal ends of septa, a narrow central cavity and a not continuous axial phyllotheca or stereotheca. Cardinal septum slightly longer, situated in a wide fossula. Septal index = 18/9. Dissepimentarium slightly flattened, tabularium narrow, flat, axially somewhat concave.

Material. — About 180 specimens, frequently with a well-preserved calyx, but damaged proximal end, 93 peels and 15 thin sections, transverse and longitudinal.

Description. — Corallites subcylindrical, with a wide talon. Epitheca with growth wrinkles (8—10) between transverse contractions, which indicate rejuvenescence and which are slightly withdrawn towards talon. Septa raised above the bottom of calyx and steeply sloping towards a narrow cavity. Proximal end sharp, bent towards talon.

Transverse section. Septal index n/d — shown in Text-fig. 41. The most frequent are corallites 7-8 mm in diameter and having 12-16 septa. In such cases, axial tube is 2.2 mm in diameter. A verticil of lonsdaleoid vesicles occurs when the transverse section passes through the corallite below the line of rejuvenescence. Septa bent, with axial ends slightly swollen. Dissepiments flatly adhering to them give the impression that they are split. A not continuous phyllotheca or stereotheca occurs axially. Cardinal septum, slightly longer and thicker than the adjoining metasepta, is situated in an open, fairly wide fossula. Some septa are slightly swollen in a fusiform manner halfway their length, some others are thick all over their length.

Longitudinal section. Dissepimentarium flattened, vesicular; tabularium narrow, tabulae vesicular, more frequently trapezoidal, axially slightly depressed. Many accessory, vesicular plates.

Variability range wide, concerning all skeletal elements: septa variable in thickness and length, "split" or smooth; cavity variable in diameter; lonsdaleoid vesicles widely spaced or gathered in 2-3 verticils; tabularium almost not separated from dissepimentarium or markedly separated from it.

Ontogeny (Text-fig. 42 *B-C*) of the metriophylloid-nalivkinelloid type. 1) *Nepionic stage* visible only on the weathered specimen. Proximal end 0.7 mm in diameter, with a thick epitheca and 5-6 septa connected

axially. 2) *Early-neanic stage.* Talon, together with proximal end, is 6 mm in longer diameter, proximal end 0.6 and axial tube 0.1 mm in diameter. Wall of tube interrupted cyato-phyllotheca. Proximal end closed by a thick wall. 3) *Mid-neanic stage.* Proximal end open towards talon. Diameters: of talon with proximal end — 7 mm, of proximal

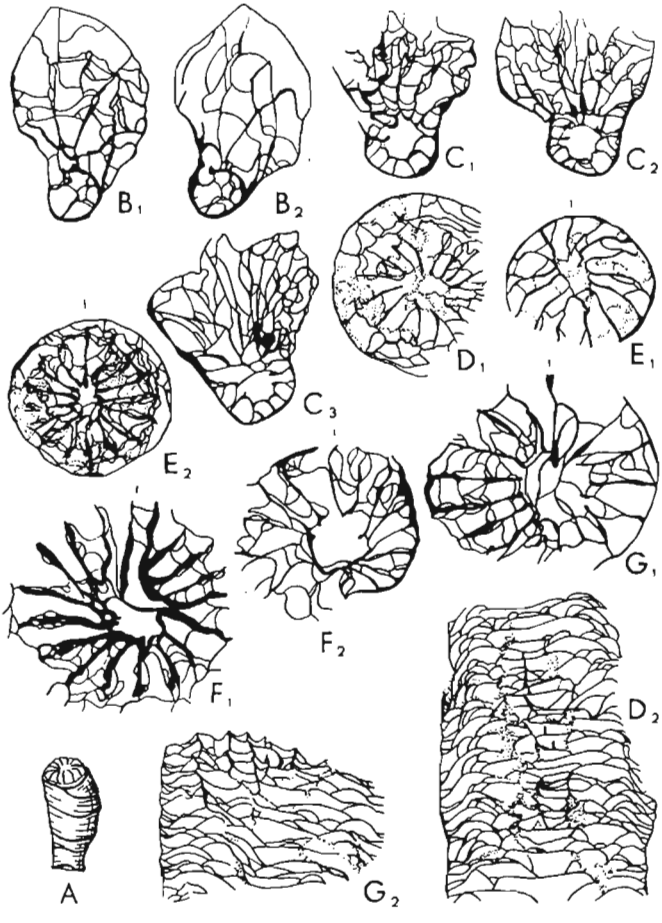

Fig. 42. — *Kielcephyllum confluens* n.gen., n.sp.: *A* a diagrammatic drawing of the shape of coral, calyx hexacoralloid with septa raised in a domelike manner over epitheca (Kadzielnia I, bed 1; Z. Pal. P. Tc No. 3/309), about × 0.5; B_1-B_2 transverse sections, early-neanic stage (Kadzielnia I, bed 2; No. 3/936), × 3; C_1-C_2 transverse sections, mid-neanic stage, C_3 late-neanic stage (Kadzielnia G; No. 3/220), × 2; D_1 transverse section of a mature individual with a wide verticil of lonsdaleoid vesicles and with a narrow cavity of calyx, D_2 longitudinal section with a wide axial and vertically raised periaxial tabularium (Kadzielnia II, bed K; No. 3/923), approx. × 2; E_1-E_2 transverse sections, a stage after (E_1) and before rejuvenescence (E_2), with a wide verticil of lonsdaleoid vesicles and with cardinal fossula (Kadzielnia II, bed N; No. 3/1464), × 2; F_1-F_2 transverse sections, ephebic stage, F_1 septa thick, conspicuous, cardinal septum in an open fossula, F_2 septa thin (Kadzielnia II, bed N; No. 3/1406), × 2; G_1 transverse section with a conspicuous cardinal septum, G_2 longitudinal section (Kadzielnia, the dump; No. 3/1605), nat. size.

end — 2.3 mm, of axial tube — 0.8 mm. 4) *Late-neanic stage.* Diameter of talon with proximal end about 7 mm, of proximal end 3 mm. Wall of axial tube open towards talon. 5) *Early-ephebic stage.* Diameter of corallite, which is already almost circular in cross section, amounts to 5 mm. Bases of septa resting on the wall. Their axial ends, inclined to each other, form an almost continuous cyato-phyllotheca. Cardinal septum situated in a fossula.

Remarks. — *K. confluens* n.sp. is very similar to *K. cupulum* n.sp., but differs from it in the following characters (dimensions in mm):

Species	Max. diameter of coral	Rejuv-enes-cence	Max. diameter of cavity	Distal ends of septa	Wall of axial tube	Max. septal index
Kielcephyllum confluens n.sp.	13.2	frequent	2.0	low	discont-inuous	n/d = 18/13
Kielcephyllum cupulum n.sp.	18.0	rare	wide, to 6.0mm	high	hardly marked	n/d = 21/18

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure G; exposure I, beds 2-1; exposure II, beds N-K and D; exposure III, beds 46, 45, 43, 28 and 25; Lower Famennian, *quadrantinodosa* Zone.

Kielcephyllum densum n.sp.
(Text-fig. 43 *A-B*; Pl. IV, Figs. 5, 6)

Holotype: Specimen Z.Pal.P. Tc No. 3/1806; Text-fig. 43 *A*.
Type horizon: Lower Famennian, *quadrantinodosa* Zone.
Type locality: Kielce (Kadzielnia quarry), exposure III, bed 43.
Derivation of the name: Lat. *densus* — after densely crowded skeletal elements.

Diagnosis. — *Septal index* = 20/20. Tabularium consisting of densely crowded, vesicular or platelike tabulae, covered with many vesicular accessory plates. Dissepimentarium built of horizontally disposed semicircular vesicles, steeply sloping outwards to the wall.

Material. — Thirteen fragmentary specimens without proximal end and with calyx preserved in few cases only. Interiors recrystallized, microstructure destroyed. Fifteen peels and two thin sections transverse and longitudinal.

Description. — Corallites large, to 30 mm in diameter, subcylindrical, covered with a thick epitheca, which is transversely striated. Septa have low distal edges, arcuate and raised above the bottom of calyx. Axial cavity of calyx very narrow.

Transverse section. Corallites round in transverse section. Septa short, wavy, mounted on the wall, but mostly separated from it by lonsdaleoid vesicles, between septa there are visible dense tabulae, dissepiments and marginal vesicles. Peripheral parts of septa are mostly destroyed and only their axial parts are visible. Septal index = 20-24/20, although, due to a poor preservation state of corallites, it is not certain.

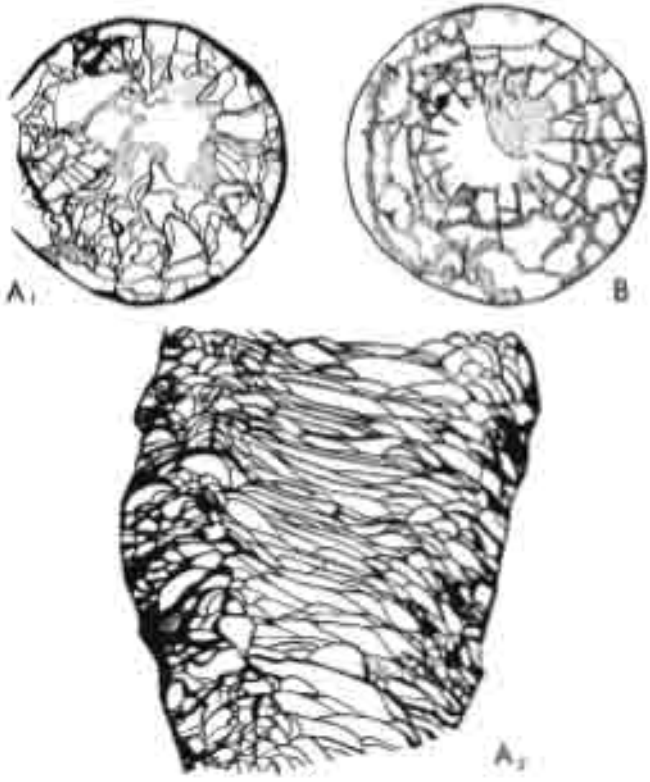

Fig. 43. — *Kielcephyllum densum* n.gen., n.sp.: A_1 transverse section, septa short, tabulae densely intersected, × 1.5; A_2 longitudinal section, crowded vesicular axial and perlaxial tabulae (Kadzielnia III, bed 49; Z. Pal. P. Tc No. 3/1806), holotype, × 1.75; *B* transverse section of a coral with a skeleton damaged by fossilization (Kadzielnia III, bed 46, No. 3/1845), × 1.5.

Longitudinal section. Corallite with a thick wall. Dissepimentarium, adhering to it, is wide, convex, consisting of vesicles variable in size and obliquely descending towards the wall. Some vesicles have thick walls. Tabularium occupies 1/3-1/2 of the width of corallite and consists of densely crowded, convex vesicles, trapezoidal plates and very numerous accessory vesicles.

Variability is considerable, although due to the recrystallization, its range is difficult to determinate. Variable are the length of septa, structure of tabularium and dissepimentarium.

Remarks. — This species distinguishes from other Famennian corals by its shape and dimensions. In these characters it is most similar to *Gorizdronia profunda* (Soshkina) from which it differs, however, in the presence of lonsdaleoid vesicles and in a hexacoralloid calyx. *K. densum* n.sp. also differs from the related species *K. cupulum* n.sp. in a smaller number of septa with a corresponding diameter, in larger dimensions and in lower arcs of distal ends of septa.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure III, beds 46, 43, 39; Lower Famennian, *quadrantinodosa* Zone.

Genus *Kozlowskinia* n.gen.

(Type species: *Kozlowskinia flos* n.sp.)

Derivation of the name: named in honour of Professor Roman Kozłowski, Warsaw, Poland.

Species assigned: *Kozlowskinia flos* n.sp., *K. phyllis* n.sp.

Stratigraphic and geographic range: Lower Famennian of the Holy Cross Mountains.

Diagnosis. — Corallites with a ringlike or less frequently, complete epitheca; septa complete of two, different lengths, here and there projecting outside the wall as costae. Major septa long, entering the stereocyatotheca around the axis. Minor septa reaching half the length of major septa. Cardinal septum slightly longer than adjoining septa and situated in a fossula. Tabulae either widely spaced or densely crowded, gathered in systems.

Remarks. — Corallites of this genus resemble those of the genus *Pterorrhiza* Ehrenberg, having a similar hexacoralloid structure displayed in the rings of epitheca, trabecular fans, convex distal ends of septa and in the dissepimentarium which reveals a tendency of a vertical growth. The difference lies, however, in the ontogeny which in *Pterorrhiza* is zaphrentoid and in *Kozlowskinia* n.gen. — nalivkinelloid. Characters which differ *Kozlowskinia* n.gen. from *Kielcephyllum* n.gen. are given in page 106.

Kozlowskinia flos n.sp.

(Text-figs. 44, 45; Pl. VI, Fig. 2; Pl. VII, Figs. 1, 8)

Holotype: Specimen Z.Pal.P. Tc No. 3/1898; Text-fig. 44 *E*.

Type horizon: Lower Famennian, *quadrantinodosa* Zone.

Type locality: Kielce (Kadzielnia quarry), the dump.

Derivation of the name: Lat. *flos* = flower, after the shape of a young corallite, which resembles a flower bud.

Diagnosis. — With a diameter of 9 mm, this *Kozlowskinia* has 12-16×2 septa. Skeletal elements mostly thin.

Material. — About 100 mostly well-preserved specimens complete with epitheca and calyx. In all specimens, the nepionic stage is lacking. 162 peels and 8 thin sections transverse and longitudinal.

Description. — Corallite subcylindrical, straight or slightly bent, with a small, round talon. The longest specimen (25.3 mm long) is 6.4 mm in diameter. Calyx contracted, resembling an opening flower bud. Epitheca, reduced to thin rings, mostly falls away and then paratheca plays the role of a wall, sometimes reaching as far as the base of calyx. Septa of two different lengths. Where the epitheca is lacking, septa are visible in the form of costae.

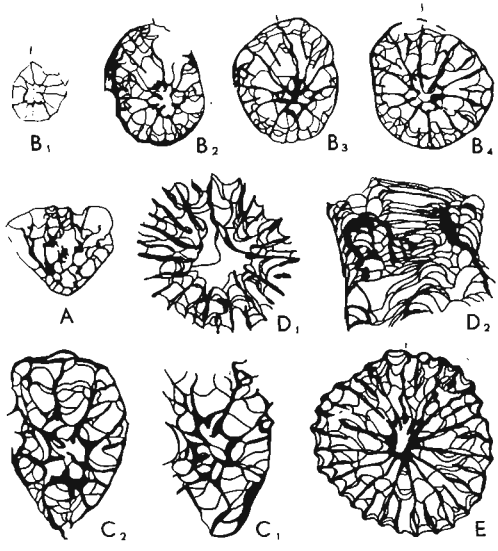

Fig. 44. — *Kozlowskinia flos* n.gen., n.sp.: *A* mid-neanic stage of a coral with cyatotheca and with proximal end situated close to the side of a wide talon (Kadzielnia II, bed N; Z. Pal. P. Tc No. 3/1477), × 2; B_1-B_4 serial transverse sections, B_1 neanic stage with a round talon surrounding axial tube and with a rosette-like cyatotheca, B_2-B_4 early-ephebic stage with septa of two different lengths (Kadzielnia II, bed L; No. 3/1393), B_1 × 3, B_2-B_4 × 2.5; C_1-C_2 sections of a mid-neanic stage representing a large, elliptical talon surrounding axial tube which is shaped like a rosette (Kadzielnia II, bed N; No. 3/1506), × 4.5; D_1 transverse section through the base of calyx, D_2 longitudinal section, axial tabulae crowded gathered in systems, dissepiments with a vertical tendency of growth (Kadzielnia I, bed 1; No. 3/231), × 2; *E* transverse section, ephebic stage peripheral ends of septa in the form of costae, wall of paratheca, septa of two different lengths, stereotheca surrounds axial tube, cardinal septum situated in fossula, intersections of tabulae and dissepiments dense (Kadzielnia, the dump; No. 3/1898), holotype, × 2.

Transverse section. Coral round in transverse section, surrounded by a thin epitheca. Where the epitheca is absent, septa project in the form of costae and paratheca replaces the wall. Major septa thin or thick, wavy, terminating freely around the axis or entering the stereo-cyatotheca. Cardinal septum mostly somewhat longer, situated in a narrow,

open fossula. The length of minor septa is equal to about a half of the length of major septa. Their costae are slightly lower. Axial tube may persist until the mature stage. Dissepiments form 1-3 verticils parallel to the edge of calyx. Some of them, situated more internally, are parallel to the sides of septa. Septal index shown in Text-fig. 45.

Longitudinal section. Dissepimentarium wide with semicircular periaxial dissepiments arranged vertically and with peripheral ones disposed obliquely outwards and downwards. Rare horseshoes occur among dissepiments . Tabularium variable in width, axial tabulae gathered in systems and periaxial ones are more widely spaced and vesicular.

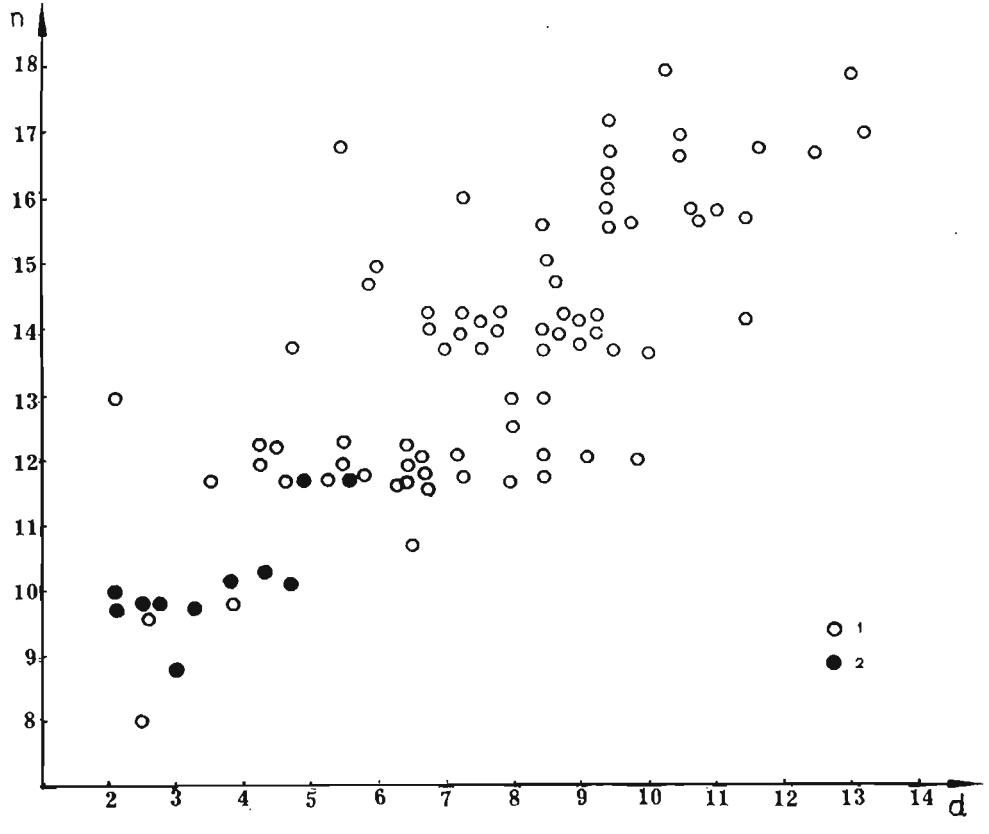

Fig. 45. — Scatter diagram of n/d (n — major septa): *1 Kozlowskinia flos* n.sp., *2 K. phyllis* n.sp.

Variability range is very wide. Variable are the shape of corallite, structure and length of epitheca, thickness and length of septa, width of dissepimentarium and density of tabularium.

Ontogeny (Text-fig. 44 *A-C*). — A young corallite has the form of a knob and resembles corals of the genus *Microcyclus* Meek & Worthen,

1868 having an identically flattened base, thick roller-like epitheca and distal septal ends raised above it in an arcuate manner. 1) *Nepionic stage* — not preserved. 2) *Mid-neanic stage.* Proximal end situated on the side of a wide talon, surrounded by a wall partly open towards talon, is 2×3 mm in diameter and has 10 septa. Axial tube 1 mm in diameter, round. 3) *Neanic stage.* This is only the proximal end, without talon, having a diameter of 2.3 mm and 11 septa of which protosepta enter a rosette-like tube which is 0.8 mm in diameter. 4) *Early-ephebic stage.* Coral elliptical in cross section, 5×6 mm in diameter. Minor septa appear cyclically. Axial tube, 1.3 mm in diameter, has a continuous stereo-cyatotheca shaped like a rosette with all the 11 major septa entering its inside.

In the genus *Kozlowskinia* n.gen., proximal end is rarely situated on the side of talon; more frequent is the phenomenon of talon surrounding on all sides the proximal end.

Remarks. — *K. flos* n.sp. differs from the related species *K. phyllis* n.sp. in larger absolute dimensions and larger number of thin septa which do not touch each other on the periphery.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure G; exposure I, beds 2-1; exposure II, beds N-F and C; the dump; exposure III, beds 46-45, 18 and 16; Lower Famennian, *quadrantinodosa* Zone.

Kozlowskinia phyllis n.sp.
(Text-figs. 45, 46; Pl. VI, Fig. 3; Pl. VII, Fig. 12)

Holotype: Specimen Z.Pal.P. Tc No. 3/218; Text-fig. 46 *B*.
Type locality: Kielce (Kadzielnia quarry), exposure G.
Type horizon: Lower Famennian, *quadrantinodosa* Zone.
Derivation of the name: Gr. *phyllis* = leaf.

Diagnosis. — Tiny cylindrical, straight corallites with epithecas shaped like rings. The largest specimens are 20 mm long and 6 mm in diameter, have 12×2 septa. On the peripheral and axial ends septa are thickened. Stereocolumella or axial tube surrounded by stereotheca.

Material. — Ten specimens fairly well-preserved but lacking proximal ends. Nine peels.

Description. — Corallites cylindrical, mostly 3-4 mm in diameter, with a contracted distal end. Epitheca thin (frequently destroyed), rings of epitheca preserved in some cases; in specimens lacking epitheca, there occur costae of two different thicknesses which correspond to septa of two different lengths.

Transverse section. Major septa bottlelike, with extended base and axial part thickened. On the periphery septa may be so extended that they contact each other and form a septotheca. Minor septa generally

short, blunt, sometimes slightly elongate. Between septa, 2-3 verticils of dissepiments are visible in some places. Stereocolumella or stereotheca occur axially, septa are sometimes free. Septal index shown in Text-fig. 45).

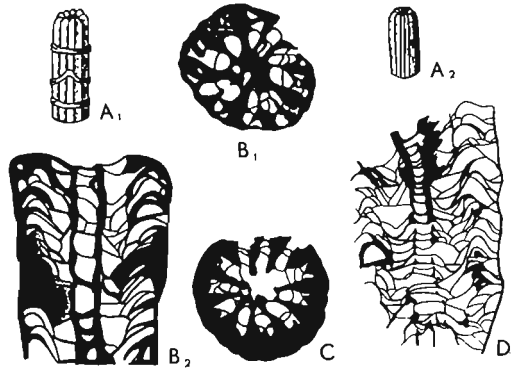

Fig. 46. — *Kozlowskinia phyllis* n.gen.. n.sp.: A_1 a diagrammatic drawing of a coral with the rings of epitheca, with septal costae and with a narrow cavity of calyx (Kadzielnia G; Z. Pal. P. Tc No. 3/1887), × 0.5, A_2 a coral without epitheca (Kadzielnia G, No. 3/217; B_1 transverse section with thick major and minor septa and stereocolumella, B_2 longitudinal section with a narrow axial tube surrounded by a thick stereotheca, axial tabulae horizontal, periaxial convex upwards (Kadzielnia G; No. 3/218), a holotype, × 5; *C* transverse section with thick septa--costae, (Kadzielnia I, bed 3; No. 3/677), × 3.5; *D* longitudinal section with a narrow axial tube and thin dissepiments raising in a domelike manner (Kadzielnia, the dump; No. 3/1903), × 2.

Longitudinal section. Tabularium axial, narrow, consisting of horizontal, narrow tabulae, surrounded by a thin or thick wall of axial tube. Periaxial part is concave and has horizontal accessory plates. Dissepimentarium consisting of 2-3 rows of semicircular or high, caplike vesicles, which steeply descend towards axis and outwards.

Variability range wide, expressed mostly in a smaller or larger deposit of stereoplasma.

Remarks. — The comparison of *K. phyllis* n.sp. and *K. flos* n.sp. was given with the description of the last-named species (p. 117). The corals illustrated by Różkowska (1967, Pl. 1, Fig. 5 A, B) belong to *K. phyllis* n.sp.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure G; exposure I, bed 2; exposure II, bed K; exposure III, beds 46, 45 and the dump; Lower Famennian, *quadrantinodosa* Zone.

Family **Adamanophyllidae** Vassiljuk, 1959

Genera assigned: *Prosmilia* Koker, 1924; *Adamanophyllum* Vassilyuk, 1959, *Pseudoclaviphyllum* Vassiljuk, 1964; *Tachyphyllum* Dobroljubova, 1962.

Stratigraphic and geographic range is wide, the representatives of this family being known from Lower Famennian to Middle Permian; Eurasia.

Diagnosis. — See Vassiljuk, 1959, p. 53.

Remarks. — Vassiljuk (1959) erected the family Adamanophyllidae for polycoeliid-like tetracorals with dissepiments. Major septa varying in length.

Genus *Prosmilia* Koker, 1924

(Type species: *Plerophyllum cyathophylloides* Gerth, 1921)

1921. *Plerophyllum*; H. Gerth, Die Anthozoen des Dyas..., p. 90.
1924. *Prosmilia*; E. M. J. Koker, Anthozoa uit net..., p. 28.
1928. *Plerophyllum*(?); A. W. Grabau, Palaeozoic corals..., p. 74.
1942. *Prosmilia*; O. H. Schindewolf, Zur Kenntnis..., p. 30.
1956. *Prosmilia*; D. Hill, Rugosa..., p. F261.

Species assigned: *P. cyathophylloides* (Gerth, 1921), *P. compressa Koker*, 1924, *P. fedorowskii* n.sp. and *P. tenera* n.sp.

Stratigraphic and geographic range: Lower Famennian - Lower Permian; Eurasia.

Diagnosis. — See Koker (1924, p. 28). Corals with major septa varying in length and thickness, one or more verticils of dissepiments and, here and there, lonsdaleoid vesicles; axial tube present in early ontogeny. Septa lamellar in microstructure.

Remarks. — Due to the presence of septa varying in length and thickness, Gerth (1921), Schindewolf (1942) and Hill (1956) assigned this genus to Polycoeliidae. Believing that septa of three different lengths correspond to three cycles and that their lamellar microstructure is a trabecular structure, Koker (1924) placed this genus among the Hexacoralla, assigning it to the family Amphiastraeidae Ogilvie, 1896, whereas Soshkina, Dobroljubova & Kabakovitsh (1962) and later Dobroljubova (1966) placed it among Adamanophyllidae Vassiljuk, 1959.

Prosmilia fedorowskii n.sp.

(Text-fig. 47 *A*)

Holotype: Specimen Z.Pal.P. Tc No. 3/1230; Text-fig. 47 *A*.
Type horizon: Lower Famennian, *quadrantinodosa* Zone.
Type locality: Kielce (Kadzielnia quarry), exposure II, bed K.
Derivation of the name: named after Dr. Jerzy Fedorowski, Poznań, Poland.

Diagnosis. — A *Prosmilia* which with a diameter of 6.3 mm has 28 septa of three different lengths. Cardinal septum slightly shortened, countercardinal septum long; alar, counterlateral septa also long, metasepta varying in length. Minor septa short. Axial ends of septa rhopaloid, peripheral thin. A narrow verticil of dissepiments. Here and there, vesicles lonsdaleoid.

Material. — One specimen found among in shales. Proximal end and calyx damaged. Five peels of transverse sections.

Description. — A small specimen 5 mm long, with the longest diameter of 6.3 mm and a small talon on the concave side. Epitheca smooth with horizontal striae.

Transverse section. Corallite round in transverse section. Epitheca thin, in some places somewhat thicker. On the periphery septa thin. threadlike, their axial ends thickened. Cardinal septum shortened in mature stage. Countercardinal septum is the longest. Alar and counterlateral septa differ little or not all from metasepta. One verticil of dissepiments is visible on periphery. Lonsdaleoid vesicles occur here and there. Bilateral symmetry is replaced, in some places, by asymmetry. A distinct acceleration is observed in countercardinal quadrants. Septal formula $\frac{5\,|\,5}{7\,:\,7}+4$.

Ontogeny (Text-fig. 46A_1). — The smallest cross section is 2.4 mm in diameter and has about 8 distinct septa which reach axial tube surrounded by cyatotheca. A small talon present.

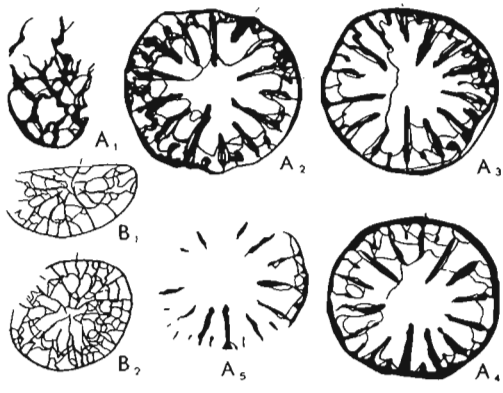

Fig. 47. — *A Prosmilia fedorowskii* n.sp.: A_1 transverse section of a coral, mid-neanic stage, axial tube surrounded by phyllo-cyatotheca, with talon, × 5.4; A_2-A_5 serial transverse sections, ephebic stage, septa of three different, lengths, dissepiments normal, here and there lonsdaleoid, counterseptum, alar, counterlateral and some metasepta more strongly developed (Kadzielnia II, bed K; Z. Pal. P. Tc No. 3/1230), holotype, × 4.

B Prosmilia tenera n.sp.: B_1-B_2 transverse section of a corallite in ephebic stage, with countersephum, alar, counterlateral and some metasepta longer and with a verticil of dissepiments (Kadzielnia, the dump; No. 3/1690), holotype, × 2.7.

Remarks. — Because of the presence of dissepiments and unequal lengths of protosepta and some metasepta, *Prosmilia fedorowskii* n.sp. is assigned by the present writer to the family Adamanophyllidae. The ontogeny of other representatives of this family is unknown. Two different groups of corals, one with a zaphrentoid ontogeny, and another

with axial tube and including *Prosmilia*, exist among Polycoeliidae Roemer, 1883. Working out a rich material of Tetracoralla from Carboniferous of Poland, Fedorowski (personal communication) attracted attention to this problem. *P. fedorowskii* n.sp. differs from Permian species in small dimensions and septa, which are thin on the periphery and separated here and there by lonsdaleoid vesicles.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure II, bed K, Lower Famennian, *quadrantinodosa* Zone.

Prosmilia tenera n.sp.
(Text-fig. 47 *B*)

Holotype: Specimen Z.Pal.P. Tc No. 3/1690; Text-fig. 47 *B*.
Type horizon: Lower Famennian, probably *quadrantinodosa* Zone.
Type locality: Kielce (Kadzielnia quarry), the dump.
Derivation of the name: Lat. *tener* = delicate, after thin skeletal element.

Diagnosis. — A *Prosmilia* with an oval calyx, asymmetric arrangement of septa, and with a diameter of 7.5×5.8 mm having 14-16×2 septa. Nine major septa long, thin, bent, reaching axis but not joined together. A single verticil of normal dissepiments; here and there lonsdaleoid dissepiments.

Material. — A single fragmentary specimen of which 2 peels of transverse sections were made.

Description. — Specimen shaped like a short, wide cone 4 mm high and with the longest diameter of 7.5 mm.

Transverse section. Corallite oval in transverse section, with a thin epitheca. Septa arranged irregularly and varying in length, hence the asymmetry of the section. Counterseptum the longest, cardinal septum somewhat shorter. Alar and counterlateral septa and some metasepta are among long septa reaching the axis. Minor septa fairly long, equalling about 1/3 of the length of major septa. Dissepiments occur in 1-2 incomplete verticils. The inner verticil forms an internal wall, which is penetrated by minor septa. Here and there lonsdaleoid vesicles.

Remarks. — The structure of the Famennian specimen is similar in transverse section to that of *P. cyatophylloides* (Gerth) in Koker (1924, Pl. 10, Fig. 2). Similar are the oval shape of transverse section, as well as thin irregularly distributed septa. There are, however, the following differences: 1) the number of septa in the Famennian specimen is probably larger than that in the specimen from the Island of Timor (their n/d indices are 28/7 and 60/20 mm resp.); 2) major septa in *P. tenera* n.sp. are longer and more of them reach the axis; 3) *P. tenera* has a distinct internal wall formed by the internal verticil of dissepiments and penetrated by minor septa.

Occurrence. — Poland: Kielce (Kadzielnia quarry), the dump, Lower Famennian.

Genus *Pseudoclaviphyllum* Vassiljuk, 1964

(Type species: *P. tenuiseptatum* Vassiljuk, 1964)

1964. *Pseudoclaviphyllum* Vassiljuk; N. P. Vassiljuk, Korally zon..., p. 65.

Species assigned: *P. tenuiseptatum* Vassiljuk and *P.* aff. *tenuiseptatum* Vassiljuk.

Stratigraphic and geographic range: Upper Famennian-Viséan of Europe.

Diagnosis. — See Vassiljuk (1964, p. 65). Microstructure of septa lamellar, of the wall laminar wavy.

Remarks. — According to Vassiljuk (*l.c.*, p. 65), this genus is most similar to *Claviphyllum* Hudson since, like the latter, it has a long counterseptum and a pair of longer metasepta in each of the four quadrants. The occurrence of dissepiments in *Pseudoclaviphyllum* makes up a character in which this genus differs from both *Claviphyllum* Hudson and *Sochkineophyllum* Grabau. In addition, it has long septa sharply terminating axially, whereas in *Sochkineophyllum* their ends are rhopaloid.

Pseudoclaviphyllum aff. *tenuiseptatum* Vassiljuk, 1964

(Text-fig. 48)

Material. — A single fragmentary coral of which a peel of a transverse section was made.

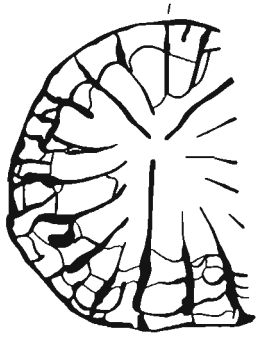

Fig. 48. — *Pseudoclaviphyllum* aff. *tenuiseptatum* Vassiljuk: transverse section of an incomplete specimen, counterseptum long, cardinal septum shortened (Gałęzice, bed 2; Z. Pal. P. Tc No. 3/2418), × 2.25.

Description. — *Transverse section.* With a diameter of 10.4 mm, the number of major septa amounts to about 20. They are thin and have sharp axial ends. The longest and the thickest is the counterseptum,

which exceeds the middle of the corallite and in cardinal quadrants approaches elongate metasepta, varying in length. In conformity with the diagnosis of the genus, the longest is the counterseptum, a short cardinal septum being situated in an open fossula. Septa III and IV, situated in cardinal quadrants, and septa I and II in countercardinal quadrants are longer than other metasepta. Other metasepta also differ from each other in length. Minor septa do not occur everywhere, they may be slightly longer or only marked by knobs visible on the inner surface of epitheca. One to three verticils of vesicles are visible on the periphery.

Remarks. — This fragment of coral is only with reservation assigned by the present writer to *P. tenuiseptatum* Vassiljuk, but it is considered as closely related. There are the following common characters: a similar septal index n/d which in the Famennian corallite amounts to 20/10.4 and in the Viséan one to 20-35/12-13, a similar system of major septa and atrophied minor septa.

Occurrence. — Poland: Gałęzice (Besówka), Upper Famennian, *costatus* Zone.

Family **Amplexidae** Chapman, 1893
(Type genus: *Amplexus* Sowerby, 1814)

Genus *Amplexus* Sowerby, 1814
(Type species: *A. coralloides* Sowerby, 1814)

Species assigned: *A. coralloides* Sowerby, 1814.

Stratigraphic and geographic range: Upper Famennian of Poland; Lower Carboniferous of Ireland.

Diagnosis. — See Smith & Thomas (1963, p. 162).

Remarks. — The assignment of many species to this genus which may be found in several authors' works, is debatable as long as the ontogeny of the type species remains unexamined. According to the present state of knowledge, *Amplexus* is polyphyletic and corals, assigned to this genus, are very simple in structure, have short septa, complete, horizontal tabulae, strongly shortened minor septa and no dissepiments. Their ontogeny was examined several times, but the result of these studies were divergent. After a study on two new species (*A. adnatus* and *A. geniculatus*), Easton (1945) stated that their development was zaphrentoid and that 22 septa, which they had, were joined together axially. Stainbrook (1959), describing the ontogeny of *A. deeringi* Stainbrook, found that this was a syringaxonoid form. Busch (1914) described an ontogenic series in *A. hamiltoniae* Hill and stated that with 16 septa their axial fusion was yet observed. Różkowska (1967, p. 753, Pl. 1, Fig. 6 A) presented a neanic stage of a coral from *costatus* Zone at Kowala and tentatively determined it as *A. coralloides* Sowerby. This

specimen has a short cardinal septum (situated in a fossula) and short other septa (Text-fig. 49 *A*). Topotype of *A. coralloides* from the collections of the British Museum· kindly sent to the present writer by Dr. C. Scrutton, have their proximal ends damaged and, therefore, the ontogeny of the type species *A. coralloides* continues to be debatable. A few corals with the morphology, internal structure and microstructure identical with those of *A. coralloides* occur in the Uppermost Famennian of Kowala. Although their generic assignment is uncertain, they are considered by the present writer as conspecific with *A. coralloides*.

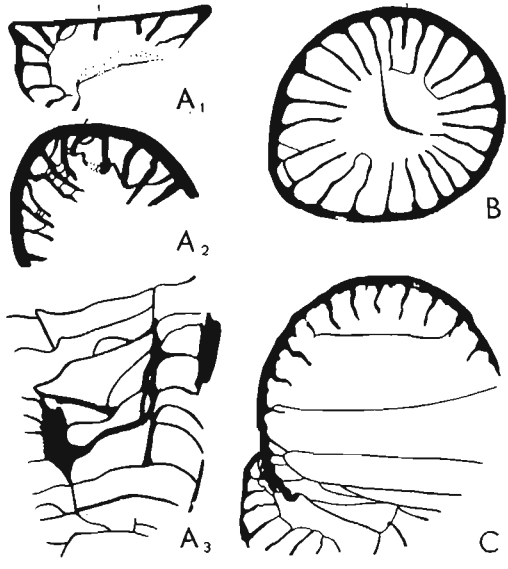

Fig. 49. — *A Amplexus* sp.(?): A_1 transverse section, neanic stage, cardinal septum in a wide fossula, a few septa connected with each other by cyatotheca, × 8; A_2 transverse section of part of a corallite, ephebic stage, cardinal septum shortened, situated in fossula, × 2.5; A_3 longitudinal, slightly tangential section, × 2.5 (Kowala V; Z. Pal. P. Tc No. 3/2788).

B-C Amplexus coralloides Sowerby: *B* transverse section with a shortened cardinal septum, *C* transverse-oblique section, its plane passing through the bend of coral (Kowala; I. G. No. 163n, II, 62), × 2.5.

Amplexus coralloides Sowerby, 1814

(Text-fig. 49 *B-C*; Pl. VII, Figs. 6, 7)

1814. *Amplexus coralloides* Sowerby; J. Sowerby, The mineral conchiology..., p. 165, Pl. 72, Figs. 1-5.

1963. *Amplexus coralloides* Sowerby; S. Smith & H. D. Thomas, On *Amplexus*..., p. 163, Pl. 7.

1967. ?*Amplexus coralloides* Sowerby; M. Różkowska, Famennian corals..., p. 752, Pl. 1, Fig. 6 A.

Material. — Ten fragments of specimens from the Geological Institute's collections, found by the late J. Czarnocki in the red limestone of Kowala. Twelve peels of transverse and longitudinal sections.

Description. — The biggest fragment is serpuloidally bent, tubelike, 10×11 mm in diameter and 40 mm long. Its surface is ornamented with fine, undulated growth wrinkles and has a few transverse annulations.

Transverse section. Septa lamellar. With a diameter of 9×12 mm, the number of major septa amounts to 24 reaching 3 mm in length. Cardinal septum slightly shorter, fossula open. In another transverse section of this same specimen, septa are considerably shorter, reaching 1.5 mm. Since this section is somewhat oblique, minor septa are visible in the form of short slats.

Longitudinal section. Thin, widely spaced, horizontal tabulae with peripheral ends slightly bent downwards are visible on the obliquely sectioned corallite.

Remarks. — Since the ontogeny of the lectotype of *A. coralloides* Sow. is unknown, the present writer assigns the Famennian corals to this genus with a certain reservation which is caused by the following facts: they are almost of the same age (in Poland — Famennian, *costatus* Zone, limestones directly underlying Tournaisian shales, *Gattendorfia* Zone and in Ireland — Lower Carboniferous, *Syringothyris*-c Zone) and have all morphological characters in conformity with the lectotype, determined by Smith & Thomas, i.e.: 1) a wormlike bent shape, 2) a smooth epitheca with growth wrinkles only, 3) a similar septal index n/d = 24/10.5, 4) short, straight, amplexoid septa 1.5-3.0 mm long, 5) minor septa very short, only very slightly entering the lumen, and 6) complete, horizontal tabulae slightly bent downwards on the periphery.

Occurrence. — Poland: Kowala, Upper Famennian, *costatus* Zone. Ireland, Lower Carboniferous.

Superfamily **Zaphrentoidida** Schindewolf, 1952

Diagnosis. — See Schindewolf (1952, p. 164).

Remarks. — According to Schindewolf (1952, p. 165), two families, Polycoeliidae Roemer, 1883 and Hapsiphyllidae Grabau, 1928, genetically related to each other by a similar zaphrentoid ontogeny, may be distinguished in this superfamily. A distinct bilateral symmetry, caused by the predominance of 4-5 protosepta and, sometimes, a few metasepta, is a diagnostic character of the family Polycoeliidae, whereas in Hapsiphyllidae Grabau, 1928 the bilateral symmetry is caused by the distinction of two septa, cardinal and counterseptum. Since characteristic features, which disappear in the mature stage when the coral reaches a subradial symmetry, are more conspicuous in the juvenile stage, the knowledge of morphogeny is necessary for the assignment to a family. In addition, the knowledge of early ontogenetic stages allows one to trace the phyletic relationships. The genera *Prosmilia* Koker, 1924 and

Endothecium Koker, 1924, which have polycoeloid septa with a nalivkinelloid ontogeny, may serve as an example. The morphogenesis of the Zaphrentoidida was studied mostly by Schindewolf (1952).

Family **Polycoeliidae** Roemer, 1883

Stratigraphic and geographic range: Devonian-Permian; North America, Europe, Asia, Australia. *Ufimia* Stuckenberg, 1895 occurs in Famennian of Poland.

Diagnosis. — See Hill (1956, p. F260).

Genus *Ufimia* Stuckenberg, 1895

(Type species: *Ufimia carbonaria* Stuckenberg, 1895)

1895. *Ufimia*; A. Stuckenberg, Korally i mšanki..., p. 27.
1922. *Tachylasma*; A. Grabau, Palaeozoic corals..., p. 24, *partim*.
1928. *Ufimia*; A. Grabau, *Ibid.*, p. 53.
1928. *Tachylasma*; A. Grabau, *Ibid.*, p. 44, *partim*.
1928. *Tachylasma*; E. D. Soshkina, Nižnepermskie..., p. 350, *partim*.
1941. *Tachylasma*; E. D. Soshkina, T. Dobroljubova & G. Porfiriev, Permskie Rugosa..., p. 47, *partim*.
1942. *Plerophyllum* (*Ufimia*); O. Schindewolf, Zur Kenntnis..., p. 122.
1942. *Plerophyllum* (*Prionophyllum*); O. Schindewolf, *Ibid.*, p. 47.
1953. *Tachylasma*; V. Fomitshev, Permskie korally..., p. 92.
1963. *Plerophyllum* (*Ufimia*); G. de Groot, Rugose corals..., p. 22.
1965. *Plerophyllum* (*Ufimia*); J. Kullmann, Rugose Korallen..., p. 115.

Species assigned: *Ufimia carbonaria* Stuckenberg, 1895; *Tachylasma cha* Grabau, 1922; *T. elongatum* Grabau, 1922; *T. aster* Grabau, 1922; *T. rhizoides* Soshkina, 1935; *T. latum* Soshkina, 1925; *T. magnum* Grabau, 1928; *T. beyrichi* (Rothpletz, 1892) in Grabau, 1928; *Tachylasma lopingense* Grabau, 1928; *T. cylindroconica* (Heritsch, 1938); *Plerophyllum* (*Ufimia*) *persymmetricum* Schindewolf, 1942; *P.*(*U.*) *infracarbonicum* Schindewolf, 1942; *P.*(*U.*) *clavatum* Schindewolf, 1942; *P.*(*U.*) *schwarzbachi* Schindewolf, 1942; *P.*(*U.*) *kobayashii* Schindewolf, 1942; *P.*(*U.*) *cuneiseptatum* Schindewolf, 1942; *P.*(*U.*) *multitabulatum* Schindewolf, 1942; *P.*(*U.*) *longiseptatum* (Frech) in Schindewolf, 1942; *Pentaphyllum* (*Prionophyllum*) *crassiseptum* Schindewolf, 1942; *Tachylasma aster* var. *rhizoides* Soshkina, 1941; *T. columbinum* Fomitshev, 1953; *T. vaganense* Fomitshev, 1953; *Plerophyllum* (*Ufimia*) *alternans* de Groot, 1963; *P.*(*U.*) *prius* Kullmann, 1965.

Stratigraphic and geographic range: Middle Devonian-Permian; Asia, Australia, Europe.

Diagnosis. — See Hill (1956, p. F262). Microstructure of wall laminar-wavy, of septa — lamellar.

Remarks. — Erecting the genus *Ufimia*, Stuckenberg (1895) enclosed a comprehensive description and a schematic drawing. This genus is marked by two long and thick alar septa, two strong counterlateral septa, a cardinal septum, which is reduced in the mature stage, and a counterseptum which shortens in this stage. Grabau (1922) erected the genus

Tachylasma with a type species, *T. cha* Grabau for which he gave a diagnosis almost identical as that given by Stuckenberg for *Ufimia*. According to Grabau, *Tachylasma* differs from *Ufimia* only in more strongly expressed septal characters. The present writer considers, therefore, *Tachylasma* to be a junior synonym of the genus *Ufimia* Stuckenberg. This applies, however, only to those species whose cardinal septum and counterseptum are subject to shortening. Since some species, described by Grabau, in which a very long counterseptum persists, are different, they were assigned by a few authors to *Tachylasma* Grabau. Such a view was taken by Schindewolf (1942), Fomitshev (1953), Sokolov (1960) and Soshkina, Dobroljubova & Kabakovitsh (1962). Some of them (Schindewolf, 1942) consider *Ufimia* to be a subgenus of *Plerophyllum* Hinde, 1892, some others as Hill (1956), Sokolov (1960), Soshkina, Dobroljubova & Kabakovitsh (1962) and the present writer consider it as an independent genus.

Ufimia supradevonica n.sp.

(Text-figs. 50, 51 *B*; Pl. VIII, Figs. 3, 13)

Holotype: Specimen I. G. No. 163 f, II, 62 from the collections of the Geological Institute in Warsaw; Text-fig. 50 *B*.

Type horizon: Upper Famennian, zones III—IV according to the goniatite zonation.

Type locality: Zaręby near Łagów, the dump.

Derivation of the name: Lat. *supradevonica* = Upper Devonian.

Diagnosis. — An *Ufimia* which with a diameter of 12.6 mm has 23×2 septa. A thick deposit of stereoplasma on septa reaching as far as calyx.

Material. — Three specimens, two of which found by J. Czarnocki and H. Makowski are well-preserved. A fragmentary specimen was found in limestone from Gałęzice.

Description. — Corallite 30 mm long, without proximal end, bent, subcylindrical. Dense, interseptal striae and transverse contractions are visible on the surface of epitheca.

Transverse section. With a diameter of 12.6 mm, there are 23×2 septa. Cardinal septum strongly shortened, situated on the convex side, counterseptum slightly less shortened. Alar and counterlateral septa are strongly developed on the right-hand side of the section. Metasepta varying in length, the most conspicuous are central ones in particular quadrants. Minor septa developed in the form of short slats entering the lumen of tabularium. A characteristic acceleration of septa, $\frac{4\,|\,3}{5\,|\,5}+6$ is observed in countercardinal quadrants. One side of corallite has, on septa, a thicker deposit of stereoplasma which gradually decreases on the right side.

Longitudinal section. Calyx deep. Right of the cardinal septum — counterseptum line, septa are strongly bound together by stereoplasma and form a compact stereoplasmatic mass. On the opposite side, they are free and, therefore, tabulae, raised towards the axis, are developed between them.

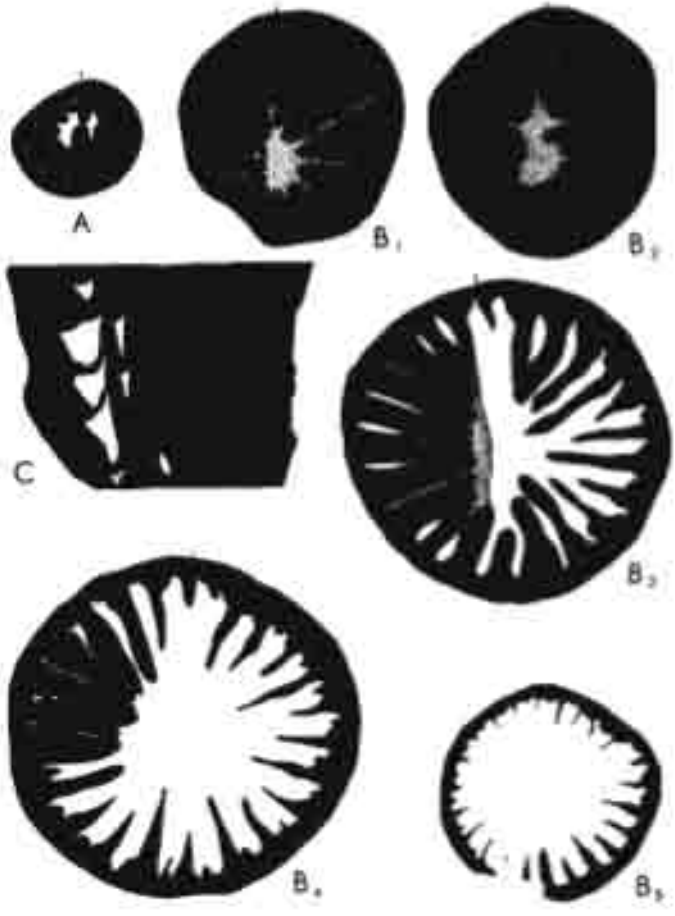

Fig. 58. — *Ufimia supradevonica* n.sp.: *A* transverse section of a coral, neanic stage, counterseptum long, cardinal septum somewhat shorter (Zaręby; I. G. No. 163g, II, 62), × 3.4; B_1-B_5 a series of transverse sections, B_1-B_3 neanic stage, B_3-B_4 ephebic stage with cardinal and counterseptum shortening, B_5 transverse section through the edge of calyx (Zaręby; I. G. No. 163f, II, 62), holotype, × 2.7; *C* longitudinal section (Zaręby; I.G. No. 163j, II, 62), × 2.4.

Ontogeny (Text-fig. 50 *A*-*B*). — 1) The smallest section has, with a diameter of 5×4 mm, 12 septa. Among them, conspicuous are the counterseptum and cardinal septum almost fused together axially. Close to them, axial region is free of septa but filled with stereoplasma. 2) With a diameter of 9.2 mm, the number of septa amounts to 13. Septa thick,

closely adhering. Cardinal septum slightly shortened, counterseptum does not differ from adjoining counterlateral septa. Alar septa slightly thicker. 3) Diameter — 9.5×8.5 mm, number of septa — 18. Alar septa markedly long, their axial ends thickened. Arrangement of septa in cardinal quadrants pinnate, in countercardinal — radial. Acceleration in countercardinal quadrants-according to the formula $\frac{2\,|\,2}{4\,|\,4}+6$.

Remarks. — The new species is most strongly related to the Middle Devonian *Plerophyllum* (*Ufimia*) *prius* Kullmann, 1965, but has somewhat longer minor septa, which enter tabularium and stronger major septa.

Occurrence. — Poland: Zaręby near Łagów, Upper Famennian, zones III-IV.

Ufimia makowskii n.sp.
(Text-fig 51 *A*)

Holotype: Specimen I. G. No. 163k, II, 62; Text-fig. 51 *A*.

Type horizon: Lower Famennian, zone III or IV, according to the cephalopod zonation.

Type locality: Zaręby near Łagów.

Derivation of the name: dedicated to Professor Henryk Makowski, Warsaw, Poland.

Diagnosis. — An *Ufimia* which with a diameter of 11.4 mm has 25 major septa. Cardinal and counterseptum slightly shorter, alar and counterlateral septa differ in length slightly from metasepta. A long lasting deposit of stereoplasma occurs in cardinal quadrants and in axial part of the corallite.

Material. — One, fairly well-preserved specimen, found by the late Prof. J. Czarnocki among shales on the dump in Zaręby.

Description. — Coral small, wide-conical, about 15 mm long, with the longest diameter amounting to 11.4 mm. Wide septal grooves, delicate growth wrinkles and transverse annulations are visible on epitheca.

Transverse section. Thick septa are closely distributed according to the pseudoradial symmetry. Septal index 25/11.4. Cardinal septum as thick as adjoining septa but considerably shorter. Counterseptum somewhat thinner and shorter than the adjoining ones. Counterlateral and alar septa slightly stronger than other proto- and metasepta. Axial ends of septa rhopaloid and cemented together with stereoplasma, peripheral parts free at their bases. Septal formula: $\frac{5\,|\,4}{5\,|\,5}+6$.

Ontogeny (Text-fig. 51 *A*). — The youngest stage lacking. 1) With a diameter of 4.2 mm there are 13 septa, which are short, wedgelike and contacting each other with their sides. Axial part of the corallite free of septa but filled with stereoplasma. Countercardinal septum is the longest. Cardinal septum as long as adjoining septa. 2) With a diameter of 9.5 mm, the number of septa amounts to 21. Cardinal septum slightly

shortened the same as countercardinal. In cardinal quadrants distinct bilateral symmetry. Septal formula $\frac{2|2}{3|4}+4$. 3) With a diameter of 11.4 mm, the number of septa amounts to 24. Septa almost uniform in thickness; alar and counterlateral septa are somewhat longer. Septa continue to adhere to each other in cardinal quadrants and axial part. Axial field free of septa, slightly extended. 4) *Ephebic stage* with strongly reduced stereoplasma.

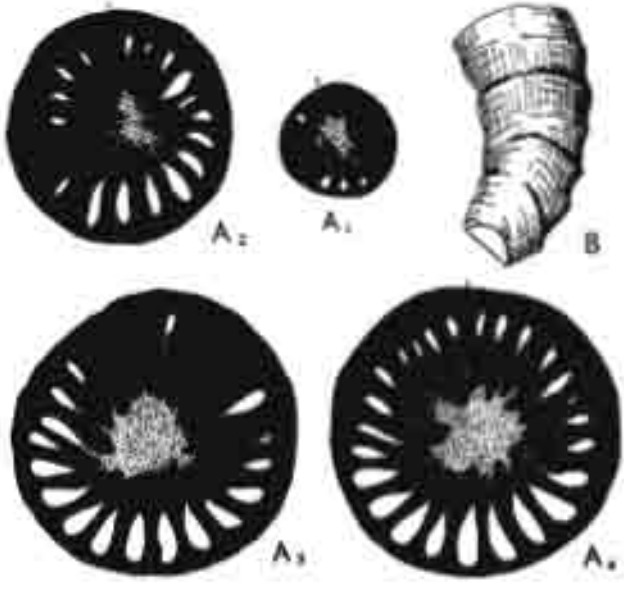

Fig. 31. — *A Ufimia makowskii* n.sp.: A_1–A_4 a series of transverse sections, showing the ontogenetic development, A_1 neanic stage with elongate counterseptum, A_2–A_4 ephebic stage with cardinal septum shortening and counterseptum thinning (Zaręby, the dump; I. G. No. 163K, II, 62), holotype, × 3.4.

B Ufimia supradevonica n.sp.: a diagrammatic drawing (Zaręby, I. G. No. 163I, II, 62), × 1.4.

Remarks. — *U. makowskii* n.sp. has septa similarly crowded as those in *Tachylasma densum* Hill, 1937, but its septa are shorter and little differentiated and it has not minor septa. It differs from *U. supradevonica* n.sp. in only slightly differentiated proto- and metasepta and in lack of minor septa.

Occurrence. — Poland: Zaręby near Łagów, Upper Famennian (according to Osmólska, 1963, zone III or IV).

Family **Hapsiphyllidae** Grabau, 1928

Diagnosis. — See Hill (1956).

Remarks. — Since there are too many synonyms, many genera are insufficiently described and others have a structure which does not

occur in zaphrentoids, Sutherland (1958, p. 44) and Schouppé (1959, p. 239) are of the opinion that zaphrentoids require a penetrating revision. After analyzing part of this group, Sutherland (*l. c.*, p. 44) stated that: 1) *Menophyllum* M. Edw.-H., 1851, *Zaphrentoides* Stuckenberg, 1895 and *Heterophrentis* Billings, 1875 are insufficiently studied; 2) some other genera have a structure different from that of zaphrentoids. According to Ivanovsky (1960), a structure typical of zaphrentoids is as follows: 1) corals are solitary; 2) septa have a bilateral symmetry in relation to cardinal septum situated in a fossula; 3) septa have a deposit of stereoplasma; 4) dissepiments lacking or occurring only in exceptional cases. The following genera have not such characters: *Zaphrentis* Rafinesque & Clifford, 1820; *Triplophyllum* Simpson, 1900; *Siphonophyllia* Scouler, 1944; *Zaphriniphyllum* Sutherland, 1958. Strictly speaking, only three genera of the many discussed by Sutherland are appropriate representatives of the family Hapsiphyllidae. These are: *Amplexizaphrentis* Vaughan, 1906; *Zaphrentites* Hudson, 1941; *Hapsiphyllum* Simpson, 1900. Other genera, assigned by the present writer to Hapsiphyllidae but requiring revision, since they may be synonyms, are as follows: *Fasciculophyllum* Thomson, 1883; *Duplophyllum* Koker, 1924; *Lytvolasma* Soshkina, 1925; *Allotropiophyllum* Grabau, 1928; *Bradyphyllum* Grabau, 1928; *Neozaphrentis* Grove, 1935; *Euryphyllum* Hill, 1937; *Rotiphyllum* Hudson, 1941; *Homalophyllites* Easton 1944; *Canadiphyllum* Sutherland, 1958; *Basleophyllum* Schouppé & Stacul 1959; *Asthenophyllum* Grubbs, 1939; *Enniskillenia* Kabakovitsh, 1962; *Thecophyllum* Fomitshev, 1953; *Tungassophyllum* Ivanovsky, 1959; *Protozaphrentis* Yu, 1957; *Meniscophyllum* Simpson, 1900. Hapsiphyllidae, which occur from Silurian to Permian inclusively, were described from North America, Europe, Asia and Australia.

The following genera were found by the present writer in Famennian of the Holy Cross Mountains: *Asthenophyllum* Grubbs, 1939; *Amplexizaphrentis* Vaughan, 1906; *Duplophyllum* Koker, 1924; *Fasciculophyllum* Thomson, 1883; *Euryphyllum* Hill, 1937.

Genus *Amplexizaphrentis* Vaughan, 1906, sensu Sutherland, 1958

(Type species: *Zaphrentis bowerbanki* Thomson, 1883, non M. Edw.-H. (Lang, Smith & Thomas, 1940))

1883. *Zaphrentis*; J. Thomson, On the development..., p. 368, Pl. 6, Fig. 3.
1906. *Amplexi-Zaphrentis*; A. Vaughan, The Carboniferous..., p. 315.
1906. *Zaphrentis*; A. Vaughan, *Ibid.*, p. 315.
1908. *Zaphrentis*; A. Vaughan, *Ibid.*, p. 457.
1924. *Zaphrentis*; E. M. J. Koker, Anthozoa uit..., p. 7.
1930. *Zaphrentis*; H. P. Lewis, The Avonian succession..., p. 277.
1940. *Amplexi-Zaphrentis*; W. D. Lang, S. Smith & D. H. Thomas, Index..., p. 16.
1944. *Triplophyllites*; W. H. E. Easton, Corals from..., p. 35.

1953. *Thecophyllum*; V. D. Fomitshev, Korally Rugosa..., p. 175.
1956. *Amplexizaphrentis*; D. Hill, Rugosa..., p. F267.
1958. *Amplexi-Zaphrentis*; P. K. Sutherland, Carboniferous..., p. 44.
1962. *Enniskillenia*; N. V. Kabakovitsh, Tetracoralla..., p. 323.
1965. *Barytichisma*; D. Weyer, Über *Amplexus*..., p. 449.
non 1967. *Amplexizaphrentis*; J. Pickett, Lower Carboniferous..., p. 8.

According to Sutherland (1958), in addition to *Amplexizaphrentis enniskilleni* (M. Edw.-H., 1850), the following species occur in Carboniferous of Canada: *A. taylori* Sutherland, 1958; *A. indifferens* Sutherland, 1958; *A. cassa* Sutherland, 1958; *A. pilata* Sutherland, 1958. A new species, *Thecophyllum lebedevi*, was erected by Fomitshev (1953).

Diagnosis. — See Hill (1956, p. F267). Sutherland (1958, p. 50) gives a detailed description of *A. enniskilleni* (M. Edw-H.), which in the present writer's opinion is the most exhaustive presentation of a species of that genus. Microstructure of wall lamellar-wavy, of septa — lamellar.

Remarks. — The species *A. rejuvenescens* Pickett, 1967 which, according to Pickett's description, forms buds and has dissepiments is not assigned by the present writer to *Amplexizaphrentis*.

Amplexizaphrentis conus n.sp.
(Text-fig. 52; Pl. VII, Fig. 13)

Holotype: Specimen I. G. No. 163c, II, 62; Text-fig. 52.

Type horizon: Upper Famennian, *Wocklumeria* beds, red limestone, *costatus* Zone.

Type locality: Kowala near Kielce.

Derivation of the name: Lat. *conus* = cone, after a conical shape of the corallite.

Diagnosis. — An *Amplexizaphrentis* shaped like a wide, straight cone, with a deep calyx and, with a diameter of 8.6×8.0 mm, having 28 major septa. Stereotheca around a long, rhomboidal cardinal fossula, reaching outside the middle of the coral. Two alar fossulae and one, not very conspicuous countercardinal fossula. Cardinal septum thin, countercardinal — shorter than the adjoining septa.

Material. — One specimen, fairly well-preserved, except for the lack of proximal end.

Description. — A widely conical, straight corallite 25 mm in incomplete length and 36.5 mm in the longest diameter near the edge of calyx. Calyx 23 mm deep. Delicate interseptal grooves, thin growth wrinkles and regularly repeated contractions are visible on epitheca.

Transverse section. Epitheca fairly thick (0.4 mm). Septa, slightly bent and pointing towards a rhomboidal fossula, are visible in transverse section. Their bases are triangular and their rhopaloid axial ends form a stereotheca around the fossula. Cardinal septum thin, longer and

counterseptum shorter than the adjoining septa. A large rhomboidal fossula is narrow on the periphery, open towards alar fossulae and a shortened counterseptum, next to alar fossulae the widest. Minor septa are embedded in epitheca. With a diameter of 8.0 mm, there are 28 septa. A distinct acceleration occurs in cardinal quadrants: $\frac{7\,|\,6}{5\,|\,4}+6$.

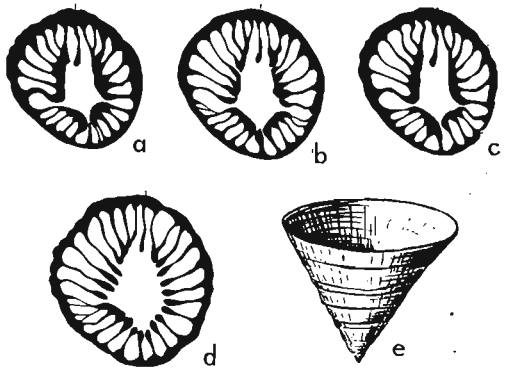

Fig. 52. — *Amplexizaphrentis conus* n.sp.: *a-d* successive transverse sections of an ephebic stage, septa gathered in four systems surrounding cardinal fossula which extends towards axis, cardinal septum elongate, two narrow alar fossulae and one countercardinal fossula; *e* a diagrammatic drawing of the shape of a coral (Kowala; I. G. No. 163c, II, 62), holotype, × 2.

Ontogeny (Text-fig. 52 *a-d*) was traced up to a height of 4.3 mm. 1) The earliest preserved stage is 7.5×6.0 mm in diameter and has 26 septa. Axial ends of septa form stereotheca around fossula which is open in the following three places: near cardinal septum, near alar fossulae and near counterseptum. Acceleration in cardinal quadrants: $\frac{6\,|\,6}{4\,|\,4}+6$. 2) In the course of a further development, cardinal septum becomes thinner and counterseptum longer, cardinal fossula extends and alar fossulae disappear. Deposit of stereoplasma on axial ends of septa becomes reduced.

Remarks. — The Famennian specimen has a thick deposit of stereoplasma on epitheca and septa. A thick, compact stereotheca is visible around fossula, which slightly resembles the Silurian species *Zaphrentis conulus* Lindstroem, 1883 and is typical of Protozaphrentidae Ivanovsky, 1960. A somewhat similar, large, rhomboidal fossula, a similar arrangement of septa and a similarly shortened counterseptum occur in *Z. enneskilleni* (M. Edw.-H., 1850), figured and described by Lewis (1930, Pl. 23, Figs. 7 *a*, *b*). Its skeletal elements are, however, very thin. Of Canadian species, similar is *A. pilata* Sutherland (1958, Pl. 10, Figs. 2-4), which has a thick skeleton and a wide, closed fossula, but its counterseptum is somewhat longer than the adjoining ones, and fossula is not,

therefore, open towards it. The corallite illustrated by Różkowska (1967, Pl. 1, Fig. 7) belongs to the species described above.

Occurrence. — Poland: Kowala, Upper Famennian, *costatus* Zone, according to J. Czarnocki — *Wocklumeria* beds.

Genus *Fasciculophyllum* Thomson, 1883
(Type species: *Fasciculophyllum dybowskii* Thomson, 1883)

1883. *Fasciculophyllum* Thomson; J. Thomson, On the development..., p. 448.
1883. *Centrocellulosum*; J. Thomson, *Ibid.*, p. 452.
1935. *Zaphrentis*; W. Weissermel, Zwei Korallen..., p. 277.
1942. *Fasciculophyllum*; R. G. S. Hudson, *Fasciculophyllum...*, p. 258.
1952. *Fasciculophyllum*; D. Hill, Rugosa..., p. F260.
1966. *Fasciculophyllum*; T. A. Dobroljubova & N. V. Kabakovitsh, Korally nižnego..., p. 21 (*cum synonymy*).
1966. *Plerophyllum* (*Plerophyllum*); J. Kullmann, Goniatiten-Korallen..., p. 450.

Species assigned: *Fasciculophyllum dybowskii* Thomson, 1883; *Zaphrentis omaliusi* M. Edw.-H. 1851; *Hadrophyllum edwardsianum* Koninck, 1872; *Densiphyllum rushianum* Vaughan, 1908; *Rotiphyllum* cf. *densum* (Carruthers), in Hudson, 1944; *Zaphrentis* aff. *phillipsi* M. Edw.-H., 1851, in Vaughan, 1905; *Rotiphyllum costatum* (MCoy) in Hudson, 1944; *Rotiphyllum rushianum* (Vaughan, 1906); *Fasciculophyllum thomsoni* Hudson & Fox, 1942; *Fasciculophyllum repressum* Schindewolf, 1952; *Plerophyllum* (*Plerophyllum*) *tenuiseptatum* Kullmann, 1966; *Fasciculophyllum* aff. *rushianum* (Vaughan, 1906); *Fasciculophyllum dobroljubovae* n.sp.

Stratigraphic and geographic range: Upper Famennian-Upper Carboniferous, Europe.

Diagnosis. — See Dobroljubova & Kabakovitsh (1966). Microstructure of epitheca laminar-wavy, of septa — lamellar.

Fasciculophyllum aff. *rushianum* (Vaughan, 1906)
(Text-fig. 53)

Material. — One of the specimens from J. Czarnocki's collections, found in Kowala, in *Wocklumeria* beds. Twelve peels.

Description. — Coral conical, slightly bent, with a mostly worn off surface. In some places longitudinal striae and in some others transverse annulations are visible. Edge of calyx sharp. Major and minor septa occur on the edge in the form of low slats. Calyx deep.

Transverse section. Wall thick (0.6 mm). Symmetry pseudoradial. Cardinal septum long, situated in a closed fossula and reaching stereocolumella. Alar and counterlateral septa indistinct. Septa, gathered in systems, four of them in each quadrant, almost straight, varying in length. With a diameter of 6.7 mm, the number of septa amounts to 22.

Countercardinal septum and two counterlateral septa are thin and fused together near stereocolumella. Minor septa do not enter the lumen. Stereocolumella occupies about 1/3 of the diameter of the coral.

Ontogeny (Text-fig. 53). — 1) The youngest stage is, along the cardinal--countercardinal septum line, 2 mm in diameter. The wall near cardinal septum is flattened because this is the place where talon is situated. Number of septa — 10, in addition to protosepta, one metaseptum occurs in each quadrant. Septa and wall are thick. Stereocolumella distinct. Fossulae slightly marked. 2) The next stage is 2.7 mm in diameter and has 16 septa, very wide, concave talon and indistinct fossulae. Cardinal septum thick, countercardinal thin. Distinct four systems of septa. 3) In the next-stage, talon is narrowed, with a wide fossula containing a thick cardinal septum, adhering to it. Distinct alar fossulae. Countercardinal septum thin, connected with counterlateral septa which are uniform in thickness. Distinct bilateral symmetry. Septal formula $\frac{4\,|\,4}{4\,|\,3}+6$.

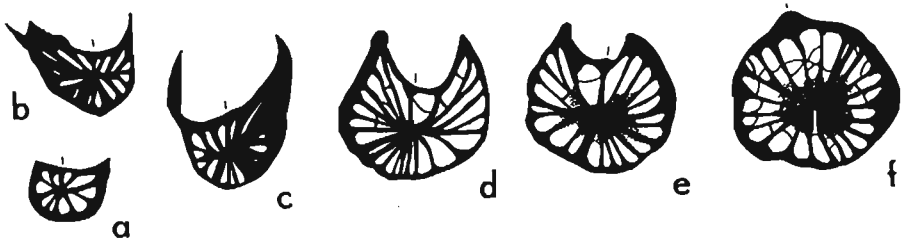

Fig. 53. — *Fasciculophyllum* aff. *rushianum* (Vaughan, 1906): *a-f* successive stages of ontogenetic development, septa gathered in systems, cardinal septum in a triangular fossula on the side of talon, stereocolumella wide (Kowala; I. G. No. 163j, II, 62), × 2.7.

Remarks. — The coral from Kowala, described above, is related to *Fasciculophyllum rushianum* (Vaughan, 1908, p. 459) by its pseudoradial symmetry, narrow, triangular, cardinal fossula and poorly developed, scarcely visible countercardinal and alar fossulae. In the Famennian species, skeletal elements are, however, more delicate, its counterseptum and counterlateral septa being smaller than others and fused together. The form described differs from *F. omaliusi* M. Edw.-H. in the pseudoradial structure, triangular cardinal fossula and a triplet of thin countercardinal and counterlateral septa. From *F. repressum* Schindewolf, 1952 it differs in a strong stereocolumella, cardinal fossula tapering towards the axis and counterlateral septa fusing with counterseptum and not with adjoining metasepta.

Occurrence. — Poland: Kowala, Upper Famennian, *costatus* Zone.

Fasciculophyllum dobroljubovae n.sp.
(Text-fig. 54)

Holotype: Specimen Z.Pal.P. Tc No. 3/2791; Text-fig. 54.
Type horizon: Upper Famennian, *costatus* Zone.
Type locality: Kowala, trench II.
Derivation of the name: dedicated to Dr. T. A. Dobroljubova, Palaeontological Institute of the USSR's Academy of Sciences, Moscow.

Diagnosis. — A corallite with a thick wall and septal index n/d = = 20/3.5. Cardinal, alar and countercardinal fossulae conspicuous. Distinct four systems of septa. Counterseptum very thick, counterlateral septa, fused to it, thin, threadlike.

Material. — One, very small specimen, found in red limestone of Kowala in trench II. One peel of transverse section was made.

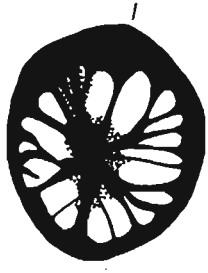

Fig. 54. — *Fasciculophyllum dobroljubovae* n.sp.: transverse section of a juvenile individual with a strong cardinal septum in a triangular fossula, with a thick counterseptum fused with adjoining septa and with a wide stereocolumella (Kowala II; Z. Pal. P. Tc No. 3/2791), × 8.

Description. — *Transverse section.* Corallite oval in transverse section. Wall thick, particularly on the side of cardinal septum, which is long, intersects a wide, triangular fossula and reaches an elongate, wide stereocolumella. Alar and counterlateral fossulae distinct, separating 4 groups of septa, each consisting of 4 respectively 3 septa varying in length. Counterseptum very thick, reaching stereocolumella and with very thin counterlateral septa fused to it. Almost all septa are concave, with their concavity directed to cardinal septum. Their peripheral ends are triangularly thickened and axial ends fusiform.

Remarks. — The species described above is similar to *F.* aff. *rushianum* by its thick skeletal elements. In *F. dobroljubovae* n.sp., however, the symmetry is bilateral, the fossulae: cardinal, alar and countercardinal are more conspicuous, the countercardinal septum is very thick and the counterlateral septa joined with it, are very thin, threadlike.

Occurrence. — Poland, Kowala, Upper Famennian, *costatus* Zone.

Genus *Euryphyllum* Hill, 1937
(Type species: *Euryphyllum reidi* Hill, 1937)

Schouppé & Stacul (1959, p. 258) presented an exhaustive synonymy of this genus.

Species assigned: *Zaphrentis cainodon* Koker, 1924; *Stereolasma minus* Soshkina, 1925; *Euryphyllum trizonatum* Hill, 1937; *E. minutum* Hill, 1937; *E. reidi* Hill, 1937; *Lytvelasma cainodon* Wang, 1947; *Duplophyllum* (*Euryphyllum*) *cainodon* Schouppé & Stacul, 1959; *D.*(*E.*) *robustum* (Koker, 1924); *D.*(*E.*) *coniculiforme* Schouppé & Stacul 1959, *D.* (*E.*) *hilli* Schouppé & Stacul, 1959; *D.* (*E.*) *breviseptatum* Schouppé & Stacul, 1959; *Euryphyllum hispanicum* de Groot, 1963; *E.*(?) *australe* M'Coy, 1847).

Stratigraphic and geographic range: Upper Famennian-Permian of Eurasia.

Diagnosis. — See Hill (1937, p. 150). Microstructure of septa — lamellar.

Remarks. — According to Schouppé & Stacul (1959, p. 253), *Euryphyllum* is a subgenus of *Duplophyllum*. Like de Groot (1963, p. 45), the present writer is, however, of the opinion that such a relationship is not justified because long, contratingent minor septa are a diagnostic character of *Duplophyllum*, whereas *Euryphyllum* is characterized by a lack of these septa. Hill (1956) yet more strongly emphasizes the difference between *Duplophyllum* and *Euryphyllum*, assigning *Duplophyllum* to the family Metriophyllidae, and *Euryphyllum* to Hapsiphyllidae. The present writer believes that both these genera belong to Hapsiphyllidae Grabau, 1928.

Euryphyllum aff. *cainodon* Koker, 1924
(Text-fig. 55)

Material. — One, strongly damaged specimen, filled with red limestone which comes from the collection of the Geological Institute in Warsaw and is labelled "*Wocklumeria* limestone". Two peels, one of a transverse and other of a longitudinal sections, were made.

Description. — A subcylindrical coral with a strongly worn off surface. Only major septa are visible. Minor septa lacking.

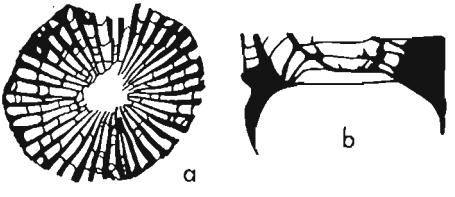

Fig. 55. — *Euryphyllum* aff. *cainodon* Koker: *a* transverse section, ephebic stage, cardinal septum slightly shortened, *b* longitudinal section (Kowala; I. G. No. 1630, II, 62), × 2.25.

Transverse section. Diameter 12 mm, 39 septa uniform in length. Septa wedgelike, thick at the base and extended by the deposit of stereoplasma on peripheral ends. Their axial ends are thin and not reaching the axis. The free axial field is slightly asymmetric and narrowing towards a somewhat shortened cardinal septum. Cardinal fossula indistinct. Counterseptum does not differ from the neighbouring septa.

Longitudinal section. Tabulae complete, slightly convex, steeply sloping towards the wall, axially flattened.

Remarks. — Despite the facts that the ontogeny of this specimen is unknown and that its epitheca is worn off, it is assigned by the present writer to the species *E. cainodon* Koker, 1924. Its transverse section is identical with that figured by Koker (1924, Pl. 3, Fig. 2). There is a difference in the septal index n/d which in the Famennian specimen amounts to 39/12 and in the Permian *E. cainodon* — to 34/20 but, on the other hand, septal index is subject to changes with the geological age. The plane of section cut through the Famennian specimen passes through the base of calyx where septa are shortened.

Occurrence. — Poland: Kowala, Upper Famennian, *Wocklumeria* beds.

Genus *Duplophyllum* Koker, 1924

(Type species: *Duplophyllum zaphrentoides* Koker, 1924)

The synonymy given by Schouppé & Stacul (1949, p. 242) is supplemented by the present writer with the following synonyms:

1924. *Duplophyllum*; E. M. J. Koker, Anthozoa uit..., p. 21.
1941. *Duplophyllum*; R. C. Moore & R. M. Jeffords, New Permian..., p. 108.
1959. *Duplophyllum* (*Duplophyllum*); A. v. Schouppé & P. Stacul, Säulchenlose..., p. 241.
1962. *Duplophyllum*; E. D. Soshkina, T. A. Dobroljubova & N. V. Kabakovitsh, Tetracoralla..., p. 324.
1963. *Duplophyllum*; G. E. de Groot, Carboniferous..., p. 44.

Species assigned: *Duplophyllum zaphrentoides* Koker, 1924; *D. septarugosum* Moore & Jefford, 1941; *D. calyculatum* Koker, 1924; new species erected by Schouppé & Stacul (1959): *Duplophyllum* (*Duplophyllum*) *wanneri*, *D.* (*D.*) *tenuiseptatum*, *D.* (*D.*) *schindewolfi*, *D.* (*D.*) *micron*. In addition, the writer assigns here *Duplophyllum* sp. de Groot, 1963 and *Duplophyllum* sp., described in the present work.

Stratigraphic and geographic range: Upper Famennian-Permian of North America, Europe, Asia and Australia.

Diagnosis. — See Hill (1956, p. F258). Microstructure of septa lamellar.

Remarks. — The genus *Duplophyllum* Koker is assigned by Hill (1956) to the family Metriophyllidae and by Schouppé & Stacul — to Zaphrentoididae Schindewolf, 1938. De Groot (1963), like Schouppé diameter: n/d = 19/11 in the Famennian specimen and 18/7 in the

(= Zaphrentoididae Schindewolf 1938). Because of the incompleteness of the only specimen available, the present writer cannot take her own view in this respect.

Duplophyllum sp.
(Text-fig. 56)

Material. — A small fragment from the Upper Famennian of Gałęzice, bed 2. A peel of a transverse section.

Description. — Diameter about 8 mm, number of septa about 18×2. Septa thin, bent. Major septa, fused axially, from a stereocolumella extended by the deposit of stereoplasma. Minor septa long, fused to major septa close to the stereocolumella. Irregular sections of tabulae are visible.

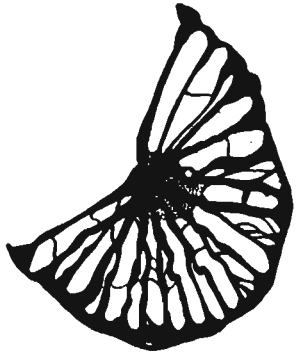

Fig. 56. — *Duplophyllum* sp.: transverse section of a strongly damaged specimen with stereocolumella and long contratingent minor septa (Gałęzice, the dump; Z. Pal. P. Tc No. 3/2171), × 5.4.

Remarks. — Because of its bent septa and long major and minor septa, the Famennian coral here described is somewhat similar to the Permian species *D. zaphrentoides* Koker, 1924 which, however, has much thinner septa.

Occurrence. — Poland: Gałęzice (Besówka), bed 2, Upper Famennian, *costatus* Zone.

Genus *Asthenophyllum* Grubbs, 1939

(Type species: *Asthenophyllum orthoseptatum* Grubbs, 1939)

Species assigned: *A. orthoseptatum* Grubbs, 1939; *A.* cf. *occidentale* Whiteaves in Norfolk, 1962; *A. orientale* Ivanovsky, 1963, in Famennian of Poland occurs *A.* aff. *orthoseptatum* Grubbs, 1939.

Stratigraphic and geographic range: Middle Silurian-Famennian of North America, Europe, Asia and Australia.

Diagnosis. — See Grubbs (1939).

Remarks. — The specimen from Kowala has a structure characteristic of the type species. However, a long time interval is observed in its occurrence (Middle Silurian-Famennian).

Asthenophyllum aff. *orthoseptatum* Grubbs, 1939
(Text-fig. 57)

Material. — One, damaged specimen. Two peels were made.

Description. — Preserved is a 7 mm long distal end of the corallite. Diameter on the side of proximal end amounts to 11 mm and near calyx — to 12.5 mm. Edge of calyx slightly deflected outwards, sharp. Epitheca thin, with delicate interseptal striae, corresponding to major and minor septa, as well as with thin growth wrinkles visible on its surface.

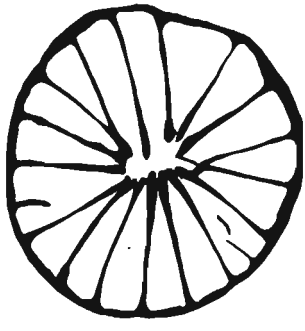

Fig. 57. — *Asthenophyllum* aff. *orthoseptatum* Grubbs: transverse section of a coral, cardinal septum long, situated in a wide fossula (Kowala; I. G. No. 163 p, II, 62), × 3.5.

Transverse section is almost completely in conformity with Grubbs' figure. Corallite round in transverse section, skeletal elements thin. Septa straight, with rhopaloid axial ends contacting each other and forming a stereotheca, which is discontinuous in the place where fossula is situated. A long cardinal septum penetrates as deep as the axis. Septa arranged zaphrentoidally. Number of major septa in quadrants according to the formula $\frac{3\,|\,3}{4\,|\,3}+6$. Minor septa embedded in a thin epitheca and visible only in the form of interseptal grooves occurring on the surface. With a diameter of 11 mm the number of major septa amounts to 19.

Remarks. — The Famennian specimen has the same number of septa as the Middle Silurian *A. orthoseptatum* Grubbs, but differs in a greater diameter: n/d = 19/11 in the Famennian specimen and 18/7 in the

Silurian specimen. *A.* aff. *occidentale* (Whiteaves, in Norfolk, 1962) has serrate axial edges of septa. The Siberian species *A. orientale* Ivanovsky has septa of one length and occurring in a great number (n/d = = 32/11).

Occurrence. — Poland: Kowala, Upper Famennian, *costatus* Zone.

Superfamily **Zaphrenticae** M. Edw.-H., 1850
Family **Mycophyllidae** Hill, 1940
(Type genus: *Mycophyllum* Etheridge, 1894)

1902. Zaphrentidae; P. Počta, Système silurien..., p. 76, *partim.*
1940. Mycophyllidae; D. Hill, The Middle Devonian..., p. 156.
1940. Mycophyllidae; D. Hill, The Silurian..., p. 399.
1949. Chonophylidae; E. C. Stumm, Revision..., p. 48, *partim.*
1949. Kodonophyllidae; E. D. Soshkina, Devonskie korally..., p. 35, *partim.*
1960. Mycophyllidae; G. M. Philip, The Paleontology..., p. 173.
1962. Kodonophyllidae; E. D. Soshkina, T. A. Dobroljubova & N. V. Kabakovitsh, Tetracoralla..., p. 308, *partim.*
1962. Chonophyllidae; E. D. Soshkina, T. A. Dobroljubova & N. V. Kabakovitsh, Tetracoralla..., p. 309, *partim.*

Genera assigned: *Aspasmophyllum* Roemer, 1880; *Mycophyllum* Etheridge, 1894; *Pseudamplexus* Weissermel, 1897; *Briantia* Barrois, 1899, *Pseudophyllum* Počta, 1902; *Pseudomphyma* Wedekind, 1927.

Diagnosis. — See Hill (1956, p. F277).

Remarks. — The family assignment of the genera mentioned above, their diagnostic characters and relationships with other genera are exhaustively discussed by Hill (1940). Because of the fact that Weissermel (1897) did not determine species assigned to the genus *Pseudamplexus*, Lang, Smith & Thomas (1940) considered the genus *Pseudamplexus* Weissermel, 1897 to be a caelebs genus. On the other hand, Hill (1940, p. 158) maintained this genus because she found that *Zaphrentis ligeriensis* Barrois, 1889 was assigned by Weissermel to *Pseudamplexus* which, according to her, met the requirements of the International Code of Zoological Nomenclature. After studying an appropriate literature, the present writer shares Hill's view.

Genus *Pseudamplexus* Weissermel, 1897
(Type species: *Zaphrentis ligeriensis* Barrois, 1889)

1889. *Zaphrentis*; Ch. Barrois, Faune du calcaire..., p. 52.
1897. *Pseudamplexus;* W. Weissermel, Die Gattung..., p. 878.
1937. *Zelophyllum*; E. D. Soshkina, Korally verchnego..., p. 46, *partim.*
1940. *Pseudamplexus*; D. Hill, The Middle Devonian..., p. 157 (*cum synonymy*).
1949. *Pseudamplexus*; E. D. Soshkina, Devonskie korally..., p. 37.
1954. *Pseudamplexus*; D. Hill, Devonian corals..., p. 158.

Species assigned: *Zaphrentis ligeriensis* Barrois, 1889; *Pselophyllum obesum* Počta, 1902; *P. bohemicum* Barrande, 1902; *Pseudamplexus princeps* Etheridge, 1907; *Zelophyllum multitabulatum* Soshkina, 1937; *Z. minimum* Soshkina, 1937; *Pseudamplexus* sp. Hill, 1940; *Pseudamplexus quadripartitus* Soshkina, 1949; *P. fascicularis* Soshkina, 1949; *Pseudamplexus* sp. Hill, 1954; *Pseudamplexus princeps costatus* Philip, 1962; *P. granulatus* n.sp.

Stratigraphic and geographic range: Upper Silurian-Famennian of Europe, Asia and Australia.

Diagnosis. — See Hill (1956, p. F277). Solitary and colonial corals with a rhabdacanthine microstructure of their septa.

Remarks. — According to Hill (1940), *Zelophyllum* Wedekind, 1927, having holacanthine septa, does not belong to Mycophyllidae, but Soshkina (1937) describes a few genera of *Zelophyllum,* maintaining that their microstructure is similar to that of *Pselophyllum* Počta. At the request of the present writer, Dr. J. Fedorowski made the photographs of the species of *Zelophyllum minimum* (No. 406) and *Z. multitabulatum* Soshkina (No. 137), which are housed in the collections of the Palaeontological Institute of the USSR's Academy of Sciences. These specimens are well-preserved, have rhabdacanthine trabeculae, and, therefore the species they represent belong to the genus *Pseudamplexus* Weissermel. Hill (1956, p. F277) maintains that the corals which belong to Mycophyllidae Hill are solitary. In the present writer's opinion, the diagnosis should be extended because corals of this genus may be either solitary or colonial. *Pseudamplexus granulatus* n.sp., which develops lateral buds, is an example of the latter form.

Pseudamplexus granulatus n.sp.
(Text-fig. 58; Pl. VI, Fig. 5; Pl. VIII, Fig. 1 *a-b*)

Holotype: Specimen Z. Pal. P. Tc No. 3/2014; Text-fig. 58D.
Type horizon: Upper Famennian, *costatus* Zone.
Type locality: Gałęzice (Besówka), bed 1.
Derivation of the name: Lat. granulatus — after a granulate surface of epitheca.

Diagnosis. — A *Pseudamplexus* laterally budding, subcylindrical, with granulate surface. With a diameter of 3.8 mm, it has 32 major and minor septa. Stereozone more or less thick, tabularium wide, tabulae complete, widely spaced.

Material. — Five specimens, ten peels, one thin section.

Description. — Corallites subcylindrical, with a slowly increasing diameter. Fine tubercles are irregularly scattered over the surface of wall and arranged in rows near buds. Buds grow out on the sides of corallite and are alternately arranged on two sides.

Transverse section. Septotheca mostly very thick (= 1/3 of the diameter of the coral), sometimes thin. Major and minor septa about

identically strong and long. Septa project outside in the form of rounded costae, their axial ends are free and penetrate tabularium in the form of rounded denticles.

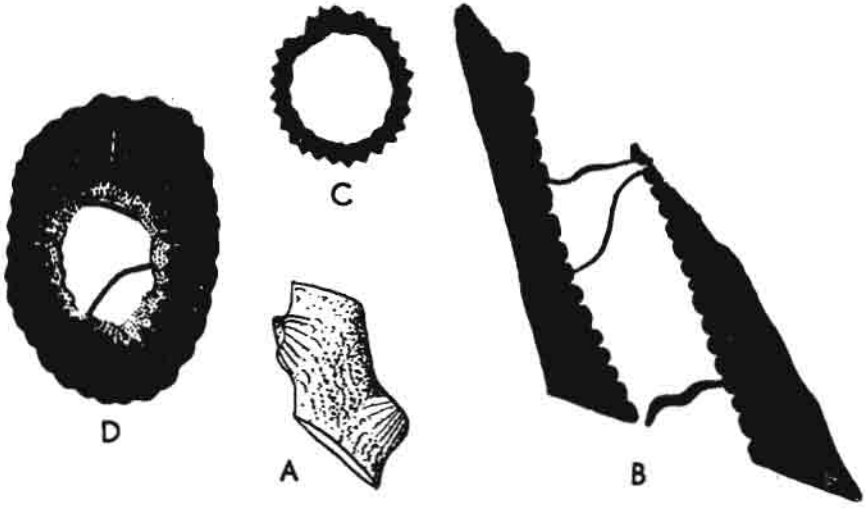

Fig. 58. — *Pseudamplexus granulatus* n.sp.: *A* a diagrammatic drawing of a budding corallite (Gałęzice, bed 1; Z. Pal. P. Tc No. 3/2014), × 2; *B* longitudinal section with a thick stereotheca (Gałęzice, bed 2; No. 3/2162), × 7; *C* transverse section of a very thin-walled corallite (Gałęzice, bed 1; No. 3/2009), × 7; *D* transverse section of a thick-walled specimen (Gałęzice, bed 1; No, 3/2014), holotype, × 7.

Measurable characters are (in mm):

Z.Pal.P. Tc No. 3/	n/d	Thickness of septotheca	Width of tabularium	Spacing of tabulae	Length of corallite
2007	—/3	0.7	1.5	1.2	17.5
2009a	32/4.6	1.0	2.0	—	7.5
2009b	27/2.4	0.2	2.0	—	—
2014	30/4.5	1.2	2.1	—	—
2047	32/4	1.2	1.6	—	—

Longitudinal section. Septotheca thick, trabeculae slightly obliquely penetrate tabularium in the form of rounded tubercles. Tabulae widely (1.2 mm) spaced, thin, horizontal, with tubercles on some of them.

Variability. — Despite the scarcity of material a considerable variability can be observed. Variable is primarily the thickness of stereotheca as shown in transverse sections. Likewise, variability is observed in the spacing of tabulae.

Microstructure. — This important diagnostic character was described in detail by Hill (1940, p. 159) for the representatives of the family Mycophyllidae, whose septa are rhabdacanthine in microstructure. In *P. granulatus* n.sp., trabeculae are arranged obliquely upwards and towards the axis of corallite. A wavy sclerenchyma is visible between trabeculae.

Remarks. — The representatives of the genus *Pseudamplexus* mostly reach large dimensions, as, for instance, *P. ligeriensis* Barrois (in Soshkina, 1937) which is 44 mm in diameter and has 72 septa. Famennian specimens are very small, have a mostly thick septotheca and widely spaced tabulae, in which they resemble to the greatest degree *Pseudamplexus* sp. Hill (1954). In addition to large dimensions, specimens described by Soshkina (1949) as *P. quadripartitus* Soshkina are marked by a different (parricidal) type of budding. The corals illustrated by Różkowska (1967, Pl. 1· Fig. 9 A, B) belong to the species described above.

Occurrence. — Poland: Gałęzice (Besówka), Upper Famenian, *costatus* Zone.

Family **Cyathopsidae** Dybowski, 1873
Genus *Caninophyllum* Lewis, 1929
(Type species: *Cyathophyllum archiaci* M. Edw.-H., 1852)

Stratigraphic and geographic range: (?) Upper Famennian, Lower-Upper Carboniferous of Europe and Asia.

Diagnosis. — See Hill (1956, p. F292). Microstructure of septa fibrous-lamellar.

Caninophyllum(?) sp.
(Text-fig. 59)

Material. — A small fragment of a corallite found in the Upper Famennian limestone of Gałęzice, bed 2, *costatus* Zone, which is assigned by the present writer, with the reservation, to the genus mentioned above. A peel of a longitudinal oblique section was made.

Description. — Tabularium wide, axial tabulae convex with many accessory plates. Septa thickened, wavy, do not reach the axis and there remains free a wide axial area. Minor septa long, only slightly shorter than major septa. Dissepimentarium wide. Dissepiments convex in transverse section, with their convexity pointing towards the axis. There are the following characters common with some species of the genus *Caninophyllum*: a wide dissepimentarium, long major and minor septa, wide tabularium with many accessory plates. Unfortunately, the specimen is

to a considerable extent fragmentary and fossula which may be present, as well as the thickening of septa near fossula and a shortened cardinal septum, are invisible.

Fig. 59. — (?)*Caninophyllum* sp.: longitudinal-oblique section (Gałęzice, bed 2; Z. Pal. P. Tc No. 3/2116), × 2.5.

Superfamilly **Phillipsastraeicae** Roemer, 1883

Families assigned: this superfamily includes the following three families (Różkowska, 1965): 1) Phacellophyllidae Wedekind, 1924 with the type genus *Thamnophyllum* Penecke, 1894; 2) Phillipsastraeidae Roemer, 1883 with the genus *Phillipsastrea* d'Orbigny, 1894; 3) Marisastridae Różkowska, 1965 with the type genus *Marisastrum* Różkowska, 1965.

Diagnosis. — See Schouppé, 1959 (for Phillipsastraeacea).

Remarks. — Schouppé (1959) distinguished the genera of the families mentioned above as belonging to a separate suborder, Phillipsastraeacea Roemer. He believed that in their hexacoralloid structure they conspicuously differ from other Tetracoralla. It was, however, found by the present writer that corals with a hexacoralloid structure occur not only in the group Phillipsastraeacea. The family Kielcephyllidae n.fam. of the superfamily Lindstroemiicae Počta, 1902 is also marked by a distinct hexacoralloid structure. Consequently, this great and differentiated group of phillipsastreoid corals, common in Givetian and widely spread in Frasnian, is continuously assigned by the present writer to the suborder Streptelasmatina and distinguished as a superfamily Phillipsastraeicae Roemer, 1883.

Family **Phacellophyllidae** Wedekind, 1921

Genera assigned: *Pterorrhiza* Ehrenberg, 1832; *Thamnophyllum* Penecke, 1894; *Macgeea* Webster, 1889; *Peneckiella* Soshkina, 1939; *Sudetia* Różkowska, 1960; *Synaptophyllum* Simpson, 1900.

Diagnosis. — See Soshkina (1949) emend. Solitary and phaceloid corallites with a hexacoralloid structure, trabecular microstructure,

dissepimentarium consisting of an external row of flat dissepiments and of a row of horseshoe dissepiments which may be reduced during the phylogenetic development. Tabularium formed by complete tabulae or consisting of axial and periaxial ones. Pseudocolumella may occur. A zaphrentoid stage occurs in the early ontogeny.

Remarks. — Schouppé & Stacul (1963) consider *Thamnophyllum* Penecke to be a subgenus of *Macgeea* Webster (= *Pterorrhiza* Ehrenberg) and assign it to the family Macgeeidae Schouppé. According to the International Code of Zoological Nomenclature, par. 23c, the name of Phacellophyllidae Wedekind, 1924 has a priority. The following authors consider *Macgeea* Webster and *Thamnophyllum* Penecke to be independent genera: Pickett (1967), Scrutton (1968) and the author of the present monograph. At present, debatable is the generic name of *Macgeea* Webster, 1889, which gives way to the name of *Pterorrhiza* Ehrenberg, 1834 being an older synonym, already used by Glinski (1961), Birenheide (1963), Pickett (1967), Durkoop (1967) and Fedorowski (1968). Together with Schouppé & Stacul (1959) and Pickett (1967), the present writer assigns *Pexiphyllum* Walther, 1928 — as a junior synonym — to the genus *Pterorrhiza* Ehrenberg, 1834, because the latter has, in some species, also a developed pseudocolumella and very thick skeletal elements.

Genus *Thamnophyllum* Penecke, 1894

(Type species: *Thamnophyllum stachei* Penecke, 1894)

1894. *Thamnophyllum*; K. A. Penecke, Das Grazer Devon..., p. 102.
1967. *Thamnophyllum*; J. Pickett, Untersuchungen..., p. 30.
1968. *Thamnophyllum*; C. T. Scrutton, Colonial..., p. 257 (*cum synonymy*).

Species assigned: *T. caespitosum* (Goldfuss, 1826); *T. hoernesi* Penecke, 1894; *T. stachei* Penecke, 1894; *T. murchisoni* Penecke, 1894, *T. reclinatum* Hill, 1939; *T. monozonatum* Soshkina, 1939; *T. virgatum* Soshkina, 1941; *T. morganiense* Soshkina, 1949; *T. uniense* Soshkina, 1951; *T. skalense* Różkowska, 1956; *T. kozlowskii* Różkowska, 1956; *T. germanicum superius* Różkowska, 1956; *T. germanicum pajchelae* Różkowska, 1956; *T. caespitosum paucitabulum* Scrutton, 1968; *T. germanicum germanicum* Scrutton, 1968.

Stratigraphic and geographic range: Lower to Upper Devonian of North America, Europe, Asia and Australia.

Diagnosis. — See Scrutton (1968, p. 258). Microstructure of septa — trabecular.

Thamnophyllum germanicum germanicum Scrutton, 1968

(Text-fig. 60)

1968. *Thamnophyllum germanicum germanicum* Scrutton; C. T. Scrutton, Colonial ..., p. 260 (*cum synonymy*).

Material. — One damaged specimen with a partly preserved epitheca. Two peels of transverse and longitudinal sections.

Description. — A subcylindrical coral 11.5 mm long, 7.5 mm in diameter at the proximal end and 9.5 mm at the distal end. Epitheca preserved in some places. No traces of budding.

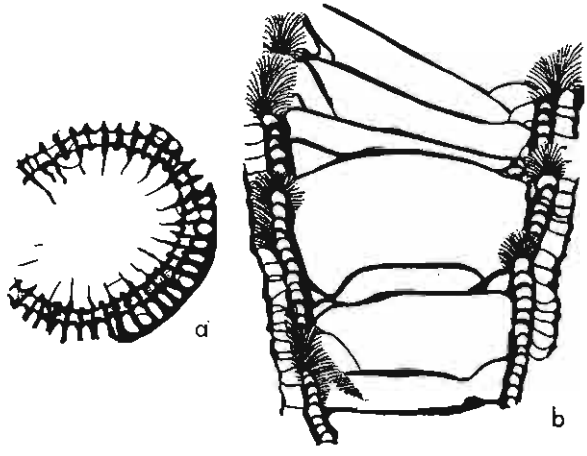

Fig. 60. — *Thamnophyllum germanicum germanicum* Scrutton: *a* transverse section with remains of epitheca and a verticil of horseshoe dissepiments trapezoidal in cross section; *b* longitudinal section with a thick epitheca, and a row of flat dissepiments, thick-walled horseshoe dissepiments and fans of trabeculae (Kadzielnia I, bed 2; Z. Pal. P. Tc No. 3/628), × 3.

Transverse section slightly oval, epitheca thick; the zone of flat dissepiments wide, with a verticil of fine, thick-walled horseshoe dissepiments, rhomboid in transverse section, adhering to it. Major septa short, their peripheral ends thickened, axial ends thin, threadlike. Minor septa partly piercing the periaxial wall of dissepiments. With a diameter of 6 mm, the number of major septa amounts to 22.

Longitudinal section. Epitheca thick. Two vertical rows of flat dissepiments with thick-walled horseshoe dissepiments adhering to them. Tabularium wide. Tabulae complete, convex and flat, widely spaced. Accessory plates on periphery.

Remarks. — Quenstedt (1881) introduced *Cyathophyllum caespitosum trigemme*. Glinski (1957), showed that this species belonged to the genus *Favistella* (*Dendrostella*) and not to the genus *Thamnophyllum*, to which it was erroneously assigned by Penecke (1894) when he described *Thamnophyllum trigeminum* (Quenstedt). Consequently, instead of *T. trigeminum* (Quenstedt), Scrutton (1968) introduced a new name, *T. germanicum germanicum*.

Despite the fact that the manner of budding of the Famennian specimen is unknown so far (parricidal, common among *Thamnophyllum*

or lateral, met with only in the species *Thamnophyllum caespitosum* (Goldfuss) and in the subspecies *T. caespitosum paucitabulatum* Scrutton, 1968), the present writer assigns it to the *T. germanicum germanicum* because the Famennian specimen has an identical structure and septal index n/d = 22/6.5 with those of *T. germanicum germanicum* Scrutton from Givetian of Skały.

Occurrence. — Poland: Givetian, Frasnian, Famennian; Great Britain, Germany, Austria and the U.S.S.R.: Givetian and Frasnian.

Genus *Pterorrhiza* Ehrenberg, 1834

(*Genolectotype*: *Pachyphyllum solitarium* Hall & Whitfield, 1873)

1834. *Pterorrhiza*; C. G. Ehrenberg, Beiträge..., p. 312.
1889. *Macgeea*; C. L. Webster, Description of a new genus..., p. 711.
1929. *Pexiphyllum*; C. Walter, Mitteldevon-Oberdevongrenze..., p. 128.
1963. *Macgeea* (*Macgeea*); A. v. Schouppé & P. Stacul, Bau und taxionomische..., p. 289, *partim*.
1967. *Pterorrhiza*; J. Pickett, Untersuchungen..., p. 27.

Species assigned: *Macgeea solitaria* (Hall & Whitfield, 1873); *M. dubia* (de Blainville, 1830); *M. gallica* Lang & Smith, 1935; *M. supradevonica* Penecke, 1903; *M. berdensis* Soshkina, 1939; *M. bathycalyx* (Frech, 1886); *M. multizonata* Reed, 1922; *M. prima* (Walther, 1928); *M. recta* (Walther, 1928); *M. alta* (Walther, 1928); *M. arcuata* (Walther, 1928); *M. ultima* (Walther, 1928); *M. breviconus* Soshkina, 1939; *M. originata* Soshkina, 1939; *M. caucasica* Soshkina, 1952; *M. araxis* (Frech, 1886); *M. proteus* S. Smith, 1945; *M. czarnockii* Różkowska, 1953; *M. siemiradzkii* Różkowska, 1953; *M. touti* Pedder, 1965; *Pterorrhiza czarnockii breviseptata* Pickett, 1967; *P. densa* Fedorowski, 1968.

Stratigraphic and geographic range: Middle and Upper Devonian of North America Europe, Asia and Australia.

Pterorrhiza berdensis (Soshkina, 1939)

(Text-fig. 61)

1939. *Macgeea berdensis*; E. D. Soshkina, Verchnedevonskie..., pp. 18—20, Pl. 3, Figs. 19—36; Pl. 4, Figs. 37—38; Pl. 13, Figs. 108—111.
1953. *Macgeea berdensis*; M. Różkowska, Pachyphyllinae..., pp. 22—24, Pl. 4, Figs. 7—11 in text (*cum synonymy*).

Material. — One strongly damaged specimen of which a peel of transverse section was made. The specimen was found during the exploitation of the Lower Famennian shales in the Kadzielnia quarry near Kielce, exposure I, bed 1.

Transverse section. Epitheca mostly destroyed, in such cases septa projecting outside in the form of "costae". Septa thick, fusiform, their axial ends thin, threadlike. Major septa short and, consequently, a wide axial area is free of septa. The sections of convex incomplete tabulae are visible only in this place. Minor septa slightly thinner, short, not

entering the internal verticil of thick-walled dissepiments. In addition to flat and horseshoe dissepiments, there are also 1-2 rows of normal dissepiments.

Remarks. — The Famennian specimen is very similar to the specimens from Frasnian of Ural described and illustrated by Soshkina (1939, 1952, pp. 18-22). The similarity is expressed by septal index n/d, which in the specimen from Ural amounts to 26×2/12 mm and in that from Famennian of Poland — to 25×2/12 mm, as well as by the structure viewed in transverse section. Less similar is the specimen, described by Różkowska (1953) from Frasnian of Kielce, whose septa are longer and straight and dissepimentarium wider.

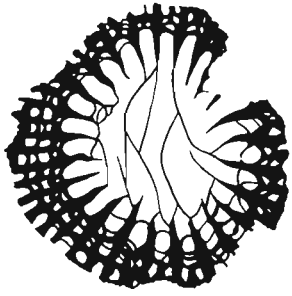

Fig. 61. — *Pterorrhiza berdensis* (Soshkina): transverse section with thick, short major and minor septa and remains of epitheca having 3-4 verticils of dissepiments (Kadzielnia, the dump; Z. Pal. P. Tc No. 3/1711), × 3.4.

Occurrence. — Poland: Kielce (Kadzielnia and Wietrznia quarries), Kowala, Frasnian, Kielce (Kadzielnia quarry), Lower Famennian. U.S.S.R.: Ural, Frasnian.

Genus *Peneckiella* Soshkina, 1939

(Genolectotype: selected by Soshkina, 1939; *Diphyphyllum minus* Roemer, 1855)

1939. *Peneckiella*; E. D. Soshkina, Verchnedevonskie..., p. 23.
1967. *Thamnophyllum* (*Peneckiella*); J. Pickett, Untersuchungen..., p. 31, *partim*.
1968. *Peneckiella*; C. T. Scrutton, Colonial..., p. 271 (*cum synonymy*).

Species assigned: *Peneckiella minor* (Roemer, 1855); *P. minor kunthi* (Dames, 1868); *P. nalivkini* Soshkina, 1939; *P. achanayensis* Soshkina, 1939; *P. jevlanensis* Bulvanker, in Soshkina (1952); *P. mesa* Hill, 1942; *P. teicherti* Hill, 1955; *P. tolstichinae* Soshkina, 1954; *P. tabulata* Bulvanker, 1958; *P. salternensis* Scrutton, 1968; *P. boreensis* Strusz., 1965. Ivania (1965) described: *P. carinata, P. irregularis, P. glubokiensis, P. elegans, P. belskajae, P. jakovlevi.*

Stratigraphic and geographic range: According to Scrutton (1968, p. 273): "Uppermost Givetian and Frasnian of Europe; ?Upper Lower Devonian to Frasnian of Australia; ?Lower, Middle and Upper Devonian of North America. Famennian of Europe and Asia."

Diagnosis. — See Scrutton (1968, p. 272).

Remarks. — Much attention has recently been paid by several authors to this genus, whose critical elaborations are met with in the works of the following palaeontologists: Flügel (1956), Schouppé (1959), Różkowska (1960), Strusz (1965), Ivania (1965), Pickett (1967) and Scrutton (1968). The systematic assignment of the genus *Peneckiella* is variously understood. Soshkina (1949) erected the family Peneckiellidae and, in addition to *Peneckiella,* assigned to it other genera as *Keriophylloides* Soshkina, 1951, *Megaphyllum* Soshkina, 1939, *Tabellaephyllum* Stumm, 1948 and *Donia* Soshkina, 1951. After studying a topotype from Upper Frasnian of Grund (Harz Mountains), Schouppé (1958) introduced the subfamily Peneckiellinae assigned to the family Macgeeidae Schouppé, 1958. He found that this genus has a thamnophylloid structure. Examining the subspecies *P. minus kunthi* (Dames) from Upper Frasnian of Mokrzeszów. Różkowska (1960) found the presence of various dissepiments, as horizontal, horseshoelike, peneckielloid and sigmaid ones. A similar variety of dissepiments was also observed by Strusz (1965) in *P. mesa* Hill from the Lower Devonian of Australia, by Pickett (1967) in the specimens from the Harz Mountains and by Scrutton (1968) in *P. salternensis* Scrutton. Schouppé (1958) considered *Peneckiella* to be an independent genus and Pickett (1967) — a subgenus of *Thamnophyllum.* The present writer, Strusz (1965) and Scrutton (1968) consider *Peneckiella* as an independent genus.

The Upper Frasnian species *P. minor kunthi* (Dames) from Mokrzeszów is considerably similar to the Lower Devonian *P. mesa* Hill from Australia. Both are almost identical in structure, which is described by Strusz (1965, p. 558). Even the diagrams of the correlation of their septa and diameters are similar.

Peneckiella sp.
(Text-fig. 62)

Material. — A fragmentary specimen, embedded in zoogenic limestone from Gałęzice. A peel of longitudinal section of wall and dissepimentarium.

Remarks. — Various dissepiments characteristic of *Peneckiella* and in particular of *P. minor kunthi* (Dames) and *P. mesa* Hill are visible in the region of epitheca. These are irregular, wide, horizontal dissepiments near which, towards the inside of the corallite, there occur horseshoe dissepiments and peneckielloid vesicles.

Occurrence. — Poland: Gałęzice (Besówka), bed 2; Upper Famennian, *costatus* Zone.

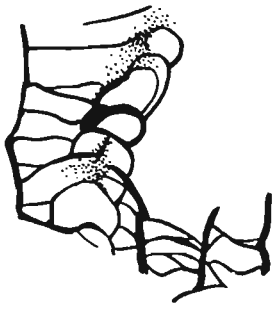

Fig. 62. — *Peneckiella* sp.: longitudinal section of a fragmentary specimen with different (flat, peneckelloid and horseshoe) dissepiments (Gałęzice, bed. 2; Z. Pal. P. Tc No. 3/2568), × 3.

Family **Phillipsastraeidae** Roemer, 1883

Genus *Phillipsastrea* d'Orbigny, 1849

(Type species: *Astrea hennahi* Lonsdale, 1840, *partim*)

1849. *Phillipsastrea*; A. d'Orbigny, Note sur les polypiers..., p. 12.

1967. *Pseudoacervularia*; J. Pickett, Untersuchungen..., p. 26.

1968. *Phillipsastrea*; C. T. Scrutton, Colonial..., p. 210 (*cum synonymy*).

Species assigned: *Phillipsastraea ananas* (Goldfuss, 1826); *P. roemeri* (Verneuil & Haime, 1853); *P. ibergense* (Roemer, 1855); *P. macrommata* (Roemer, 1855); *P. lacunosa* (Gürich, 1896); *P.* aff. *macouni* Smith, 1945; *P. sobolevi* Różkowska, 1953; *P. dybowskii* Różkowska, 1953; *P. samsonowiczi* Różkowska, 1953; *P. friedbergi* (Różkowska, 1953); *P. smithi* (Różkowska, 1953); *P. ibergense progressa* Różkowska, 1953.

Stratigraphic and geographic range: According to Scrutton (1968, p. 212): "Middle and Upper Devonian of Europe and Asia, Lower and Middle Devonian of Australia, Upper Devonian of North America".

Remarks. — The colonies of *Phillipsastrea* may be pseudocerioid, astreoid, aphroid and secondary phaceloid. To designate cerioid colonies, the name of *Pseudoacervularia* was introduced by Schlüter (1881). Unfortunately, the specimen of the type species *Acervularia coronata* M. Edw.-H. which was determined by Lang, Smith & Thomas (1940) to be a genolectotype, was lost. According to Scrutton (1968, p. 213): "the species is almost certainly conspecific with *Phillipsastrea hennahi* Lonsdale, and *Pseudoacervularia* is a subjective synonym of *Phillipsastrea*". Since the genus *Pseudoacervularia* Schlüter has cerioid and, less frequently, phaceloid colonies, trabecular fans and horseshoe dissepiments, it has been recently separated by Pickett (1967, p. 26) from *Phillipsastrea*. According to the last named author an epitheca surrounding individual corallites occurs in this genus. All the species described by the present writer (Różkowska, 1953) from Givetian and Frasnian and assigned to *Pachyphyllum* and *Pseudoacervularia* have pseudotheca or it is lacking. Only secondarily phaceloid corals had

epitheca surrounding individual corallites (*P. lacunosum* Gürich). The fragmentary cerioid colony from the Upper Famennian has epitheca, lonsdaleoid dissepiments, and additionally horseshoes. Therefore this specimen has been assigned tentatively by the writer to (?)*Phillipsastrea* d'Orbigny.

?*Phillipsastrea* sp.
(Text-fig. 63)

Material. — A single fragmentary specimen embedded in limestone. One peel of transverse section.

Transverse section. This fragmentary specimen is a part of a cerioid colony, surrounded by epitheca. It has character typical of the genus *Phillipsastrea*, i.e., the presence of a verticil of horseshoe dissepiments, as it may be concluded from a trapezoid transverse section of dissepiments. Lonsdaleoid dissepiments occurring here beside an epitheca, are the character which is not typical in *Phillipsastrea*. Their presence may be a result of phylogenetic progression. Similar, although not so strongly marked lonsdaleoid dissepiments occur in the Upper Frasnian species *P. lacunosum* (Gürich, 1896, in Różkowska, 1953, Fig. 26). In addition, in

Fig. 63. — (?)*Phillipsastrea* sp.: transverse section of a fragment of a colony with a verticil of horseshoe dissepiments trapezoidal in cross section, septa separated from the wall by dissepiments (Gałęzice, bed. 2; Z. Pal. P. Tc No 3/2566), × 3.4.

the Famennian specimen the major septa, varying in thickness and length, slightly resemble those of *P. samsonowiczi* (Różkowska, 1953, Pl. 6).

Remarks. — This specimen has been assigned by the present writer to the genus *Phillipsastrea* with reservation because of its poor state of preservation and its non typical for *Phillipsastrea* structure.

Occurrence. — Poland: Gałęzice (Besówka), Upper Famennian, *costatus* Zone.

Suborder **Columnariina** Rominger, 1876
Family **Endophyllidae** Torley, 1933

Genera assigned: The following genera are here assigned by Soshkina, Dobroljubova & Kabakovitsh (1962): *Tabulophyllum* Fenton & Fenton, 1924; *Sanidophyllum* Etheridge, 1899; *Stelechophyllum* Tolmachov, 1933; *Endophyllum* M. Edw.-H., 1851; *Neocolumnaria* Soshkina, 1949; *Solominella* Ivania, 1952. In addition, there are also the following genera mentioned by Hill (1956): *Sinospongophyllum* Yoh, 1937; *Strombodes* Schweigger, 1919; *Pilophyllum* Wedekind, 1927; *Diversophyllum* Sloss, 1939; *Iowaphyllum* Stumm, 1949. A new genus, *Smithiphyllum* Birenheide, 1962 has been recently introduced. The assignment of these genera to Endophyllidae will, however, be debatable as long as their ontogeny is not elucidated. Two genera: *Tabulophyllum* Fenton & Fenton, 1924 and *Smithiphyllum* Birenheide, 1962 occur in Famennian of Poland.

Diagnosis. — See Hill (1956, p. F300).

Genus *Tabulophyllum* Fenton & Fenton, 1924
(Genotype: *Tabulophyllum rectum* Fenton & Fenton, 1924)

1924. *Tabulophyllum*; C. L. Fenton & M. A. Fenton, The stratigraphy..., p. 30.

1928. *Apolythophyllum*; C. Walther, Untersuchungen..., p. 135.

1939. *Diversophyllum*; Z. L. Sloss, Devonian Rugose..., p. 65.

1960. *Tabulophyllum*; E. D. Soshkina, Turnejskie korally..., p. 289 (*cum synonymy*).

Species assigned: The following species are introduced by Fenton & Fenton (1924): *Tabulophyllum rectum*, *T. regulare*, *T. ehlersi*, *T. rotundum*, *T. erraticum*, *T. exiguum*, *T. robustum*, *T. magnum*, *T. longum*, *T. expansum* and *T. ponderosum*. Other species are mentioned by Soshkina (1960): *T. burringtonense* (Vaughan & Reynolds, 1911), *T. transitorium* (M'Coy, 1849), *T. caninoides* Gorsky, 1935, *T. nalivkini* Gorsky, 1935, *T. plativesiculosum* Gorsky, 1935, *T. aquisgranense* Frech, 1885, *T. longiseptatum* Bulvanker, in coll., *T. gorskyi* Bulvanker, in coll., *T. macconelli* (Whiteaves, 1889), *T. grandivesiculosum* Soshkina 1952, *T. heckeri* Bulvanker, in coll. Describing a new genus, *Apolythophyllum*, which is a junior synonym of *Tabulophyllum*, Walther (1928) introduces the following new species: *A. gracile*, *A. cylindricum*, *A. brevissimum*, *A. tenuissimum* and *A. normale*. *Zaphrentis transversensis* Winchell, 1866 is the type species of the genus *Diversophyllum* Sloss, 1939 which may be a junior synonym of the genus *Tabulophyllum*. *T. sibiricum* was also described by Bulvanker (1952) and *T.? meridionale* Philip — by Philip (1962). In Famennian of Poland occurs *T.* aff. *gorskyi* Bulvanker, in coll.

Stratigraphic and geographic range: Upper Devonian to Lower Carboniferous of North America, Europe, Asia and Australia.

Diagnosis. — See Smith, 1945, p. 58. Microstructure of septa trabecular.

Remarks. — To this genus the present writer assigns only solitary corals. Questionable is even the assignment of those solitary corals whose ontogeny remains unknown.

Tabulophyllum aff. *gorskyi* (Bulvanker in coll., in Soshkina, 1951)
(Text-fig. 64)

Material. — One specimen, of which 13 peels were made, and a fragmentary specimen, of which two peels were made.

Description. — A juvenile corallite 10 mm long, with a short, conical proximal end and a wide (8.5×6.5 mm in diameter) talon. Epitheca thick, having only wide, transverse contractions.

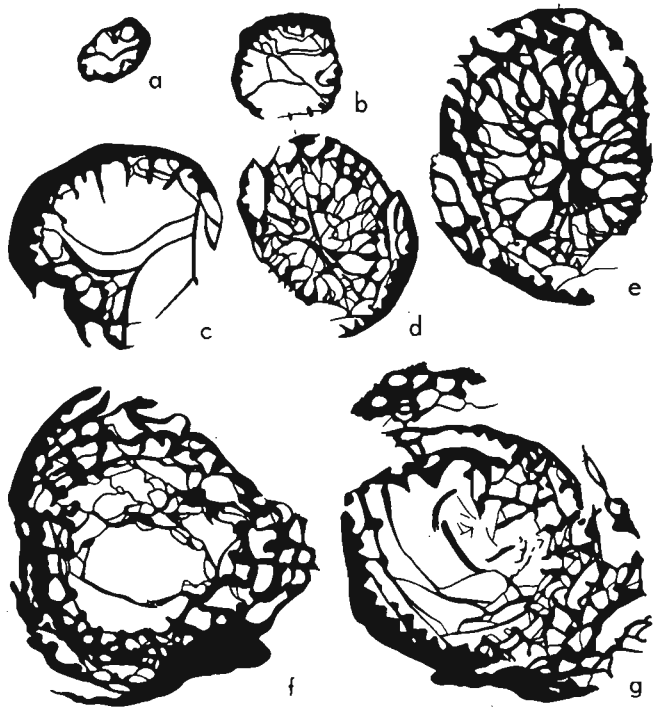

Fig. 64. — *Tabulophyllum* aff. *gorskyi* Bulvanker; a series of transverse sections, showing the ontogenetic development: *a-c* neanic stage, *d-e* ephebic stage, *f-g* transverse sections through the base of a destroyed calyx (Kadzielnia G; Z. Pal. P. Tc No. 3/142), × 2.5.

Transverse section. Shape of section oval; distinct bilateral symmetry, diameter — 5.5×7 mm. Epitheca thick, with 20×2 mm short, thick, triangular bases of major and minor septa mounted on it. Wide but shallow peripheral vesicles have thick walls. Major septa, discontinuous in the peripheral part, become complete beginning with the internal verticil of vesicles. In the early ephebic stage, with an oval transverse section of the corallite, septa are arranged bilaterally. They are long, thick, partly forming systems and reach the axis where they fuse and together with tabulae, form a pseudocolumella. Minor septa are short and fused

to a major septum on the side of cardinal septum. Cardinal septum short, situated in a closed fossula. In a transverse section through the bottom of calyx, septa are short, thick and discontinuous, peripheral vesicles large; a wide, free, axial area.

Ontogeny (Text-fig. 64). — The earliest, i.e. nepionic and early-neanic stages, lacking. 1) The youngest preserved stage is 3×3.5 mm in diameter and has about 12 distinguishable septa. Coral has then a thick wall, short, thick septa, which are equal in length, and a single, wide tabula. 2) With a diameter of 5×6 mm septa continue to be short and thick; there are about 20 distinguishable, somewhat longer major septa, and between them the same number of minor septa. Transverse sections of wide tabulae are visible. Lonsdaleoid vesicles lacking. 3) With a diameter of 6 mm (a damaged corallite) short septa are visible. Vesicles yet lacking, but talon appears.

Remarks. — In the ontogeny of the species described, there is no axial tube and this fact differs *Tabulophyllum* from a convergent genus *Guerichiphyllum* n.gen. The ontogeny of the Famennian specimen is similar to that in *T. normale* (Walther, 1928), described by Soshkina (1951, 1960). In early-neanic stages, septa occur only in the form of short slats. After studying of the ontogeny in *T. macconelli* (Whiteaves), Smith (1945) found that in the early-neanic stage its septa are thick and axially fused, later on they shorten. So early ontogenetic stage was not probably preserved in the Famennian specimen. Likewise, short septa are observed in the early-neanic stage of *T. priscum* (Münster) from Mokrzeszów.

The Famennian specimen from Poland differs from west-European species *T. priscum* and *T. aquisgranense* in thick, widely spaced septa and bilateral symmetry. It is most strongly related to the Famennian species *T. gorskyi* Bulvanker from Timan with which it has such characters in common, as thick, widely spaced and axially fused septa and a bilateral symmetry. Because of a juvenile age of the coral, the present writer considers its specific assignment to be rather uncertain.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure G, Lower Famennian, probably *quadrantinodosa* Zone; Gałęzice (Besówka), bed 2, Upper Famennian, *costatus* Zone.

Genus *Smithiphyllum* Birenheide, 1962

(Genolectotype: *Spongophyllum imperfectum* Smith, 1945)

1945. *Spongophyllum*; S. Smith, Upper Devonian..., p. 55.
1962. *Smithiphyllum*; R. Birenheide, Revision..., p. 81 (*cum synonymy*), *partim*.
1965. *Smithiphyllum*; A. E. H. Pedder, Some North American..., p. 618.

Species assigned: *Smithiphyllum. stuckenbergi* (Lebedev, 1902), *S. weberi* (Lebedev, 1902); *S. tschernyschevi* (Lebedev, 1902), *S. alpenense* (Stumm, 1948), *S. mar-*

tinense (Stumm, 1948), *S. imperfectum* (Smith, 1945), *S. belanskyi* Pedder, 1965, *S. kindlei* Pedder, 1965, *S. whittakeri* Pedder, 1965.

Stratigraphic and geographic range: Upper Devonian of North America and Europe.

Diagnosis. — See Pedder (1965), emend. Endophylloid corallites forming phaceloid colonies with the major and strongly atrophied minor septa. Peripheral vesicles form a single, discontinuous row, tabulae mostly complete, horizontal, slightly wavy. Microstructure of septa trabecular.

Remarks. — The ontogenetic development of this genus is, unfortunately, unknown. Its microstructure (Pedder, 1965) is identical with that in *Tabulophyllum*. It is likely, therefore, that a close relationship may occur between these two genera, which are also related to each other by the presence of lonsdaleoid dissepiments and tabulae bent downwards on the periphery. *Tabulophyllum* is a solitary and *Smithiphyllum* a colonial, phaceloid form. Middle and Upper Devonian, colonial, phaceloid and cerioid species were included by Birenheide (1962) in the new genus, *Smithiphyllum*. Sharing Smith's (1945) opinion, the present writer believes that only the specimens with endophylloid structure, with phaceloid colonies and which occur in Upper Devonian, should be assigned to *Smithiphyllum*. The Middle Devonian ones have a spongophylloid structure, i.e. of another plan, characterized by a concave tabularium. This was mentioned by Pedder (1965).

Smithiphyllum aff. *imperfectum* (Smith, 1945)

(Text-fig. 65)

Material. — Seven fragmentary specimens, of which ten peels were made.

Description. — Very small fragments, 8.2 mm in longest diameter and 7.5 mm long. One of the specimens is an evident fragment of a phaceloid colony. Epitheca so thin that septal grooves and transverse annulations are visible. Shallow grooves, corresponding to minor septa, are visible between wider, longitudinal grooves.

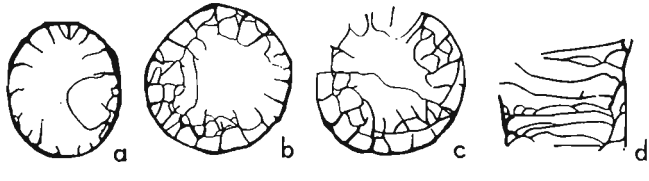

Fig. 65. — *Smithiphyllum* aff. *imperfectum* (Smith): *a-c* successive transverse sections of a mature individual, septa short, here and there separated from the wall by lonsdaleoid vesicles, *d* longitudinal section (Kadzielnia G; Z. Pal. P. Tc No. 3/9), × 2.

Transverse section round or oval, wall thin, major septa thin, short, mostly complete, lonsdaleoid vesicles occurring here and there. Minor septa strongly reduced, mounted only in epitheca. With a diameter of 8 mm, the number of septa amounts to 16—20. Lonsdaleoid vesicles, if any are present, flat and wide.

Longitudinal section. Tabulae mostly complete, horizontal, on the periphery slightly bent downwards, axially slightly convex. On the periphery, vesicles form a single, discontinuous row of vertical, larger or very fine vesicles. Accessory plates on tabulae.

Remarks. — The Famennian species from Poland is closely related to *S. imperfectum* (Smith) from Canada. It has a similar septal index (22/9 as compared with 18-20/8 in the Canadian form) and structure of septa and tabularium. Strongly atrophied minor septa, which in the Polish specimens do not enter the lumen of corallite, are the only difference which is probably a result of the evolutionary progression.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure G; exposures I, beds 2-1; II, bed M; III, beds 28 and 25; Lower Famennian, *quadrantinodosa* Zone.

Suborder **Cystiphyllina** Nicholson, in Nicholson & Lydekker, 1889
Family **Digonophyllidae** Wedekind, 1923

Genera assigned: After the present writer's opinion, the following genera may be here assigned: *Calceola* Lamarck, 1799; *Diplochone* Frech, 1886; *Mesophyllum* Schlüter, 1889 with numerous subgenera; ?*Plasmophyllum* Dybowski, 1873; *Cayugaea* Lambe, 1901; *Zonophyllum* Wedekind, 1924 with numerous synonyms; *Digonophyllum* Wedekind, 1923 with numerous subgenera; *Scoliophyllum* Wedekind, 1927; *Pseudomicroplasma* Soshkina, 1949; *Cystiplasma* Taylor, 1949; *Praenardophyllum* Spassky, 1955.

Stratigraphic and geographic range: Devonian of Eurasia and Australia.

Diagnosis. — See Hill (1956, p. F 314).

Remarks. — After Soshkina, Dobroljubova and Kabakovitsh (1962), *Pseudomicroplasma* Soshkina, 1949 has been placed by the present writer within the family Digonophyllidae; Soshkina (1949) assigned it to the family Cystiphyllidae M. Edw.-H. The characteristic feature for these two families are the septal cones. It is an open question, whether they are or are not related, and only farther investigations of the ontogeny and microstructure may elucidate the problem of relationship between the families Cystiphyllidae and Digonophyllidae.

Genus *Pseudomicroplasma* Soshkina, 1949
(Genolectotype: *Microplasma fractum* Schlüter, 1889)

1889. *Microplasma*; C. Schlüter, Anthozoen..., p. 81.
1901. *Microplasma*; H. v. Peetz, Materialy..., p. 217.

1949. *Pseudomicroplasma*; E. D. Soshkina, Devonskie korally..., p. 53.
1965. *Pseudomicroplasma*; V. A. Ivania, Devonskie korally..., p. 47.

Species assigned: *Pseudomicroplasma fractum* (Schlüter, 1889); *P. salairica* (Peetz, 1901); *P. nesterowskii* (Peetz, 1901); *P. fongi* (Yoh, 1937); *P. uralicum* Soshkina, 1949; *Pseudomicroplasma* sp. Soshkina, 1949; *P. subsiluriensis* Bulvanker, 1958; *P. fasciculata* Ivania, 1965.

Stratigraphic and geographic range: Devonian of Europe and Asia.

Diagnosis. — See Soshkina (1949, p. 53). Microstructure of the wall and septa laminar.

Remarks. — Dybowski (1873) introduced the genus *Microplasma* for the Upper Silurian corals. Yoh (1937) mentioned that the Devonian "*Microplasma*" does not belong to *Microplasma*, as it had derived from *Nardophyllum* Wedekind. Soshkina introduced the name *Pseudomicroplasma* for the Devonian "*Microplasma*". The main feature of *Pseudomicroplasma* is, according to Soshkina (1949, p. 53), strong reduction of the septal cones in the coral axis and their stratification at the periphery where the septal thorns form "laminar" septa.

Pseudomicroplasma stasinskae n.sp.
(Text-fig. 66 *A-G*)

Holotype: Specimen Z. Pal. P. Tc No. 3/2156; Text-fig. 66*B*.
Type horizon: Upper Famennian, *costatus* Zone.
Type locality: Gałęzice (Besówka), bed 2.
Derivation of the name: dedicated to Docent Anna Stasińska, Warsaw, Poland.

Material. — Fifty three small fragments visible in polished surface of limestone as transverse or longitudinal section. Thirty five peels.

Diagnosis. — Corals solitary, slender, subcylindrical, slightly bent, with a diameter up to 4 mm having 28 septa, with a wide (to 7 mm) talon and deep (to 5.5 mm), asymmetric calyx. Horizontal elements in the form of fine vesicles which are indistinctly differentiated into tabulae and dissepiments.

Description. — Corallites subcylindrical, slightly bent, with a wide, flat talon and deep calyx having a sharp edge. Epitheca transversally, irregularly wrinkled.

Transverse section round. Septotheca (?) consisting of short trabeculae here and there entering, in the form of short denticles, the lumen of corallite. Similar septal thorns also occur on the surface of vesicles. Sections of vesicles semicircular or wide, flattened. The cavity of corallite is situated excentrically and near the wall on the concave side.

Longitudinal section. Horizontal, skeletal elements are variously distributed, depending on the plane of section, on the age and on the intraspecific variability. In young age, calyx is deep, its bottom reaching talon. In older age — the vesicular tissue fills almost entire interior and,

if such is the case, calyx is shallow and shaped like a tube or funnel. All these structures occur within a single species since they are connected with each other by intermediate structure. Talon wide, flat.

Variability range very extensive. Variable are the thickness of wall, size and arrangement of vesicles, length and width of the funnel-like calyx.

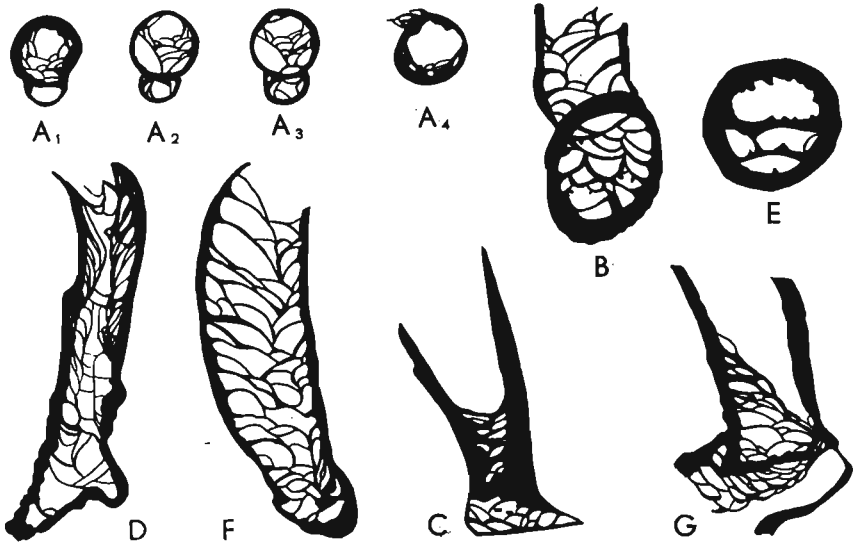

Fig. 66. — *Pseudomicroplasma stasinskae* n.sp.: A_1-A_4 successive transverse sections of a young individual, developing on an older individual of the same species, A_1 a stage without the vesicular tissue, A_2-A_4 with such tissue (Gałęzice, bed 2; Z. Pal. P. Tc No. 3/2477), × 5.4; *B* transverse, slightly oblique section of a coral with vesicular tissue, with short septal thorns and longitudinal section of an individual developing on the former (Gałęzice, bed 1; No. 3/2156), holotype, × 3.4; *C* longitudinal section of a coral with a deep, funnellike calyx and talon (Gałęzice, the dump; No. 3/2229), × 3.4; *D* longitudinal section of a coral with talon and vesicles arranged in a funnellike manner (Gałęzice, the dump; No. 3/2175), × 3.4; *E* transverse section of a thick-walled individual with septal thorns (Kadzielnia III, bed 46; No. 3/1855), × 3.4; *F* longitudinal section of a coral (Kadzielnia III, bed 46; No. 3/1856), × 3.4; *G* longitudinal section of a coral with a deep, funnellike calyx, overgrown, from the side of talon, by another individual (Gałęzice, bed 2; No. 3/2493, × 3.4.

Ontogeny (Text-fig. 66 *A-B, G*). The development of a young corallite, developped from egg and attached to the skeleton of another corallite of the same species, was examined. The larva either attaches to the lateral wall (Text-fig. 66 *B*) or overgrows another corallite on the side of talon. This phenomenon was observed several times. The development of the specimen No. Tc — 3/2477 was traced over a stretch of 2.3 mm. A young individual produces its own epitheca when it contacts another individual and laterally is separated from it by a narrow fissure. The wall of the foreign corallite grows thin in this place. The young corallite probably absorbs some calcite from the epitheca of the individual

supporting it. The young individual is cylindrical, having a uniform diameter of 1.1 mm over a stretch of 2.3 mm. From the beginning, wall is septothecal (?) and an excentric cavity of calyx is situated on the unattached side. Consequently, the cavities of the foreign, adult corallite and of the young individual are situated opposite each other and distant from each other. Inside, vesicles are at first invisible and then 2-4 of them appear, their concavity facing the cavity of calyx. Individuals, in which the larva excreted a wide talon and attached itself directly to the substratum, occur frequently. Their talon is shaped like a wide foot and is mostly diaphragmoid inside.

Remarks. — Visiting the Humboldt Museum in Berlin, the present writer examined among Dr. H. Jaeger's collections a representative *M. flexuosum* of *Microplasma* Dybowski with a structure typical of this genus. This was a phaceloid colonial form with strong syringoporoid processes. The Famennian specimen differs from it and, as a solitary coral, has a conspicuous talon. On the other hand, it is somewhat similar to the Permian *Cystiphyllum diplochone* Koker, 1924 which is also solitary and has talon and a funnellike calyx. It is also similar to the Givetian species *P. fractum* (Schlüter, 1899) from the Eifel Mts. in its dimensions and interior structure, but differs by its regular subcylindrical shape. The coral illustrated by Różkowska (1967, Pl. 1, Fig. 11) belongs to the species described above.

Occurrence. — Poland: Kielce (Kadzielnia) quarry), exposure I, bed 1, exposure II, beds N-K; III, bed 46, the dump, Lower Famennian, *quadrantinodosa* Zone; Gałęzice, beds 4-2, the dump, Upper Famennian, *costatus*, *styriaca* and *velifera* Zones.

Order **Heterocorallia** Schindewolf, 1941

Diagnosis. — See Hill (1956, p. F327). Microstructure of wall of tabulotheca, consisting of concentrical layers, is lamellar, of septa — trabecular.

Stratigraphic and geographic range. — Famennian-Lower Carboniferous of Europe, Asia and Australia.

Remarks. — An exhaustive historical review of the studies on this peculiar group of corals was given by Schindewolf (1941). The first representatives of this group were described by M'Coy (1849) under the generic name of *Heterophyllia* M'Coy with two species: *H. grandis* M'Coy and *H. ornata* M'Coy, the former being considered by M. Edwards-Haime (1850) as a type species. Dybowski (1873) erected the subfamily Heterophylliinae, which Hill (1939, 1941) raised to a rank of the family Heterophylliidae Dybowski, 1873. After a critical analysis of this group, Schindewolf (1941) stated that it was not directly related to either Rugosa

or Hexacoralla and erected for it a new order, Heterocorallia Schindewolf 1941. This order comprises only one family, Heterophylliidae Dybowski, 1873.

Family **Heterophylliidae** Dybowski, 1873

Genera assigned: *Heterophyllia* M'Coy, 1849; *Hexaphyllia* Stuckenberg, 1904; *Oligophylloides* n.gen.

Stratigraphic and geographic range: Famennian-Lower Carboniferous of Europe, Asia and Australia.

Diagnosis. — Since only one family forms the order Heterocorallia, the diagnosis is identical with that for this order.

Remarks. — The microstructure, morphology of skeleton and manner of the insertion of septa were studied by Schindewolf (1941) who discussed the diagnostic characters of the genera and species. The Famennian specimens are the oldest representatives of this family and, since some of them have their proximal end preserved, the examination of them contributes a few new data to the knowledge of the phylogenetic and ecological problems. The genera of Heterophylliidae Schindewolf, 1941, mentioned above, differ from each other in the number of septa. *Hexaphyllia* Stuckenberg, 1904 has 6 and *Oligophylloides* n.gen. 12 septa, not exceeding this number, whereas *Heterophyllia* M'Coy is multiseptal and may have even as many as 42 septa (*H. fragmentoseptata* Vassiljuk, 1964).

Genus *Oliphylloides* n.gen.

(Type species: *Oligophylloides pachythecus* n.sp.)

Derivation of the name: Gr. *oligo* =few, because of a small number of septa occurring in the corallites of this genus.

Species assigned: *O. pachythecus pachythecus* n.subsp., *O. pachythecus pentagonus* n. subsp., *O. tenuicinctus* n.sp.

Stratigraphic and geographic range: Lower and Upper Famennian of the Holy Cross Mountains.

Diagnosis. — Corallites with a talon having a very thick or less thick wall and with a number of septa not exceeding 12. Upper quadrant displaying a regressive tendency. Surface of wall smooth.

Oligophylloides pachythecus pachythecus n.subsp.

(Text-figs. 67 *A-L*, 68 *A-K*, 69 *A-B*, 70 *F*; Pl. VI, Figs. 6—9; Pl. VII, Figs. 4, 15)

Holotype: Specimen Z. Pal. P. Tc No. 3/2064; Text-fig. 67*A*.

Type horizon: Upper Famennian, *costatus* Zone.

Type locality: Gałęzice (Besówka), bed. 1.

Derivation of the name: Gr. *pachys* = thick, after a thick wall of the corallite.

Material. — Eighty five fragmentary specimens embedded in limestones (studied in polished sections), some of them prepared; nine specimens with talon preserved. Seventy eight peels and 37 thin sections were made.

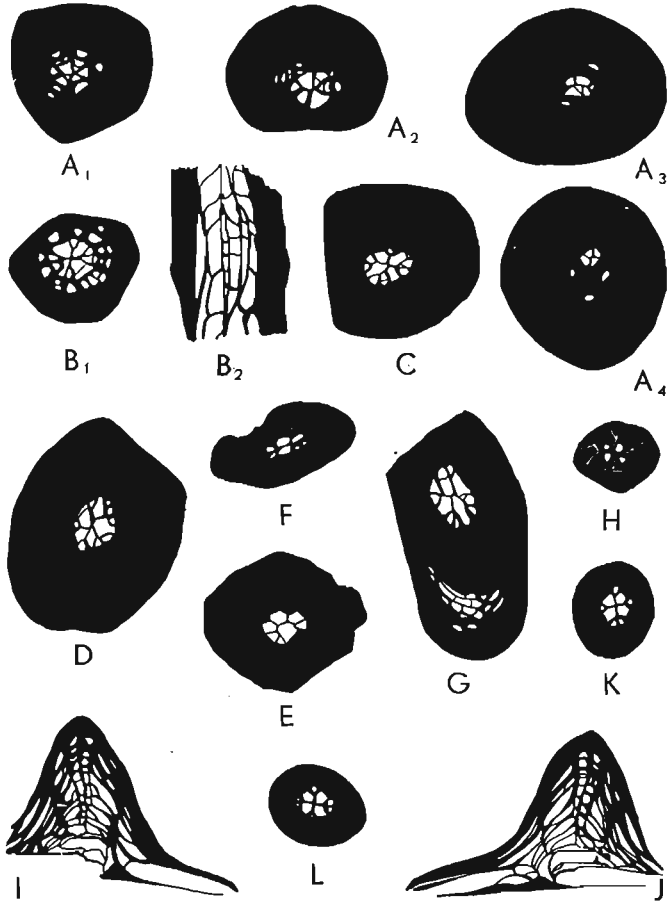

Fig. 67. — *Oligophylloides pachythecus pachythecus* n.gen., n. subsp.: A_1-A_4 a series of successive transverse sections cut directly above talon (Z. Pal. P. Tc No. 3/2064), holotype; B_1 transverse section of a coral cut through the distal end of talon, B_2 longitudinal section with convex tabulae and section of axial ends of septa (No. 3/2003); *C* transverse section of a mature, thick-walled individual with 4 protosepta fused axially and with eight metasepta (No. 3/2064); *D* transverse section (No. 3/2050); *E* transverse section of a corallite with protosepta fused axially in the form of an horseshoe (No. 3/2310); *F* transverse section of a small individual (No. 3/2316); *G* transverse-oblique section of an individual with a tabulotheca exposed in one place and consisting of concentrical layers of tabulae; *H* transverse section of a small individual with an entire set of septa in the wall (No. 3/2323); *I* longitudinal, slightly oblique section of a coral with a conical talon, consisting of tabulae arranged in a domelike manner, not yet adhering to each other in all places and forming a tabulotheca (No. 3/2330), *J* longitudinal, slightly oblique section of a coral with a conical talon as in Fig. *I* (No. 3/2331; *K* transverse section of a small individual (No. 3/2332; *L* transverse section of a small individual with 10 septa in tabularium (No. 3/2333).
A-D Gałęzice, bed 1, *E-L* Gałęzice, bed 2; × 5.4

Description. — Short fragments of tubelike corallites with a smooth, porcelain-like surface. In nine specimens, a wide, conical talon is preserved with a diameter reaching 11 mm. Calyx not preserved. Numerical data (in mm) are given in the following table:

Z.Pal.P. Tc No. 3/	Diameter of the base of talon	Length of corallite	Diameter of distal end
2399	11.0	13.0	3×3.5
2386	2.0	3.0	—
2451	8.0	9.0	2.3
2469	4.0	7.6	1.4
2482	—	6.5	1.5
2523	8.5	10.0	—

Transverse section. Corallites round and oval (probably as a result of compression) in transverse section, with a smooth edge, very thick wall and narrow tabularium, which occupies about 1/4 of the diameter of corallite. The greatest number of septa in tabularium and wall amounts to 12, axially varying within limits of 4 and 12 regardless of the diameter of corallite. Measurable characters (in mm) of transverse sections are given below:

Z.Pal. P.Tc No 3/	Diameter of corallite	Diameter of tabularium	Number of septa in tabularium	Arrangement of septa in tabularium
2050	2.8	0.8	11	2.3.3.3
2059	3.4	0.8	9	2.3.2.3
2074	3.5	0.9	12	2.3.3.4
2306	2.9	1.0	10	2.3.2.3
2310	3.0	0.7	7	1.2.2.2
2405	2.9	0.7	7	1.2.2.2
2551	3.2	0.6	6	1.2.2.1

The number of septa in tabularium is mostly smaller than in wall and rarely reaches twelve. Septa that grow in a number not exceeding 12, are always embedded in wall and may be observed as light-coloured radial stripes. According to Schindewolf's (1941) terminology, the upper quadrant is recessive and has one or two septa. This number is a convenient orientation mark. There are always four protosepta fused axially and forming a cross. Sometimes, as a result of shifting, a shape of a horseshoe is, however, formed axially. With a full number of septa, they are arranged in tabularium as follows: 2,3, 3, 4. Septa are, therefore, grouped in systems of 1, 2, 3, 4.

Longitudinal section. Wall thick, tabularium narrow, longitudinal sections of axial ends of septa axially thin and thickening towards tabulotheca; spaced domelike tabulae.

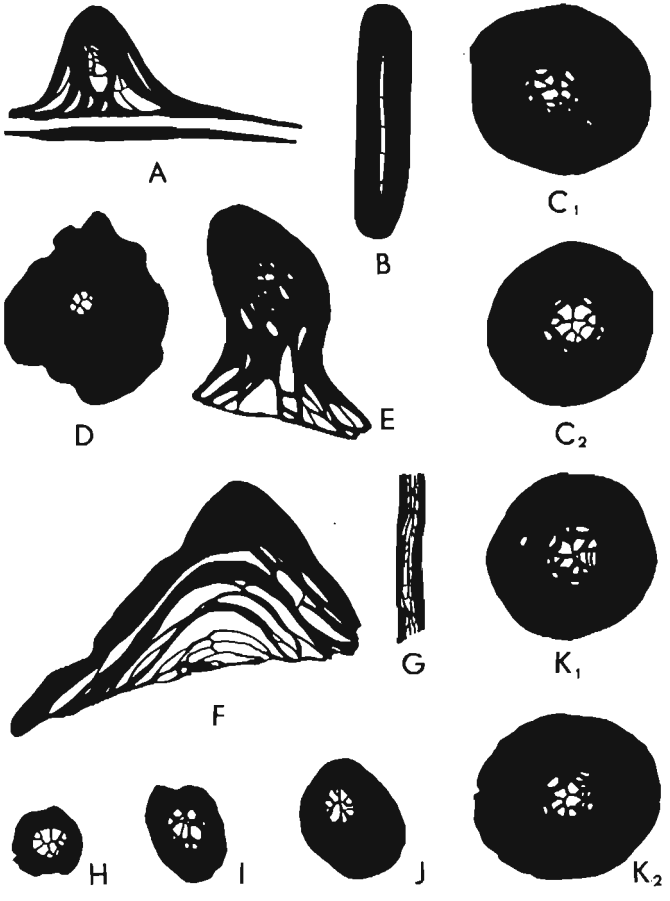

Fig. 68. — *Oligophylloides pachythecus pachythecus* n.gen., n.subsp.: *A* longitudinal, slightly oblique section through the talon of a young individual, attached by a wide base to some object (Z. Pal. P. Tc No. 3/2363); *B* longitudinal-tangential section of a thick-walled coral having thin tabulae (No. 3/2384); C_1-C_2 successive transverse sections of the distal end of talon with a porous tabulotheca around tabularium (No. 3/2394); *D* transverse section of a coral with a very thick wall and narrow tabularium (No. 3/2405); *E* oblique section of a young individual with talon, 4 protosepta fused axially and further septa (about 8) embedded in wall (No. 3/2544); *F* longitudinal-oblique section of a young individual with a conical talon (No. 3/2591); *G* longitudinal section of a small individual (No. 3/2356); *H* transverse section of a coral with a non-typical slightly wider tabularium (No. 3/2376); *I* transverse, slightly oblique section of a small individual with non-typical slightly wider tabularium (No. 3/2591); *J* transverse section of a small individual with a wide wall and 11 septa in tabularium (No. 3/2334); K_1-K_2 transverse sections through the distal end of talon in a coral having a porous tabulotheca around tabularium (No. 3/2335).

All — Gałęzice, bed 2; *A-F*, *H-K* × 5.4, *G* × 3.4.

Variability range wide, also depending on the place through which the transverse section passes. Directly above talon wall is porous near the axis, and lumen of tabularium slightly wider (Text-fig. 67 *B*), diameter of corallite somewhat larger, but above talon it decreases slowly and gradually. Diameter of corallite and of tabularium become gradually a constant value, which remains unchanged up to the distal end. Number of septa in tabularium and their arrangement are variable. "Protosepta" axially fused in the form of a cross or a horseshoe.

Ontogeny (Text-figs. 67 *I-J*; 68 *A*, *E*, *F*; 69). — Corallites with a very thick wall produced a wide talon. Its structure was examined in transverse and longitudinal sections. In transverse section whose plane passes near the base, talon is either subcircular, with axis situated slightly excentrically or elongate, oval and asymmetric. The larva probably attached itself to the bottom, excreting its basal plate. Septa probably appeared in tabularium serially, by ones as seen in the earliest stage, in which three septa are fused together axially (Text-fig. 69 *A*). Over the basal plate 2-3 tabulae axially convex are sloping to the periphery. The edges of these tabulae fuse together on the periphery and form a wall making up a loose tabulotheca. After secreting of these first tabulae, there is a complete set of 12 septa, but only four or five of them enter tabularium and are fused axially. The polyp secrets other convex tabulae, more spaced, irregularly thickened, here and there vesicular, but not all of them are reached by septa proceeding from the first tabulae of talon. Talon grows conically upwards and bends. At this bent there is precisely the place where tabulae concentrate and form a compact tabulotheca, while septa extend to the periphery of tabulotheca (Text-fig. 69 *B*). The lack of epitheca is an evidence that an overhanging polyp encircled the corallite from outside. The initial diameter of the corallite with three septa fused axially and which has a single tabula forming a wall amounts to 0.6 mm. The diameter of the entire talon amounts to 11 mm. The wall of corallite above talon is a compact tabulotheca which consists of 8-10 tabulae.

Remarks. — Talon frequently occurs in the Famennian species of Heterophylliidae. Its width is correlated with the thickness of walls. It is the widest in *O. pachythecus pachythecus* n.subsp.; in *O. tenuicinctus* n.sp., a species with a somewhat thinner wall, it is narrow and, in some cases, overgrows the test of a foraminifer (Text-fig. 71 *A*), or it is directly fused with the bottom.

The order of appearing of septa was variously described. According to the present writer's observations, in the Famennian specimens single "protosepta" are first to appear in the tabularium and they fuse together axially. Next the metasepta, which occur in the form of short septa in the tabulotheca, penetrate in the tabularium in the lateral (left or

right) or lower quadrant, and fuse with the already existing protosepta. Thus something as bifurcated septa is formed. Further septa enter the forks between protoseptum and metaseptum. This is the way, in which four systems (quadrants) of septa are formed. Spaces between these systems, called fossulae, are free of septa. Septa are therefore formed in an endocoelic(?) manner. In the present writer's opinion, these is no regularity in the appearance of septa in the tabularium. It may even happen, — which was also stated by Schindewolf (1941) — that a septum visible in a lower section does not occur in a higher one. This phenomenon is called falling out of septum.

Fig. 69. — *Oligophylloides pachythecus pachythecus* n.gen., n.subsp.: A_1-A_4 a series of successive sections through the base of talon of a large individual, A_1-A_2 neanic stage, 3-4 protosepta fused axially, further septa mounted in 3-4 concentrical rings of the oldest tabulotheca, talon consisting of 5-7 concentrical rings of tabulae varying in thickness, retreated from the axis (Gałęzice, bed 2; Z. Pal. P. Tc No. 3/2394), × 4; *B* transverse section of a smaller individual with a narrower asymmetric talon, tabulae, on one side, closely adhering to each other (Gałęzice, bed 1; No. 3/2043), × 4.

O. pachythecus pachythecus n.subsp. differs from the related species *O. tenuicinctus* n.sp. in an excessively thick (as compared with the diameter) wall and wide talon. Both species have 12 septa, similarly arranged in tabularium, for instance: 2, 3, 3, 4. The subspecies *O. pachythecus pachythecus* n.subsp. differs from *O. pachythecus pentagonus* n.subsp. in its round cross section, which in the latter is pentagonal. Both

subspecies have an equal number of septa whose arrangement is also varying within limits of individual variability.

Occurrence. — Poland: Kielce (Kadzielnia quarry), exposure II, beds N-K, exposure III, beds 41 and 14, Lower Famennian, *quadrantinodosa* Zone. Gałęzice, beds 2-1, Upper Famennian, *costatus* Zone; bed 5, *velifera* Zone. Kowala, trench III, red *Wocklumeria* limestone, *costatus* Zone. Łagów (Dule), Upper Famennian, black clymeniid limestone.

Oligophylloides pachythecus pentagonus n.subsp.
(Text-fig. 70; Pl. VI, Fig. 14).

Holotype: Specimen Z. Pal. P. Tc No. 3/2066; Text-fig. 70*A*.
Type horizon: Upper Famennian, *costatus* Zone.
Type locality: Gałęzice (Besówka), bed 1.
Derivation of the name: Lat. *pentagonus* = after a pentagonal outline of tabularium.

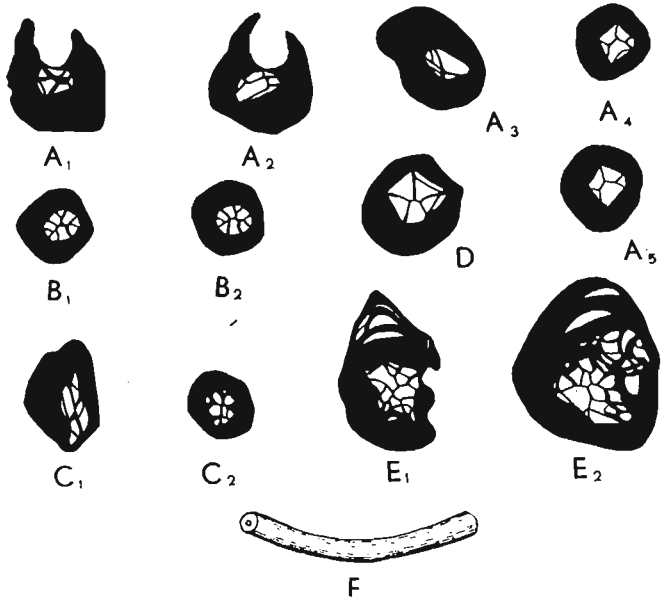

Fig. 70. — *A-E Oligophylloides pachythecus pentagonus* n.gen., n.subsp.: A_1-A_4 a series of successive sections showing the development of the individual from a stage in which talon is attached, to a stage of a pentagonal tube freely raised (Gałęzice, bed 1; Z. Pal. P. Tc No. 3/2066), holotype; B_1-B_2 successive sections of a mature individual with a less distinct pentagonal outline (Gałęzice, bed 1; No. 3/2071); C_1 transverse, slightly oblique section of an individual angular in outline, C_2 the same individual higher up (Gałęzice, bed 2; No. 3/2299); *D* transverse section of a coral with a distinct pentagonal outline of wall and tabularium (Gałęzice, bed 2; No. 3/2593); E_1-E_2 successive transverse sections through a pentagonal talon of a coral (Gałęzice, bed 2; No. 3/2133).
F Oligophylloides pachythecus pachythecus n.gen., n.subsp.: a diagrammatic drawing of a coral (Łagów-Dule; No. 3/2799).
A-E × 5.4, *F* × 6.7

Diagnosis. — A subspecies of *O. pachythecus*, having a pentagonal outline of the transverse section and tabularium.

Material. — Six fragmentary specimens embedded in limestone. Sixteen peels of transverse sections.

Description. — *Transverse section* pentagonal, rounded. Wall irregularly thickened, its margin even. Tabularium narrow but slightly wider than in the nominal subspecies. The number of septa within limits of tabularium is variable, amounting mostly to 5. If such is the case, each of them enters one corner of tabularium. Protosepta fused axially in the form of a horseshoe. In some corallites, the number of septa in tabularium amounts to 9-10, their systems being as follows: 1, 2, 3, 3 or 2, 2, 3· 3. Wall very compact and, therefore, the outline of septa difficult to trace.

Longitudinal section identical with that in the nominal subspecies. Tabulae thin, raised high. Outlines of longitudinal sections of thin septa resemble columellae.

Variability range wide. Variable are the thickness of wall, outline of tabularium, which may be either conspicuously pentagonal or rounded, as well as number of septa in tabularium (5-12). The phenomenon of "falling out" of septa is also observed. Proximal end, together with talon, have 6 septa, whereas only 5 septa occur 1.8 mm above talon.

Occurrence. — Poland: Gałęzice (Besówka), beds 5 and 3-1, Upper Famennian, *costatus*, *styriaca* and *velifera* Zones.

Oligophylloides tenuicinctus n.sp.
(Text-fig. 71 *A-F*; Pl. VI, Fig. 10)

Holotype: Specimen Z. Pal. P. Tc No. 3/2647; Text-fig. 71*D*.

Type horizon: Upper Famennian, *velifera* Zone.

Type locality: Gałęzice (Besówka), bed 5.

Derivation of the name: Lat. *tenuis* = thin and Lat. *cinctus* = girdled, after a thin wall of corallite.

Diagnosis. — An *Oligophylloides* with a thin wall and small talon.

Material. — Twenty four very small, fragmentary specimens, embedded in limestone. A few of them with talon preserved. Twenty two peels were made.

Description. — *Transverse section.* Corallites round in transverse section, with a smooth or slightly undulated wall. Tabularium very wide. Axial ends of "protosepta" fused in the form of a cross or a horseshoe. Two septa are visible in the upper quadrant (a regressive tendency) and systems of triplets and quadruplets in the lower and lateral ones.

Measurable characters (in mm) are shown below:

Z.Pal.P. Tc No. 3/	Diameter of corallite	Diameter of tabularium	Number of septa in tabularium	Length of corallite	Systems of septa
2072	1.2	1.0	10	5.0	2.2.3.3
2107	2.5	1.7	8	—	2.2.2.2
2119	1.2	0.8	—	5.0	—
2157	2.2	1.7	11	—	2.3.3.3
2296	1.1	0.8	9	—	2.2.3.2
2379	1.5	0.7	11	—	2.3.3.3
2385	2.0	1.2	12	—	2.3.3.4
2451	0.7	0.5	8	—	2.2.2.2
2466	0.7	0.5	8	—	2.2.2.2
2490	1.5	1.0	10	—	2.2.3.3
2601	2.0	1.6	7	10.3	1.2.2.3
2602	1.5	1.3	—	28.0	—
2647	1,8	1.0	—	9.0	—
2835	1.1	0.8	—	—	—

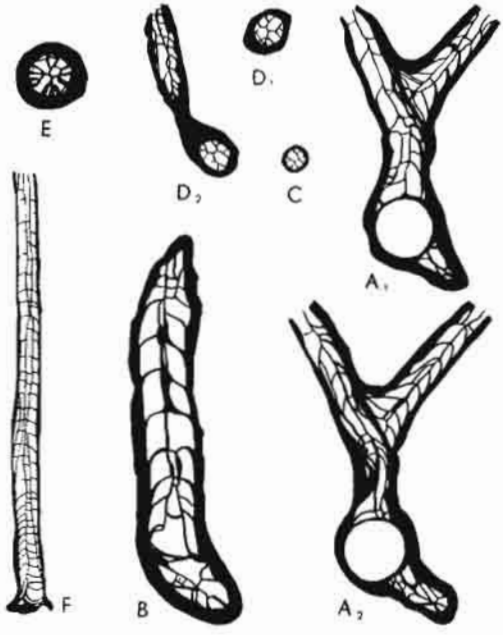

Fig. 71. — *Oligophylloides tenuicinctus* n.gen., n.sp.: A_1-A_2 longitudinal sections of a coral overgrowing some object together with another individual attached to its side (Gałęzice, bed 5; Z. Pal. P. Tc No. 3/2647), × 5.4; *B* longitudinal section of a coral (Gałęzice, bed 3; No. 3/2601), × 6; *C* transverse section of a small individual with a wide tabularium (Gałęzice, bed 2; No. 3/2451), × 6.7; D_1 transverse section of a coral with wide tabularium, D_2 tangential, transverse and longitudinal sections of a coral (Gałęzice, bed 1; No. 3/2647), holotype, × 6.7; *E* transverse section of a coral with slightly thicker skeletal elements (Gałęzice, bed 2; No. 3/2385), × 6.7; *F* longitudinal section of a specimen with thin skeleton, wide tabularium and slightly convex tabulae (Gałęzice, bed 3; No. 3/2602), × 2.7.

Small specimens not yet even 2 mm in diameter are the most abundant. Tabularium very wide, in particular in tiny specimens, in which sometimes it occupies 3/4 of their diameter.

Longitudinal section. Corallites with a narrow talon with which they were directly attached to the substratum or to a round skeleton of some organisms, presumably of a foraminifer. Tabulae axially thin and slightly convex or extended upwards, on the periphery thickened. Septa thin or very thin. Over talon corallite is slightly bent. Sometimes, an individual is attached with its talon to the side of another individual (Text-fig. 71 *A*).

Variability range fairly wide, displayed in a variable number of septa in tabularium and thickness of skeletal elements.

Remarks. — Having 12 septa and a talon, *Oligophylloides tenuicinctus* n.sp. is similar to *O. pachythecus pachythecus* n.subsp., from which it differs, however, in a thin wall and very narrow talon.

Occurrence. — Poland: Gałęzice (Besówka), beds 5 and 3-1, *velifera*, *styriaca* and upper *costatus* Zones. Jabłonna, bed 29, Upper Famennian, *costatus* Zone.

Genus *Heterophyllia* M'Coy, 1849
Subgenus *Heterophyllia* M'Coy, 1849
(Type species: *Heterophyllia grandis* M'Coy, 1849)

Species assigned: *Heterophyllia* (*Heterophyllia*) *grandis* M'Coy, 1849; *H.* (*Heterophyllia*) *parva* Schindewolf, 1941; *H.* (*Heterophyllia*) *famenniana* n.sp.

Stratigraphic and geographic range: Upper Famennian-Lower Carboniferous of Europe, Asia and Australia.

Diagnosis. — See Schindewolf (1941).

Remarks. — *Heterophyllia* M'Coy includes corallites with many septa (more than 12) and a not very thick, undulated tabulotheca. Schindewolf distinguished the following two subgenera: *H.* (*Heterophyllia*) having, in its upper quadrant, 3-5 septa (progressive forms) and *H.* (*Heterophylloides*) having, in its upper quadrant, only 1-2 septa (a regressive form). The present writer found, in the Upper Famennian of the Holy Cross Mountains, a new representative of the subgenus *H.* (*Heterophyllia*), i.e. *H.* (*Heterophyllia*) *famenniana* n.sp.

Heterophyllia (*Heterophyllia*) *famenniana* n.sp.
(Text-fig. 72 *A-J*; Pl. VI, Figs. 11-12)

Holotype: Specimen Z. Pal. P. Tc No. 3/2026; Text-fig. 72*A*.

Type horizon: Upper Famennian, *costatus* Zone.

Type locality: Gałęzice (Besówka), bed 1.

Derivation of the name: Lat. *famenniana* — a *Heterophyllia* which occurred in Famennian.

Diagnosis. — A *Heterophyllia* which, with a diameter of 4.5 mm, has 19 septa in tabularium. Upper quadrants displaying a progressive tendency. Talon present.

Material. — Small fragments (55 specimens) from marls and limestones of Gałęzice. Forty four peels and two thin sections.

Description. — Corallites thin, twiglike, slightly bent. The largest fragment is 15 mm long. Surface of wall longitudinally costate, with nodules. Talon narrow.

Transverse section oval or round. The largest observed diameter amounts to 4.5 mm and a number of septa in tabularium to 19. Wall thick (to 0.4 mm) and compact or, in some cases, thin. If septa extend outside as costae, the outer edge of the wall is undulated, whereas if the wall is thick and compact, its edge is even and septa occur in the wall in the form of delicate radial striae. Septa, not yet occurring in tabularium, are already developed here and there in the wall. Septa of the upper quadrant, 3-5 of them occurring in tabularium of different, larger or smaller individuals, display a progressive tendency. In other quadrants, systems consist of a varying number (3-7) of septa, which is shown below in a table indicating successive numbers of septa in the upper, lateral, lower and lateral quadrants:

Z.Pal. P.Tc No. 3/	Diameter (in mm)	Number of septa	Systems of septa
2001	2.6	18	3.5.5.5
2023	2.2	12	2.4.3.3
2023	3.2	19	3.5.7.4
2026	2.7	18	3.5.4.6
2056	2.7	17	3.4.4.6
2056	3.2	14	2.5.4.3
2296	1.3	9	2.?.3.2

The system of septa in particular quadrants varies not only in different individuals even with an identical diameter, but also in different transverse sections of a single corallite. As correctly observed by Schindewolf (1941), there occurs a frequent phenomenon of "falling out" of septa which become displaced from their former position and from a definite system. Septa in lateral quadrants are often numerically predominant.

Longitudinal section is as in the species described above, i.e. convex thin tabulae and sections of thin axial ends of septa and a thin or somewhat thicker wall.

Variability range very wide. Variable are: the thickness of the wall, thickness of skeletal elements and arrangement of septa in systems.

There are thin, twiglike specimens with a small talon, but there are also thick, large specimens with a large talon. It is easier to trace the development of the systems of septa in such corallites, in which protosepta form a regular axial cross and, on the other hand, it is difficult — when a horseshoe is formed.

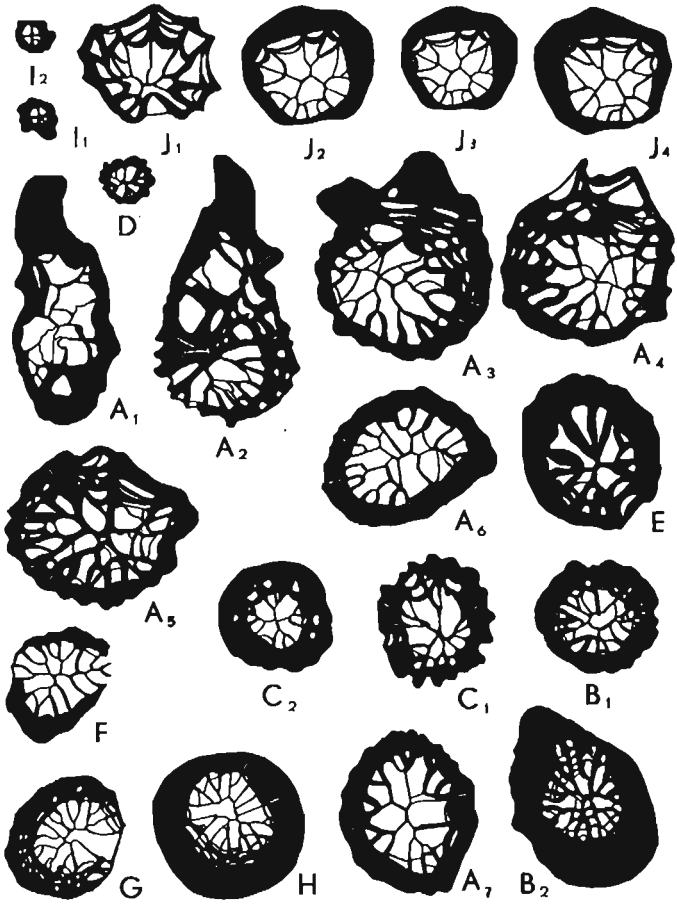

Fig. 72. — *Heterophyllia* (*Heterophyllia*) *famenniana* n.sp.: A_1-A_7 a series of successive transverse sections of a large individual, A_1-A_5 a stage with talon, A_6-A_7 a stage of a mature individual with a wide tabularium having 19 septa (Z. Pal. P. Tc No. 3/2026), × 5.4; B_1 transverse section of an individual with a thin wall, B_2 with a thick wall (No. 3/2037a, b), × 6; C_1 transverse section of an individual cut through its talon, C_2 the same, at the distal end of talon (No. 3/2003), × 5.4; *D* transverse section of a small coral (No. 3/2296a), × 6.7; *E* transverse section of an individual with thick skeletal elements and a porous tabulotheca (No. 3/2022), × 5.4; *F* transverse section of an individual with 17 thin septa in tabularium (No. 3/2060), × 5.4; *G* transverse section of an individual with a porous tabulotheca and having 17 thin septa (No. 3/2230), × 6.7; *H* transverse section of an individual with a thick, porous wall and 20 septa in tabularium (No. 3/2232), × 5.4; *I* 1-2 transverse sections of a small individual with 5 septa in tabularium (No. 3/2296, × 6.7; J_1-J_4 transverse successive sections, J_1 tabulotheca not continuous, J_2-$_4$ tabulotheca continuous (No. 3/2230), × 5. *A-C*, *E*, *F*, *I* Gałęzice, bed. 1; *D*, *G*, *H*, *J*, Gałęzice, bed 2

Ontogeny (Text-fig. 72 *A*, *D*, I). — The smallest individual known (Text-fig. 72 I), 0.5 mm in diameter, has four protosepta fused axially in the form of a regular cross. It is as early as this stage that a metaseptum appears, which fuses with one of the protosepta on the side of a small talon. Further metasepta are visible in tabulotheca where they occur as costae on the outer surface. In another stage (Text-fig. 72 *D*) it is already 11 septa that occur in tabularium with a diameter of 0.9 mm. The smallest number of septa in the upper quadrant is one, in further quadrants — 3 or 4 each. Their arrangement is as follows: 1, 3, 3, 4. Another specimen represents an exceptionally large, juvenile individual with a long talon. Its longer diameter first amounts to 4.5 mm, somewhat higher up — to 6 mm (Text-fig. 72 *A*), and then decreases to 3.5 mm. The transverse section acquires a subround outline and the number of septa amounts then to 18 (3, 4, 4, 7). A change takes place in the consistency of tabulotheca, which at first porous within talon, in the ephebic stage becomes compact. The arrangement of septa also varies from one transverse section to another.

Remarks. — In view of their small number (19) of septa with a correspondingly small diameter (4 mm), the Famennian specimens are to the greatest extent related to *H. parva* Schindewolf, 1941 from the Upper Viséan (D2) of Wałbrzych (Lower Silesia). The Famennian Heterophylliidae have talons and, unlike the Viséan ones, do not reach 5.5 mm in diameter. They are similar in variability range.

Occurrence. — Poland: Gałęzice (Besówka), beds 5 and 2-1, Upper Famennian, *costatus* and *velifera* Zones; wo specimens from Zaręby, goniatite Zones III and IV.

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April, 1968

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MARIA RÓŻKOWSKA

FAMEŃSKIE TETRACORALLA I HETEROCORALLIA Z GÓR ŚWIĘTOKRZYSKICH

Streszczenie

Autorka opracowała dolno- i górno-fameńskie korale (ponad 3000 okazów) z Gór Świętokrzyskich, z miejscowości: Kielce (Kadzielnia), Gałęzice (Besówka), Kowala, Zaręby, Łagów i Jabłonna. Korale te zaliczone zostały do 15 rodzin (w tym 1 nowa: Kielcephyllidae), do 7 podrodzin (w tym 2 nowe: Guerichiphyllinae i Friedbergiinae), do 36 rodzajów (w tym 9 nowych: *Petraiella*, *Hillaxon*, *Czarnockia*, *Guerichiphyllum*, *Friedbergia*, *Gorizdronia*, *Kielcephyllum*, *Kozlowskinia* i *Oligophylloides*), do 55 gatunków (w tym 36 nowych) i 5 nowych podgatunków (Tab. 1).

Korale zebrane zostały podczas kilku sezonów letnich w okresie 1950—1967. Miejsce ich występowania wskazał autorce, nieżyjący już, Prof. J. Czarnocki. Wraz z koralami zebrano towarzyszącą im makrofaunę i mikrofaunę. Prof. dr H. Ma-

kowski, na podstawie goniatytów i klimenii, ustalił wiek warstw według stratygrafii cefalopodowej (Lange, 1952), Dr H. Osmólska oznaczyła trylobity, Dr Z. Wolska — konodonty, oraz ustaliła ścisły wiek warstw według biostratygrafii Zieglera (1962).

Na Kadzielni występują w dolnym famenie zony konodontowe — od *crepida* do *quadrantinodosa*, w Gałęzicach — od górnej *quadrantinodosa* do *costatus* włącznie, w Kowali — zona *costatus*, w Jabłonnej zona *triangularis*, w Łagowie (Dule) — górna *quadrantinodosa*, w Zarębach wiek ustalają trylobity (zony cefalopodowe III—IV).

Dla ustalenia warunków ekologicznych w poszczególnych warstwach Dr S. Cebulak zbadał litologię warstw. Zbadano również zespoły zebranej w nich fauny.

Na *Kadzielni* występują łupki ilasto-margliste, bitumiczne, przewarstwione wapieniami gruzłowatymi. W niektórych warstwach, zwłaszcza w łupkach bardziej wapnistych, występuje bogata fauna korali, w innych — ławice małżów lub brachiopodów, miejscami liczne małżoraczki (łupki cypridynowe) lub trylobity. Częste są lingule i orbikuloidy. Sedyment z pręgami falistymi, bogaty udział materiału terygenicznego i obecność lingul — świadczą o płytkim (do 20 m), przybrzeżnym, źle przewietrzanym zbiorniku o spokojnej wodzie. Obecność gniazdowo występujących cefalopodów przemawia za okresowym połączeniem z otwartym morzem. Wśród korali dominują formy ampleksokarinoidalne, mające rurkę osiową z cyatoteką; są to znani mieszkańcy płytkich, źle przewietrzanych wód. Znajdują się one przeważnie w miejscu dawnego biotopu, na co wskazuje dobry stan ich zachowania. Natomiast korale warstw spągowych, formy duże jak *Kielcephyllum densum* n.sp., znajdują się na wtórnym złożu.

W *Zarębach*, wśród mułowców z resztkami zwęglonych roślin, korale występują rzadko (*Heterophyllia*, *Ufimia*); częste są natomiast ślepe trylobity, *Lingula*, *Orbiculoidea*. Środowiskiem ich było zapewne przybrzeżne, płytkie i ciche morze, o słabej aeracji, lecz o normalnym zasoleniu.

W *Gałęzicach* (Besówka) górno-fameńskie wapienie leżą bezpośrednio na wapieniach żyweckich amfiporowych. Są one przepełnione potrzaskanymi skamieniałościami, tworzącymi detrytus zoogeniczny. W części przyspągowej warstwy te zawierają skałotwórcze liliowce, wyżej — skałotwórcze małże i liczne klimenie. Korale stają się częstsze w warstwach stropowych, bardziej marglistych (gdzie głowonogi zanikają), zaś brak ich w warstwach leżących bezpośrednio pod kulmem. Można więc wnioskować, że w dolnej części górnego famenu, zbiornik, w którym żyły korale, był dobrze przewietrzany, oddalony od brzegu (brak niemal materiału terygenicznego) i połączony z otwartym morzem. Korale są potrzaskane, lecz nieobtoczone; wskazuje to, że nie były one transportowane. Dominuje fauna lakofyloidalna i heterokorale. W najwyższym famenie skończyło się zapewne połączenie z morzem otwartym.

W *Kowali*, wśród wapieni pelitycznych, występuje dobrze zachowana i zróżnicowana fauna klimenii, obok nielicznych korali, drobnych małżów, lingul i trylobitów. Morze było tu zapewne spokojne, niegłębokie.

Korale fameńskie są na świecie rzadkie i przeważnie niezróżnicowane rodzajowo. Obecność ich stwierdzono w Niemczech Zachodnich, Sudetach, w piętrze Etroeungt

zagłębia francusko-belgijskiego (tam należą raczej do fauny typowo karbońskiej), w Stepach Kirgiskich, w Nowej Ziemi, Kazachstanie, Kuzbassie, w Ameryce Płn. i Australii. Zestawienie gatunków przedstawia Tabela 2 (str. 24/25).

W opisie systematycznym autorka posługiwała się głównie klasyfikacją ustanowioną przez Hill (1956), wprowadziła jednak kilka zmian.

Opracowany materiał jest na ogół dobrze zachowany, nadaje się więc do badań ontogenetycznych. Na tej podstawie można było rozpatrzyć problemy filogenetyczne i powiązania między szczepami.

W obrębie nadrodziny Lindstroemiicae, mającej we wczesnej ontogenezie stereokolumellę, rodzina Metriophyllidae cechuje się tym, że kolumella trwa przeważnie przez całą ontogenezę; w rodzinie Laccophyllidae kolumella ustępuje rurce osiowej, otoczonej ścianką — filoteką; w rodzinie Amplexocariniidae kolumella ustępuje rurce otoczonej ścianką — cyatoteką; w rodzinie Kielcephyllidae n.fam., obok rurki osiowej, istnieje budowa heksakoraloidalna; u Adamanophyllidae, obok rurki osiowej, występują septa o budowie policeloidalnej. Przynależność systematyczna rodziny Amplexidae jest dyskusyjna, bowiem ontogeneza typowego gatunku — *A. coralloides* — nie jest dotychczas zbadana.

W nadrodzinie Zaphrentoidida, o ontogenezie zafrentoidalnej, autorka wyróżniła 2 rodziny: Polycoeliidae, o symetrii bilateralnej, uwarunkowanej przez proto- i metasepta o różnej budowie, i Hapsiphyllidae, u której symetrię bilateralną powoduje fossula kardynalna oraz leżące w niej septum główne.

Po wyróżnieniu kilku szczepów wśród korali fameńskich, autorka przedstawiła na Fig. 5 (str. 27) powiązania niektórych rodzajów w obrębie swojego szczepu. Formą wyjściową wśród metriofiloidalnego szczepu jest zapewne rodzaj sylurski — *Petraia*, z którym zapewne powiązane są *Petraiella* n.gen., *Metriophyllum*, *Syringaxon* i *Cyathaxonia*, mające podobną ontogenezę, a jednocześnie nowe cechy adaptacyjne. W szczepie lakofiloidalnym najbardziej długotrwałą formą jest *Neaxon*; od niego wyprowadzić można *Hillaxon* n.gen. i *Czarnockia* n.gen. Formami aberantnymi, choć o podobnej ontogenezie, są *Friedbergia* n.gen. i *Guerichiphyllum* n.gen. U przedstawicieli szczepu ampleksokarinioidalnego pojawiły się tendencje upraszczające budowę koralowiny; zmienia się również główny element tabularny, tworzący cyatotekę. W szczepie zafrentoidalnym, o silnie zaakcentowanej symetrii bilateralnej, istnieje duża różnorodność form, rozwijających się głównie w karbonie, a nawet w permie. Szczepy: filipsastreoidalny, endofiloidalny, digonofiloidalny — bujnie rozwinięte w niższym dewonie, mają w famenie przeważnie ostatnich już przedstawicieli. Prężny jest natomiast nowy szczep heterokoraloidalny, pojawiający się licznie w famenie. Najstarsi jego przedstawiciele są formami bentonicznymi. sesylnymi; w dolnym karbonie przechodzą prawdopodobnie do życia pseudoplanktonicznego.

Niektóre korale fameńskie mają przypuszczalnie wartość jako wskaźniki wieku. Zasięgi ich występowania przedstawia Fig. 5 (str. 27). Istnieją rodzaje konserwatywne, trwające od syluru do famenu, a nawet do permu, nie zmieniające niekiedy cech diagnostycznych gatunku, mianowicie: *Metriophyllum, Syringaxon, Amplexocarinia, Asthenophyllum, Pseudamplexus, Pseudomicroplasma.* Inne rodza-

je są krótkotrwałe i występują albo w dolnym famenie, jak *Petraiella* n.gen., *Gorizdronia* n.gen., *Nalivkinella*, *Kozlowskinia* n.gen. i *Kielcephyllum* n.gen., albo jedynie w górnym famenie, jak *Hillaxon* n.gen., *Czarnockia* n.gen., *Friedbergia* n.gen. i *Oligophylloides* n.gen. Gatunki krótkotrwałych rodzajów mogłyby więc służyć jako wskaźniki wieku. W górnym famenie pojawiają się poza tym rodzaje, liczbowo słabo reprezentowane, a zróżnicowane gatunkowo dopiero w karbonie i permie. Takimi są: *Cyathaxonia*, *Amplexus*, *Pseudoclaviphyllum*, *Amplexizaphrentis*, *Fasciculophyllum*, *Euryphyllum*, *Duplophyllum*, *Caninophyllum* i *Heterophyllia*. Przedstawiciele tych ostatnich rodzajów nadają faunie fameńskiej pietno karbońskie.

МАРИЯ РУЖКОВСКА

ФАМЕНСКИЕ TETRACORALLA И HETEROCORALLIA ИЗ СВЕНТОКРЖИСКИХ ГОР (ПОЛЬША)

Резюме

Автором изучены нижне — и верхнефаменские кораллы Свентокржиских Гор, из местностей Кельце (Кадзельня), Галэнзице (Бэсувка), Коваля, Зарэмбы, Лагув и Яблонна. Эти кораллы причислено к 15 семействам (в том одно новое: Kielcephyllidae), к 7 подсемействам (в том 2 новые: Guerichiphyllinae и Friedbergiinae), к 36 родам (в том 9 новых: *Petraiella*, *Hillaxon*, *Czarnockia*, *Guerichiphyllum*, *Friedbergia*, *Gorizdronia*, *Kielcephyllum*, *Kozlowskinia* и *Oligophylloides*), к 55 видам (в том 36 новых) и 5 новым подвидам (Таб. 1, стр. 24/25).

Материалы были собраны в течение лет 1950—1967. Местонахождение их было автору указано покойным Проф. Я. Чарноцким. Вместе с кораллами была собрана сопутствующая им микро- и макрофауна. На основании гониатитов и климений Проф. Г. Маковски определил возраст слоев по цефалоподовой стратиграфии (Lange, 1952), Др. Г. Осмульска определила трилобиты, Др. З. Вольска — конодонты; причем эта последняя установила точный стратиграфический возраст слоев по конодонтовой биостратиграфии Циглера (Ziegler, 1962).

В нижнем фамене Кадзельни можно выделить конодонтовые зоны — от *crepida* до *quadrantinodosa*, в Галэнзицах — от верхней *quadrantinodosa* до *costatus* включительно, в Ковали — зона *costatus*, в Яблоннэй — зона *triangularis*, в Лагове (Дуле) — верхняя *quadrantinodosa*, в Зарэмбах стратиграфический возрост можно установить по трилобитам (цефалоподовые зоны III—IV).

Для реконструкции палеоэкологических условий изучено литологию и взаимоотношение фауны отдельных слоев.

На *Кадзельни* находятся аргиллитово-мергелистые, битуминозные сланцы

с прослойками комкообразных известняков. В некоторых слоях, особенно в сланцах более известковистых находится обильная фауна кораллов, в иных банки пластинчатожаберных или брахиопод, местами обильные остракоды (ципридиновые сланцы) или же трилобиты. Часто встречаются также лингулы и орбикулоиды. Осадки с извилистыми полосами, богатая примесь теригенного материала и присутствие лингул — свидетельствуют о неглубоком (до 20 м), слабо проветриваемом, мало подвижном морском водоеме. Присутствие цефалопод, выступающих в виде скоплений, свидетельствует о кратковременном сообщении с открытым морем. Среди кораллов господствуют амплексокариниды, имеющие осевую трубку с циатотекой; это известные жители мелких, слабо проветриваемых водоемов. Находятся они преимущественно на месте прежнего биотопа, о чем свидетельствует их хорошая сохранность. Кораллы подошвенных слоев, формы большие, как *Kielcephyllum densum* n. sp., находятся во вторичном залегании.

В *Зарэмбах*, среди алевролитов с остатками обугленной флоры, кораллы встречаются редко (*Heterophyllia, Ufimia*); чаще всего выступают слепые трилобиты, *Lingula, Orbiculoidea*. Обитали они вероятно в спокойной, неглубокой и слабо проветриваемой, но о нормальном засолении части бассейна вблизи берегов.

В *Галэнзицах* (Бэсувка) верхнефаменские известняки залегают непосредственно на амфипоровых известняках живета. Они переполнены потрескавшимися окаменелостями, представляющими зоогенный детрит. Вблизи кровли эти известняки вмещают породообразующие остатки морских лилий — криноидов, а выше пластинчатожаберных, а также обильные климении. Кораллы чаще встречаются в подошвенных слоях, более мергелистых (в которых цефалоподы исчезают), а отсутствуют в слоях залегающих непосредственно под кульмом. Можно затем предполагать, что в нижней части верхнего фамена, часть бассейна, в которой обитали кораллы, была хорошо проветриваема и находилась далеко от береговой линии (почти полное отсутствие теригенного материала), а также имела сообщение с открытым морем. Хотя найденные кораллы повреждены, но не обкатаны. Это свидетельствует о том, что они не были подвержены транспорту. Преобладает фауна лакофиллоид и гетерокораллов. В самых верхах фамена сообщение с открытым морем повидимому прекратилось.

В *Ковали*, в пелитовых известняках, найдена хорошей сохранности и разнообразная фауна климений, рядом с редкими кораллами, мелкими пластинчатожаберными, лингулями и трилобитами. Повидимому тут море было спокойное и неглубокое.

Фаменские кораллы вообще в мире очень редки и преимущественно в родовом отношении мало разнообразны. Их наличие констатировано в Западной Германии, Судетах, в струнском ярусе франко-бельгийского бассейна (там имеют они характер типично каменноугольный), в степях Киргизии, на Новой Земле, в Казахстане, Кузбассе, Сев. Америке и в Австралии. Сопоставление видов подано на Таб. 2 (стр. 24/25).

При систематическом описании автор пользовалась главным образом систематикой, установленной Гилл (Hill, 1956), но ввела некоторые изменения.

Довольно хорошая сохранность исследованного материала позволила провести изучение онтогенетического развития. На этом основании можно было обсудить филогенетические проблемы и связь между типами.

В пределах надсемейства Lindstroemiicae, имеющего в ранней стадии онтогенеза стереоколумеллу, семейство Metriophyllidae отмечается тем, что колумелла существовала преимущественно в течение полного онтогенеза; в семействе Laccophyllidae колумелла уступает осевой трубке, которая окружена стенкой-филлотекой; в семействе Amplexocariniidae колумелла уступает трубке окруженной стенкой-циатотекой; в семействе Kielcephyllidae n. fam., кроме осевой трубки, имеется гексакораллоидное строение; у Adamanophyllidae, кроме осевой трубки, находятся септы полицелоидного строения. Систематическая позиция семейства Amplexidae дискуссионная, так как онтогенез типичного вида — *A. coralloides* — до сих пор не изучен.

В надсемейство Zaphrentoidida, с зафрентоидным типом онтогенеза, автором включены 2 семейства: Polycoeliidae, с билатеральной симметрией, обусловленной прото- и метасептами различного строения, и Hapsiphyllidae, у которого билатеральная симметрия вызвана кардинальной фоссулой и находящейся в ней главной септой.

После выделения нескольких эволюционных ветвей среди фаменских кораллов, автором представлено на Фиг. 5 (стр. 27) сопоставление некоторых родов в пределах своего типа. Исходной формой среди метриофилоидного типа является повидимому силурийский род *Petraia*, с которым связаны вероятно *Petraiella* n. gen., *Metriophyllum*, *Syringaxon* и *Cyathaxonia*, обладающие похожим онтогенезом, но вместе с тем имеющие новые адаптативные черты. В лакофилоидном типе наиболее длительной формой является *Neaxon*; можно принять, что от нее произошли *Hillaxon* n. gen. и *Czarnockia* n. gen. Аберантными формами, хотя с похожим онтогенезом, является *Friedbergia* n. gen. и *Guerichiphyllum* n. gen. У представителей амплексокариниоидного типа возникли разные признаки упрощающие строение коралла; меняется тоже главный элемент табулярный, создающий циатотеку. В зафрентоидном типе с сильно заакцентированной билатеральностью встречается большая разнородность форм, распространенных главным образом в каменноугольное, а даже пермское время. Типы: филипсастреоидный, эндофиллоидный, дигонофиллоидный — обильно развивающиеся в нижнем девоне, своих последних представителей имеют в фаменском ярусе. Зато новый гетероидный тип, появляющийся в обильном количестве в фамене, характеризуется жизнеспособностью. Наиболее древние его представители — это бентонные сессильные формы. В нижнем карбоне переходят они вероятно к псевдопланктонному образу жизни.

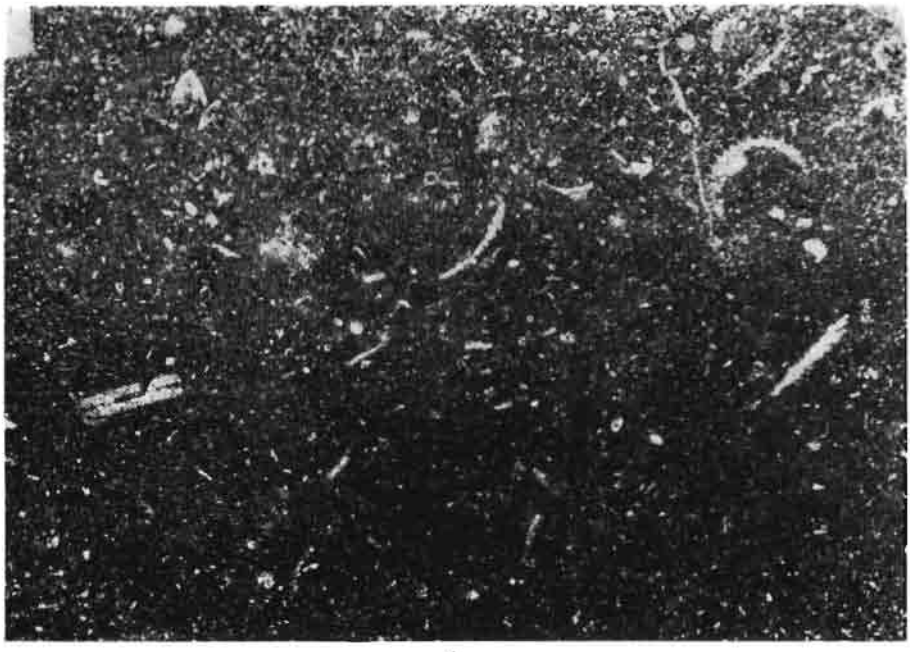
Некоторые фаменские кораллы очевидно имеют стратиграфическое значение. Пределы их распространения представлены на Фиг. 5 (стр. 27). Бывают роды консервативные, живущие от силура или нижнего девона до фамена,

а даже до перми, не меняя видовых диагностических признаков. Это: *Metriophyllum, Syringaxon, Amplexocarinia, Asthenophyllum, Pseudamplexus* и *Pseudomicroplasma.* Другие роды кратковременные и выступают или в нижнем фамене, как *Petraiella* n. gen., *Gorizdronia* n. gen., *Nalivkinella, Kozlowskinia* n. gen. и *Kielcephyllum* n. gen., или же только в верхнем фамене, как *Hillaxon* n. gen., *Czarnockia* n. gen., *Friedbergia* n. gen. и *Oligophylloides* n. gen. Виды кратковременных родов могли бы быть указателями стратиграфического возраста. В верхнем фамене кроме этого появляются роды представленные небольшим количеством, а чуть в карбоне и перми дифференцированы в видовом отношении. Это: *Cyathaxonia, Amplexus, Pseudoclaviphyllum, Amplexizaphrentis, Fasciculophyllum, Euryphyllum, Duplophyllum, Caninophyllum* и *Heterophyllia.* Представители этих последних родов придают фауне фамена каменноугольный характер.

PLATES

Plate I

Fig. 1. Fine crystalline pelitic limestone, Kadzielnia quarry; × 20.
Fig. 2. Organodetritic limestone, Gałęzice; × 20.



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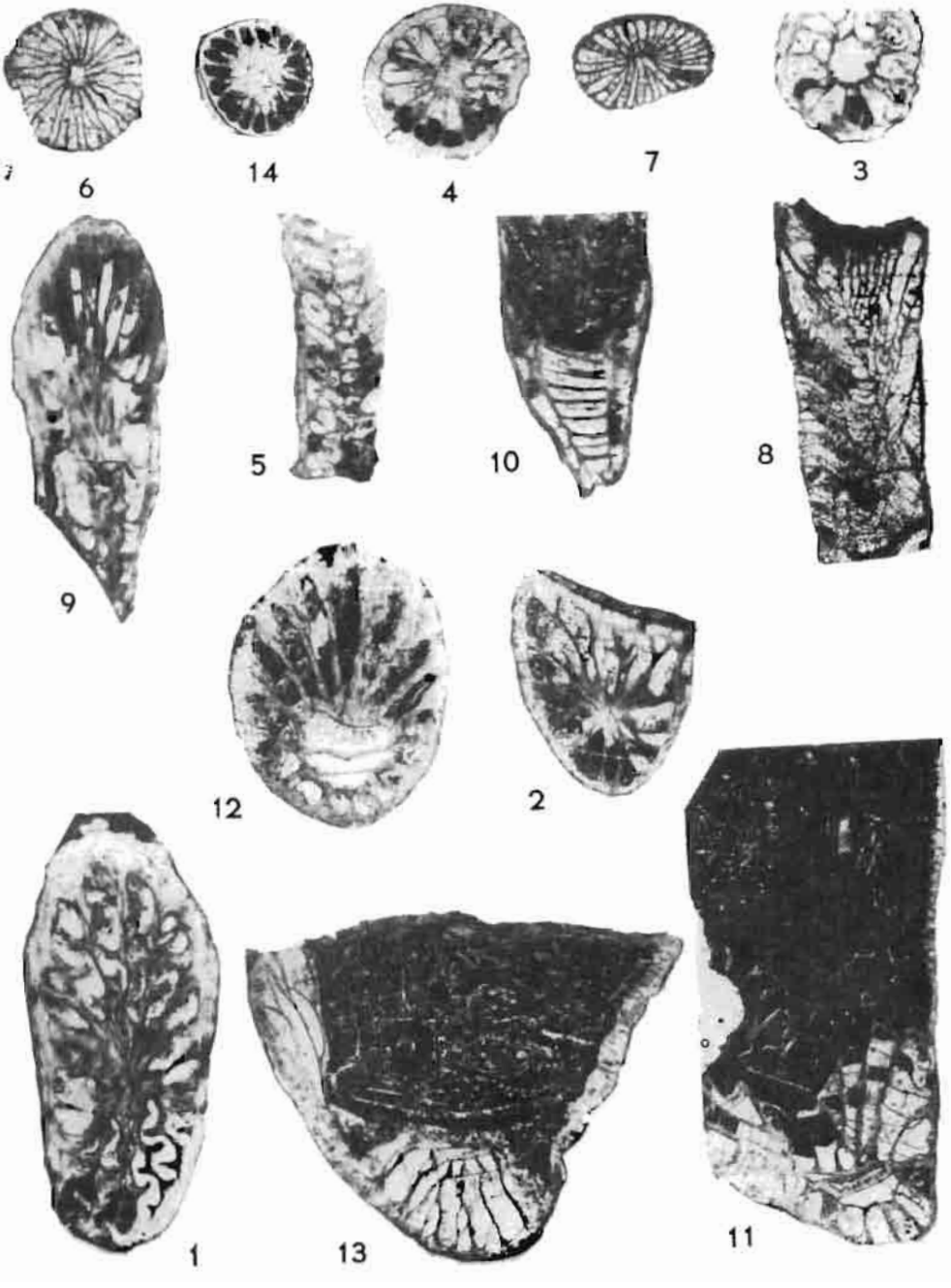
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Plate II

Metriophyllum soshkinae nom. nov.

Fig. 1. Transverse oblique section (Z. Pal. P. Tc No. 3/2197), holotype; × 6.
Fig. 2. Transverse section (No. 3/2141); × 6.

Metrioplexus carinatus n.sp.

Fig. 3. Transverse section (No. 3/2145); × 5.
Fig. 5. Longitudinal section (No. 3/2483); × 9.

Metriophyllum aff. *bouchardi* M. Edw.-H.

Fig. 4. Transverse section (No. 3/2115); × 5.

Petraiella centralis n.sp.

Fig. 6. Transverse section (No. 3/1180), holotype; × 3.

Petraiella kielcensis n.sp.

Fig. 7. Transverse section (No. 3/889); × 3.
Fig. 8. Longitudinal section (No. 3/887); × 3.

Syringaxon aff. *cyathaxoniaeformis* Gorsky

Fig. 9. Longitudinal section (No. 3/2534); × 5.

Syringaxon vacuus n.sp.

Fig. 10. Longitudinal section (No. 3/2142); × 4.

Neaxon tenuiseptatus n.sp.

Fig. 11. Longitudinal section (No. 3/2366); × 3.

Neaxon bulloides n.sp.

Fig. 12. Transverse section (No. 3/2245); × 6.

Hillaxon vesiculosus n.sp.

Fig. 13. Longitudinal section (No. 3/2565); × 3.

Cyathaxonia (*Cyathaxonia*) aff. *cornu* Michelin

Fig. 14. Transverse section (No. 3/2404); × 5.

Figs. 1,6-8 — Kadzielnia II, bed K, Lower Famennian
Figs. 2-5, 9-14 — Gałęzice-Besówka, bed 2, Upper Famennian

Plate III

Guerichiphyllum parvum n.sp.

Fig. 1. Transverse section (Z. Pal. P. Tc No. 3/807), Kadzielnia I, bed 3; × 12.

Cyathaxonia (*Cyathaxonia*) aff. *cornu* Michelin

Fig. 2. Transverse section (No. 3/2586), Gałęzice-Besówka, bed 2; × 5.

Cyathaxonia (*Cyathocarinia*) *tuberculata* Soshkina

Fig. 3. Transverse section (No. 3/1226), Kadzielnia II, bed K; × 5.

Fig. 4. Longitudinal section (No. 3/2414), Gałęzice-Besówka, bed 2; × 5.

Amplexocarinia muralis Soshkina

Fig. 5. *a* Transverse section, *b* longitudinal section (No. 3/25a), Kadzielnia G; × 3.

Fig. 8. Transverse section (No. 3/4), Kadzielnia G; × 3.

Fig. 9. Longitudinal section (No. 3/2136a), Gałęzice-Besówka, bed 2; × 3.

Amplexocarinia obliqua n.sp.

Fig. 6. Transverse section (No. 3/819), Kadzielnia I, bed 3; x 4.

Fig. 7. Longitudinal section (No. 3/485), Kadzielnia I, bed 2; × 4.

Gorizdronia profunda profunda (Soshkina)

Fig. 10. Transverse section (No. 3/1037), Kadzielnia II, bed K; × 3.

Gorizdronia profunda longiseptata n.subsp.

Fig. 11. Transverse section (No. 3/1804), Kadzielnia III, bed 43; × 3.

Gorizdronia geniculata n.sp.

Fig. 12. Transverse section (No. 3/1803), Kadzielnia III, bed 43; × 3.

Figs. 1, 3, 5-8, 10-12 — Lower Famennian
Figs. 2,4, 9 — Upper Famennian

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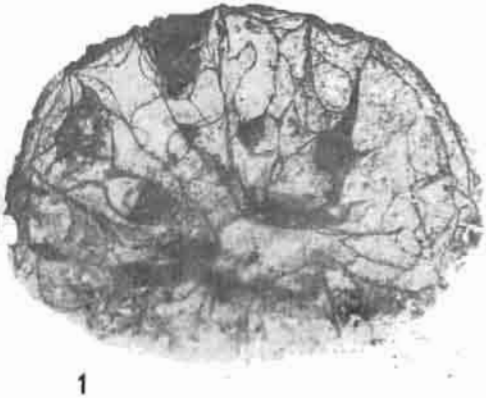

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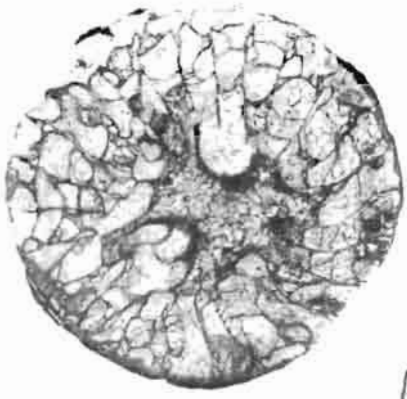

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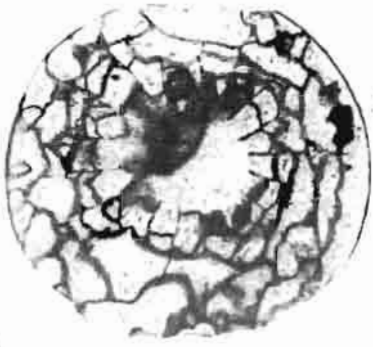

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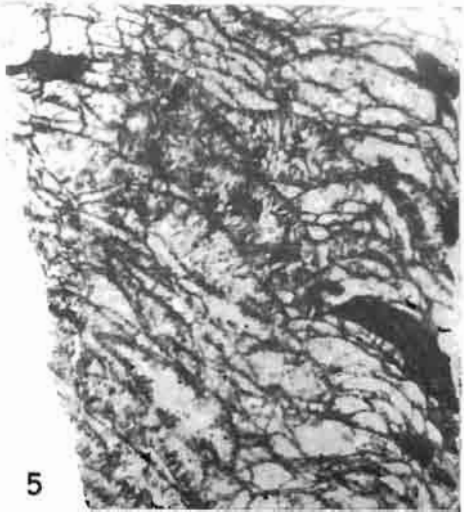

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Plate IV

Gorizdronia profunda profunda (Soshkina)

Fig. 1. Longitudinal section (Z. Pal. Tc No. 3/1796), Kadzielnia III, bed 43; × 3.

Fig. 2. Transverse section of a young corallite (No. 3/1841), Kadzielnia III, bed 46; × 3.

Gorizdronia geniculata n.sp.

Fig. 3. Longitudinal section (No. 3/1803), Kadzielnia III, bed 43; × 3.

Gorizdronia profunda longiseptata n.subsp.

Fig. 4. *a* Transverse section, *b* longitudinal section (No. 3/1037), Kadzielnia II, bed K; × 3.

Kielcephyllum densum n.sp.

Fig. 5. Longitudinal section (No. 3/1808), Kadzielnia III, bed 43; × 3.

Fig. 6. Transverse section (No. 3/37), Kadzielnia G; × 3.

All — Lower Famennian

Plate V

Nalivkinella profunda Soshkina

Fig. 1. *a* Transverse section, *b* longitudinal section (Z. Pal. P. Tc No. 3/1402), Kadzielnia II, bed M; × 4.

Kielcephyllum cupulum n.sp.

Fig. 2. Transverse section (No. 3/1870), Kadzielnia III, bed 46; × 4.

Fig. 3. Longitudinal section (No. 3/1605), Kadzielnia, the dump; × 3.

Kielcephyllum confluens n.sp.

Fig. 4. Transverse section (No. 3/1957), Kadzielnia, the dump; × 4.

Fig. 5. Transverse section (No. 3/1464), Kadzielnia II, bed N; × 4.

Fig. 6. Longitudinal section (No. 3/423), Kadzielnia I, bed 3; × 4.

All — Lower Famennian

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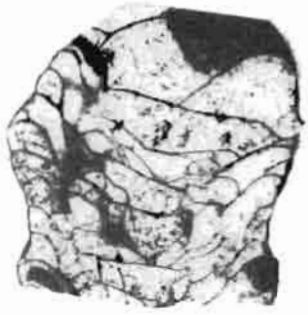

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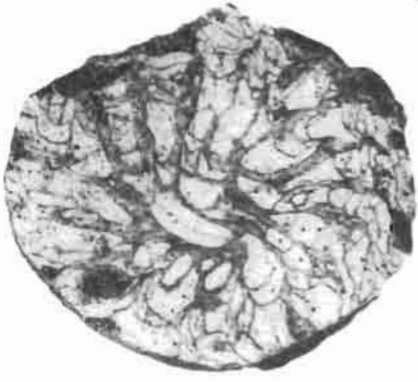

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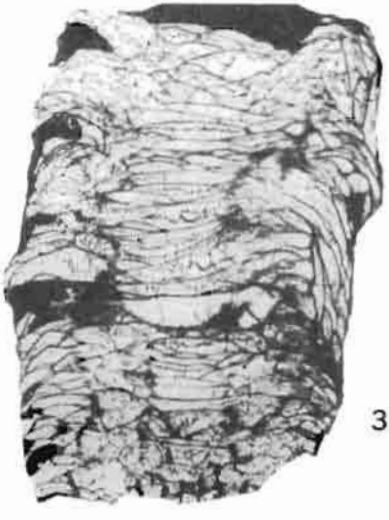

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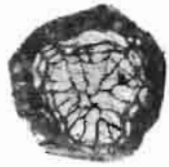
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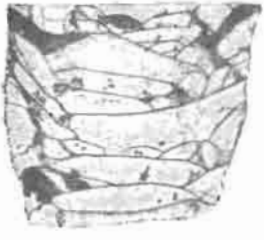
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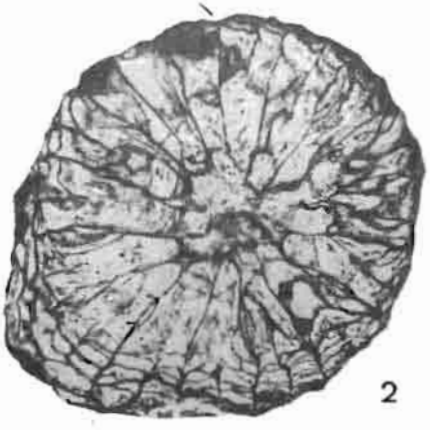
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Plate VI

Guerichiphyllum concavum n.sp.

Fig. 1. Longitudinal section (Z. Pal. P. Tc No. 3/37), Kadzielnia G; × 3.
Fig. 4. Longitudinal section (No. 3/1491a), Kadzielnia II, bed N; × 3.
Fig. 15. Transverse section (No. 3/220), Kadzielnia G; × 3.

Kozlowskinia flos n.sp.

Fig. 2. Transverse section (No. 3/1867), Kadzielnia III, bed 46; × 7.

Kozlowskinia phyllis n.sp.

Fig. 3. *a* Transverse section, *b* longitudinal section (No. 3/677), Kadzielnia I, bed 3; × 5.

Pseudamplexus granulatus n.sp.

Fig. 5. Transverse section (No. 3/2162), Gałęzice-Besówka, bed 2; × 6.

Oligophylloides pachythecus pachythecus n.subsp.

Fig. 6. Transverse section (No. 3/2292), Gałęzice-Besówka, bed 2; × 5.
Fig. 7. Longitudinal section of a young corallite with a talon (No. 3/2039), Gałęzice-Besówka, bed 1; × 5.
Fig. 8. Transverse section (No. 3/2350), Gałęzice-Besówka, bed 2; × 5.
Fig. 9. Transverse section (No. 3/2625), Gałęzice-Besówka, bed 3; × 5.

Oligophylloides tenuicinctus n.sp.

Fig. 10. Transverse section (No. 3/2167), Gałęzice-Besówka, bed 2; × 5.

Heterophyllia (Heterophyllia) famenniana n.sp.

Fig. 11. Transverse section (No. 3/2397), Gałęzice-Besówka, bed 2; × 5.
Fig. 12. Longitudinal section (No. 3/2604), Gałęzice-Besówka, bed 3; × 5.

Amplexocarinia muralis Soshkina

Fig. 13. Transverse section (No. 3/155a), Kadzielnia G; × 2.

Oligophylloides pachythecus pentagonus n.subsp.

Fig. 14. Transverse section (No. 3/2293), Gałęzice-Besówka, bed 1; × 5.

Figs. 1-4, 13, 15 — Lower Famennian
Figs. 5-12, 14 — Upper Famennian

Plate VII

Kozlowskinia flos n.sp.

Fig. 1. Distal end (Z. Pal. P. Tc No. 3/1881), Kadzielnia G; × 2.

Fig. 8. Fragment of corallite with calyx (No. 3/1339), Kadzielnia II, bed L; × 2.

Kielcephyllum cupulum n.sp.

Fig.2. Distal end (No. 3/1471), Kadzielnia II, bed N; × 2.

Neaxon bulloides n.sp.

Fig. 3. Whole corallite (No. 3/2345), Gałęzice, bed 2; × 2.

Oligophylloides pachythecus pachythecus n.subsp.

Fig. 4. Proximal end with talon (No. 3/2071), Gałęzice, bed 1; × 2.

Fig. 15. Fragmentary corallites (No. 3/2799), Łagów-Dule; × 1.5.

Cyathaxonia (*Cyathaxonia*) aff. *cornu* Michelin

Fig. 5. Corallite (No. 3/935), Kadzielnia II, bed K; × 3.

Amplexus coralloides Sowerby

Fig. 6. Bent corallite (I. G. No. 163a, II, 62), Kowala, the dump; nat. size.

Fig. 7. Fragment of corallite (I. G. No. 163b, II, 62), Kowala, the dump; nat. size.

Nalivkinella rariseptata n.sp.

Fig. 9. Whole corallite (No. 3/459), Kadzielnia I, bed 2; × 1.5.

Amplexocarinia obliqua n.sp.

Fig. 10. Whole corallite (No. 3/92), Kadzielnia G; × 2.5.

Nalivkinella profunda Soshkina

Fig. 11. Whole corallite (No. 3/380), Kadzielnia I, bed 1; × 2.5.

Kozlowskinia phyllis n.sp.

Fig. 12. Distal end with calyx (No. 3/1882), Kadzielnia G; × 3.5.

Amplexizaphrentis conus n.sp.

Fig. 13. Corallite viewed from below (I. G. No. 163c, II, 62), Kowala, the dump; nat. size.

Czarnockia obliqua n.sp.

Fig. 14. Whole corallite (I. G. No. 163d, II, 62), Kowala, the dump; × 1.5.

Figs. 1, 2, 5, 8-10, 12 — Lower Famennian
Figs. 3, 4, 6, 7, 11, 13-15 — Upper Famennian


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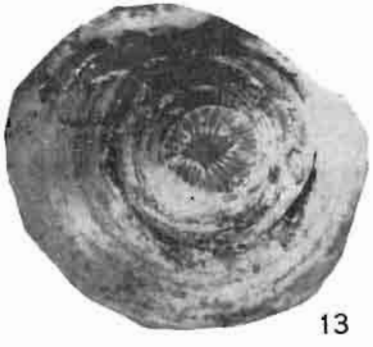
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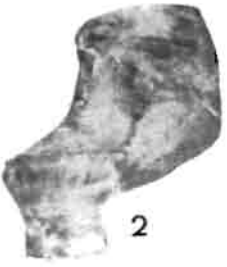
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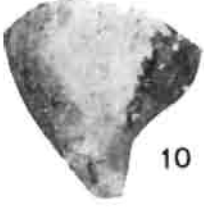
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Plate VIII

Pseudamplexus granulatus n.sp.

Fig. 1. Budding corallite (Z. Pal. P. Tc No. 3/2014), Gałęzice-Besówka, bed 1; × 2.5.

Gorizdronia geniculata n.sp.

Fig. 2. Corallite rejuvenized (No. 3/1378), Kadzielnia II, bed L; × 3.

Ufimia supradevonica n.sp.

Fig. 3. Distal end of corallite (I. G. No.163g, II, 62), Zaręby, the dump; × 2.

Fig. 13. Distal end of corallite (I. G. No. 163f, II, 62), Zaręby, the dump; × 2.

Petraiella centralis n.sp.

Fig. 4. Whole corallite (No. 3/1370), Kadzielnia II, bed L; × 1.5.

Nalivkinella rariseptata n.sp.

Fig. 5. Whole corallite with epitheca worn off (No. 3/624), Kadzielnia I, bed 2; × 2.5.

Amplexocarinia muralis Soshkina

Fig. 6. Whole corallite (No. 3/244), Kadzielnia I, bed 1; × 2.

Kielcephyllum confluens n.sp.

Fig. 7. Fragment with calyx (No. 3/1450), Kadzielnia II, bed N; × 2.

Guerichiphyllum concavum n.sp.

Fig. 8. Fragment of corallite (No. 3/645), Kadzielnia I, bed 3; × 2.

Fig. 11. Corallite (No. 3/133), Kadzielnia G; × 2.

Kielcephyllum cupulum n.sp.

Fig. 9. Distal end with calyx (No. 3/354), Kadzielnia I, bed 1; × 2.

Neaxon tenuiseptatus n.sp.

Fig. 10. Whole corallite (I. G. No. 163e, II, 62), Kowala, the dump; × 1.5.

Gorizdronia profunda longiseptata n. subsp.

Fig. 12. Corallite rejuvenized (No. 3/1707), Kadzielnia, the dump; × 2.2.

Figs. 2, 4-9, 11, 12 — Lower Famennian
Figs. 1, 3, 10, 13 — Upper Famennian