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On some Upper Carboniferous Coelenterata from Bjørnøya and Spitsbergen

ABSTRACT: Twenty species of Coelenterata (Chaetetida, Tabulata and Tetracoralla) are described. The Ambigua Limestone fauna is compared with coeval coral faunas from other regions. The systematic position of the described species is mostly discussed in the light of ontogenetic investigations. It is suggested that the lower limit of the Ambigua Limestone is Lower Kasimovian.

INTRODUCTION

The specimens described were collected by Prof. S. Siedlecki in 1964 and 1965. Because the author did not have the chance to make his own regional observations, he has used instead the information kindly provided by Prof. Siedlecki.

This study is the first palaeontological elaboration of the Coelenterata from Bjørnøya. There are only a few older stratigraphic papers (*e.g.* Andersson 1900, Holtedahl 1919) in which some remarks about corals were made. The fauna, however, was not illustrated and not described and it is impossible therefore to use mentioned papers for any detailed comparisons or considerations.

The specimens from Spitsbergen (Bellsund) described in this paper are included in four species. They do not give any serious basis on which to make stratigraphic or palaeontological assignments. Quite a fauna of Coelenterata from the Upper Carboniferous and Lower Permian of Spitsbergen has already been described by Toulà (1875), Holtedahl (1913), Heritsch (1929, 1939), Padget (1954), Fedorowski (1964, 1965, 1967), Tidten (1972).

Acknowledgements. The author is cordially thankful to Prof. S. Siedlecki for offering facilities for describing this interesting material and for comprehensive

remarks on stratigraphy. Likewise his heartfelt thanks are due to Prof. M. Rózkowska for discussion and critical reading of the manuscript, to Prof. H. Flügel who kindly sent to him the holotype of *Campophyllum intermedium* Toulou for comparison and to Dr. W. A. Oliver, Jr. and Dr. W. J. Sando for reading and correcting the manuscript. I am also grateful to Miss J. Konieczna for taking the photographs and to Mrs. K. Kobierna for preparing the thin sections.

MATERIAL

Most of the specimens described below come from the lower part of the so-called Ambigua Limestone from Bjørnøya. The fauna interbedded with the conglomerates seems particularly numerous and varied. It is, of course, reworked although it does not seem to come from the previously consolidated deposits. None of the specimens described here had a rock framing and in the pebbles of the conglomerate no fauna was found. The state of preservation of the corals in the conglomerates is very varied. Broken specimens and fragments prevail. The calices and the proximal ends of corals, least resistant to the mechanical damage, were not preserved at all. In some specimens, however, fragments of epitheca were found. This fact, as well as, the sharp-edged outline of all observed broken specimens and fragments of corals and fusulinids may indicate that they were transported fast and for comparatively short distances.

In addition to the corals, numerous Foraminifera, mostly fusulinids, appear in the conglomerate. Similarly, they are not found in the pebbles and are mostly broken. Well oriented longitudinal sections of fusulinids were not prepared, because they were found accidentally when preparing the thin sections of the corals. Thus the fusulinids have not been determined.

The state of preservation of the fauna in the conglomerate suggests that: 1) it was not transported over a long distance and, 2) it was probably living in the period when the conglomerate was deposited or at least it is not so much older than the conglomerate that the deposits in which it had been previously underwent diagenesis.

ANALYSIS OF THE COELENTERATE FAUNA

Stratigraphic aspect

The stratigraphic value of the Coelenterata described in this paper is different for Spitsbergen and for Bjørnøya. The species of Spitsbergen are not numerous and are not satisfactorily definitive stratigraphically. They may be either Gshelian or Lower Permian.

The fauna of Bjørnøya contains more taxa and more specimens and may be dealt with as an assemblage having a considerable significance for

stratigraphy. Admittedly species neither from the Upper Moscovian nor the Kasimovian are dominant, but this does not lower the value of the assemblage; it only suggests that the assemblage represents a transitional fauna. In Table 1 the geographic extension and stratigraphic range of the species are presented. Four of them, as it is seen, begin their existence in the Lower Kasimovian or later, two are known from the Upper Moscovian, and one, *Chaetetes* (*Boswellia*) *luganensis* Vassilyuk, is from the transitional beds. This last species according to Vassilyuk (1959) is, however, characteristic of the Upper Carboniferous where it is much more common.

From among the new species, *Bothrophyllum* sp. 1 may have some significance for stratigraphy because of its similarity to the Lower Permian *B. baeri* Stuckenberga and *Orygmophyllum bradyseptatum* sp. n., which is most like the Upper Carboniferous *O. convexum* Fomichev. The large "*Caninia*" (*s. l.*) are also characteristic rather of the Upper than of the Middle Carboniferous. The rest of the new species like the genera to which they belong are not characteristic of any of the mentioned stages.

All the Coelenterata below described from Bjørnøya come from the lower part of the Ambigua Limestone and may thus be discussed as the assemblage marking the lower stratigraphic boundary of this Limestone. As mentioned above, the Upper Carboniferous species, or the species having an Upper Carboniferous aspect, prevail in the assemblage. Species known previously from Middle Carboniferous of other regions, are those of the Upper or Uppermost Moscovian. The present collection seems very advantageous to the author, helping to establish the approximate age of the Ambigua Limestone since it indicates the upper and lower limit of its stratigraphic position. The facts presented seem to the author adequate for stating that the coelenterate assemblage (Table 1), may be recognized as characteristic of Lower Kasimovian. At the same time, the lower boundary of the Ambigua Limestone should be moved somewhat higher than was suggested by Cutbill & Challinor (1965), Upper Moscovian, and more or less equated with the lower boundary of the Upper Carboniferous. Because of the lack of coral fauna, the upper stratigraphic boundary of this Limestone cannot be discussed in this paper. Described Coelenterata are not adequate for any detailed subdivision of the Ambigua Limestone.

Taxonomic aspect

Tetracoralla dominate in the described fauna and among them the forms with a caninoid ephebic stage are most important. The subject of the following discussion will be the taxonomic relations among these forms. The other are separate and represented at random. The author used for this discussion specimens described below, peels of numerous

Table 1

Species	Here described		Geographic distribution								Stratigraphic occurrence						
	Spitsbergen	Björnøya	Spitsberg.	Novaya Zemlya	Ural Mts		Moscow basin	Donets basin	China	Carnio Alps	USA Texas	Lower Carbon.	Moscovian		Kasimovian	Gshelian	Lower Permian
					North	Middle							Lower	Upper			
CHAETETIDA																	
<i>Chaetetes /Roswellia/ lungensis</i> Vassilyuk		2 ²						C ₃ ¹							-----		
<i>Chaetetes /Roswellia/ sp.</i>		1															
TABULATA																	
<i>Kueichowpora supracarbonica</i> n. sp.	1																
TETRACORALLA																	
<i>"Caninia" nikitini</i> Stuckenberg		1	Kasimovian						Upper Carbon.								
<i>"Caninia" of. verneuili</i> Stuckenberg		1							Upper Carbon.								
<i>"Caninia" ordinata</i> Ross & Ross		3															
<i>"Caninia" radiata</i> n. sp.		4									Virgil						
<i>Arctophyllum intermedium</i> /Zoula/	4		Gshelian-L. Permian	Not precis. Carbonifer.													
<i>Siedleckia bjornoyana</i> n. sp.		1															
<i>Siedleckia longiseptata</i> /Grek/		5							Upper Carbon.								
<i>Siedleckia mutafii</i> /Gorsky/		5		Upper Moscovian													
<i>Fomioherella orientalis</i> /Stuckenberg/		4							?Lower Carb.								
<i>Fomioherella hoeli</i> /Holtedahl/	1		Gshelian						Lower Perm.								
<i>Bothrophylum timanicoides timanicoides</i> n. subsp.		4															
<i>Bothrophylum timanicoides nanum</i> n. subsp.		1															
<i>Bothrophylum</i> sp. 1		1															
? <i>Bothrophylum</i> sp. 2		2															
<i>Pseudotimania mosquensis</i> /Dobrolyubova/		1															
<i>Oryzophyllum bradyseptatum</i> n. sp.		2															
<i>Kionophyllum</i> sp.		1															
Pterophyllidae, gen. et sp. indet.	1																

² Numbers indicate quantity of the specimens described; - - - uncertain stratigraphic positions are indicated by thin range lines.

holotypes and other specimens described in the USSR, the originals of *Campophyllum intermedium* Toula and the specimens from Spitsbergen described by him previously (Fedorowski 1965, 1967).

Without considering the caninoid stages reached by the Permian-Carboniferous corals from the superfamily Aulophyllicae, the caninoid corals might be presently split into several groups (families?) considering ontogeny, microstructure, the development of protosepta (particularly cardinal and counter ones), and perhaps the development of the marginal vesicles. The last feature stressed much by some authors (e. g. in the Osnovy Paleontologii 1962) is, according to the author, a feature with very varied taxonomic rank. It appears in most suborders of Tetracoralla as a homeomorphic structure.

Only some representatives of Cyathopsidae (s. l.) and Bothrophylidae, are the basis for the following discussion. In the last named family, which is comparatively restricted morphologically and ontogenetically, one can distinguish two groups of genera: 1) with an elongated counter septum in the ontogeny and 2) with an elongated cardinal septum dominating in the neanic stage and a less elongated counter septum. In the last group three genera: *Pseudotimania*, *Yakovleviella* and *Hornsundia* are particularly similar. The author does not propose to suppress the genera because of: 1) the different ontogeny (*Pseudotimania* has a closed cardinal fossula), 2) microstructure is not yet fully known, and 3) the fact that in the genus *Pseudotimania* were included species having in ontogeny elongated counter septum, or being of the same length as counter-lateral septa, but thinner than them, or shortened. This freedom of interpretation of the diagnostic features points to the necessity of revision and renewed precise definition of this genus based on the original material.

Among the group of genera possessing elongated counter septum the inaccurate drawing and the lack of subsequent illustration of the holotype of *Timania schmidtii* Struckenberg, has caused much inaccuracy in the interpretation of this species and genus. The cross section of the ephebic stage of the holotype of this species illustrated in Fig. 1a of the present paper has very peculiar structure of cardinal fossula and distinct alar fossulae. Only the specimens described by Dobrolyubova (1936, Pl. 1, Figs 1—4) correspond with the diagnostic features of the genus, which can be learned from the holotype. But these specimens probably do not belong to the type species either. The other species previously included by authors in the genus *Timania* should be excluded from it. Quite a number of them will probably be assigned to the revised genus *Pseudotimania*.

Bothrophyllum is according to the present interpretation one of the most stratigraphically and geographically wide-spread and specifically varied solitary tetracoral genera. The wide interpretation of this genus

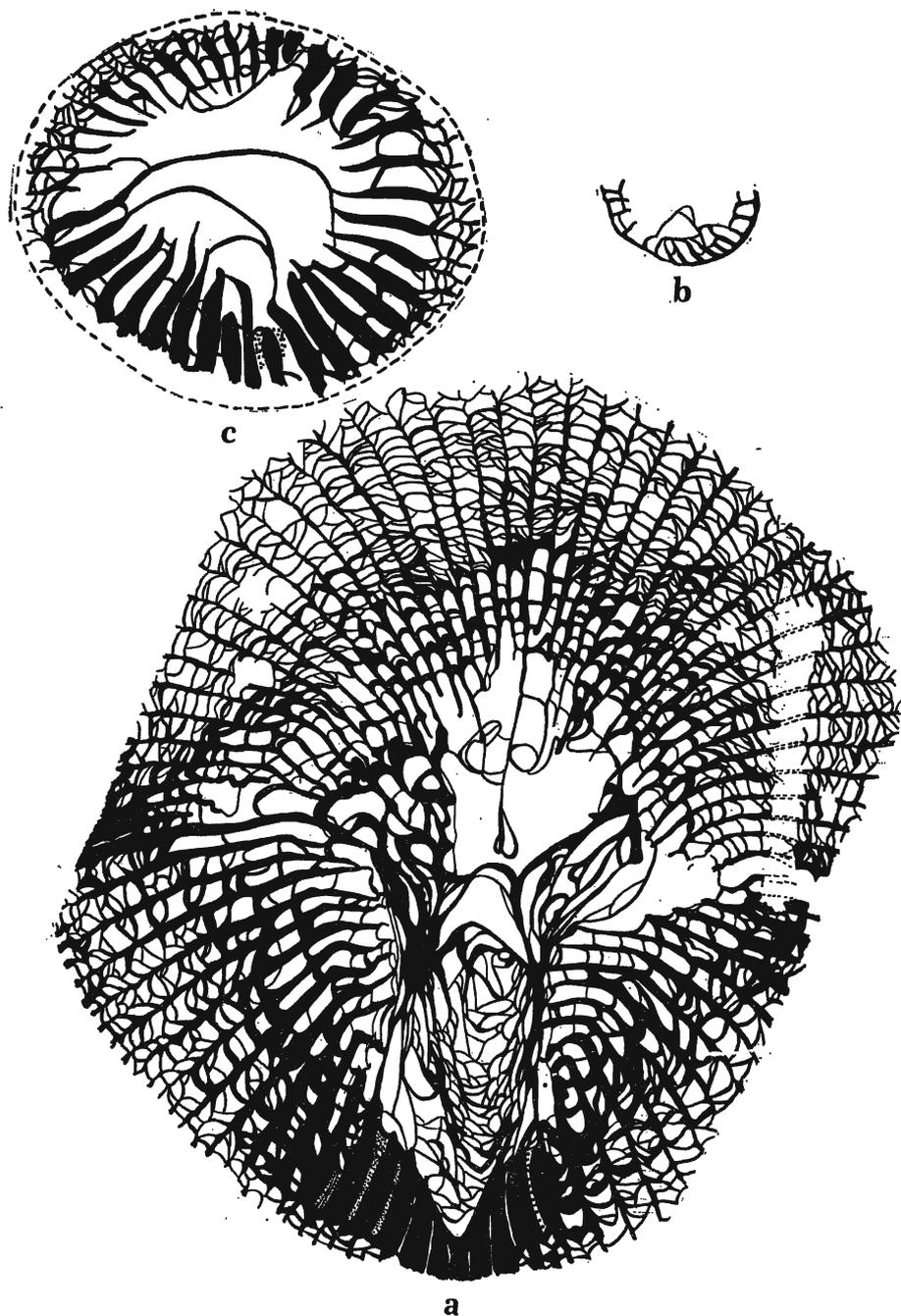


Fig. 1

a — *Timania schmidtii* Stuckenberg. Transverse section of the ephelic stage of the specimen No. 494/305, holotype, housed in the Tshernyshev's Museum in Leningrad, $\times 2.5$

b, c — *Pseudozaphrentoides jerofeewi* Stuckenberg. Specimen No. 50/336, holotype, housed in the same Museum, $\times 2.5$; *b* transverse section of the "Amplexoid" neanic stage, *c* transverse section of the ephelic stage

is mainly resulted by the extremely various type species *B. conicum* Trautschold. Among the topotypes of this species one can observe several development trends, the most important one drifting towards the caninoid forms. In addition there appears the trend to *Pseudotimania* and *Timania* by the formation of incipient alar pseudofossulae with simultaneous elongation of the counter septum; and also the trend to the species with complicated axial areas.

Species of "*Caninia*" (*s. l.*) described in the present paper have diffusio-trabecular (Kato 1963 term) microstructure in contrast to *Caninia cornucopiae* Michelin, but their ontogeny remain unknown. Numerous other Upper Carboniferous and Permian caninoids, as well as, the mentioned species may prove to be representatives of *Bothrophyllum* when their ontogeny is known.

The family Cyathopsidae seems to be an unnatural taxonomic unit. The genera included in it by Hill (1956) and by Dobrolyubova & Kabakovich (1962), often differ from each other in ontogeny and microstructure of septa, having in common the mature, caninoid stage only. In the present paper the term "Cyathopsidae" is still used in the broad sense. Only *Bothrophyllum*-like genera are excluded from it.

The existing studies of ontogeny in the family Cyathopsidae (*s. l.*) are not numerous, but it happened so that there was quite a precise examination of the type species of *Caninia* (Carruthers 1908, Salée 1910) and its microstructure (Kato 1963), thus there exists a very good frame of reference. The mentioned type species has a typical zaphrentoid ontogeny at the beginning, followed by the amplexoid stage, and has fibro-normal microstructure. The consequence of this is for example, a suggestion of close relationship between *Caninia* and *Siphonophyllia* and of a difference from "*Caninia*" *juddi* (Thomson). This last species was assigned to *Bothrophyllum* by Fomichev (1953).

The consequence of accepting ontogenetic criterion is the necessity of giving up the genus *Pseudozaphrentoides*. This name is still in use, in spite of its being synonymized by Dobrolyubova (1952). In the present paper inked and bleached photographs of peels from the Stuckenberg's holotype are presented (Fig. 1b—c). The typical amplexoid stage may indicate that the genera *Caninia* and *Pseudozaphrentoides* are congeneric. Unfortunately, the preservation of the holotype of *Pseudozaphrentoides jerofeewi* Stuckenberg is not adequate for detailed study. The proximal end is broken and the mature stage seems to be pathologically changed. No paratypes of the type species were described. To cancel the genus *Pseudozaphrentoides* is probably the best what can be done in the existing situation.

The author recognizes two new genera from among caninoid Carboniferous corals in this paper. In both cases the basis for recognition is

given by results of ontogenetic examination. Similar results were already achieved for this group of corals by Grek (1936) and Dobrolyubova & Kabakovich (1948); these authors, however, did not accept the differences in ontogenies as particularly important. The present author is of the opinion that such similar results gathered on the basis of quite different materials are the proof of their real taxonomic value.

Both of the above mentioned genera (*Siedleckia* and *Arctophyllum*) in spite of the great similarity of their ephebic stages, probably do not belong to the family Cyathopsidae (s. s.); they are included here tentatively until the time of the separation of more precise generic group, for which new families or subfamilies will be created. These genera, and particularly *Siedleckia*, seem to be quite widely distributed in the Middle and Upper Carboniferous and Lower Permian of Arctic and the USSR territory.

THE RELATIONSHIP OF THE FAUNA

Bjørnøya is relatively isolated in the Arctic, but the development of Carboniferous deposits on this island correlates with the development of the other parts of the Arctic basin. Coelenterata described in this paper are apparently the equivalent of faunas from the neighbouring regions of the Arctic. Unfortunately, there is still a lack of detailed data on this subject, since the corals from the Arctic are unsatisfactorily described, sometimes in the form of lists without descriptions and illustrations (e. g. Forbes & al. 1958). Such lists cannot be the basis of any detailed study because of the state of systematics of tetracorals still leaves a lot of places for subjective interpretation of particular taxons.

Based on present knowledge the following remarks are made about the corals here described: 1) comparatively large number of the species are known previously from other regions, not only from the Arctic; 2) among the discussed species, those which were formerly described were found in the Soviet Union, in particular in the Ural Mountains. This may result from the fact that the Soviet Union is the country where the Upper Carboniferous Coelenterata have been most fully described; 3) species or at least genera common to so distant regions as the Moscow and Donetz basins in the USSR and Texas in the USA, are included; 4) Tethys forms are almost completely lacking. Only one specimen of the genus *Kionophyllum* was found, possibly a representative of a new species of this Tethys genus.

The above remarks allow the author to suggest that the Upper Carboniferous seas reaching the region of the Arctic provided communication convenient for the long distance migration of fauna. Convenient

connections seem to have existed through the Ural Mountains with the epicontinental seas in the Soviet Union and perhaps with Tethys. The lack of Northwest American representatives of species in the Bjørnøya fauna is only apparent. Due to the courtesy of Dr. E. W. Bamber the author had possibility to examine a large collection of Middle and Upper Carboniferous corals of the Canadian Arctic Archipelago containing genera and maybe also species identical with those of Bjørnøya.

It seems that, like in Lower Permian (Fedorowski 1965), the main stream of the drifting fauna migrated from the southeast; Novaya Zemlya, Timan Mts, Ural Mts, Moscow and Donetz basins, the regions of the different but more or less continuous marine sedimentation of Carboniferous and Lower Permian deposits are probably also the regions of the speciation. Fauna spreading out from there reached Bjørnøya, Spitsbergen and Canadian Arctic Archipelago. This is indicated not only by the great number of common species, but also by the similarity and relationship between new species described here and those known from the Soviet Union.

SYSTEMATIC PART

- Phylum **Coelenterata** Frey & Leuckart, 1847
 Class **Hydrozoa** Owen, 1843
 Order **Chaetetida** Sokolov, 1939
 Family **Chaetetidae** Milne-Edwards & Haime, 1850
 Genus **CHAETETES** Fischer in Eichwald, 1829
 Subgenus **CHAETETES** (*Boswellia*) Sokolov, 1939
Chaetetes (*Boswellia*) *luganensis* Vassilyuk, 1959
 (Text-fig. 2a—b; Pl. 1, Fig. 2a—b; Pl. 8, Fig. 1a—b)

1959. *Chaetetes* (*Boswellia*) *luganensis* Vassilyuk; N. P. Vassilyuk, pp. 33 and 34, Pl. 3, Fig. 3; Pl. 4.

Material. — Two small fragments of hemispherical colonies. Individuals very well preserved including the microstructure of the wall.

Description. — Transverse section (Text-fig. 2a; Pl. 1, Fig. 2a). Corallites having no regular shapes, mostly quadrangular and pentagonal, with small nodular or wedge-shaped pseudoseptal outgrowths, appearing in a few corallites. Internal diameters 0.15—0.3 mm; thickness of the wall 0.08—0.12 mm, mostly 0.1 mm. The walls with trabecular microstructure. No middle line can be observed separating the individuals. Particular trabeculae in the walls are arranged identically to the septal trabeculae in *Scleractinia* and are most probably secreted by the part of ectoderm common to adjoining corallites. The walls are thus vertical structural elements rather than dividing walls *sensu stricto*. The calcite filaments in trabeculae unusually thin and not always visible. Pseudoseptal spines prolonged and arranged nearly pinnately, particularly when these spines are long.

Longitudinal section (Pl. 1, Fig. 2b, Text-fig. 2b). The walls of the corallites are thickened at tabulae. Tabulae about 0.01 mm thick, flat, slightly concave or convex, placed quite regularly, about 3—4 in 1 cm. The dark line separating the walls between some corallites is not really the middle line. It appears when two already formed, parallel walls contact, as in very narrow corners.

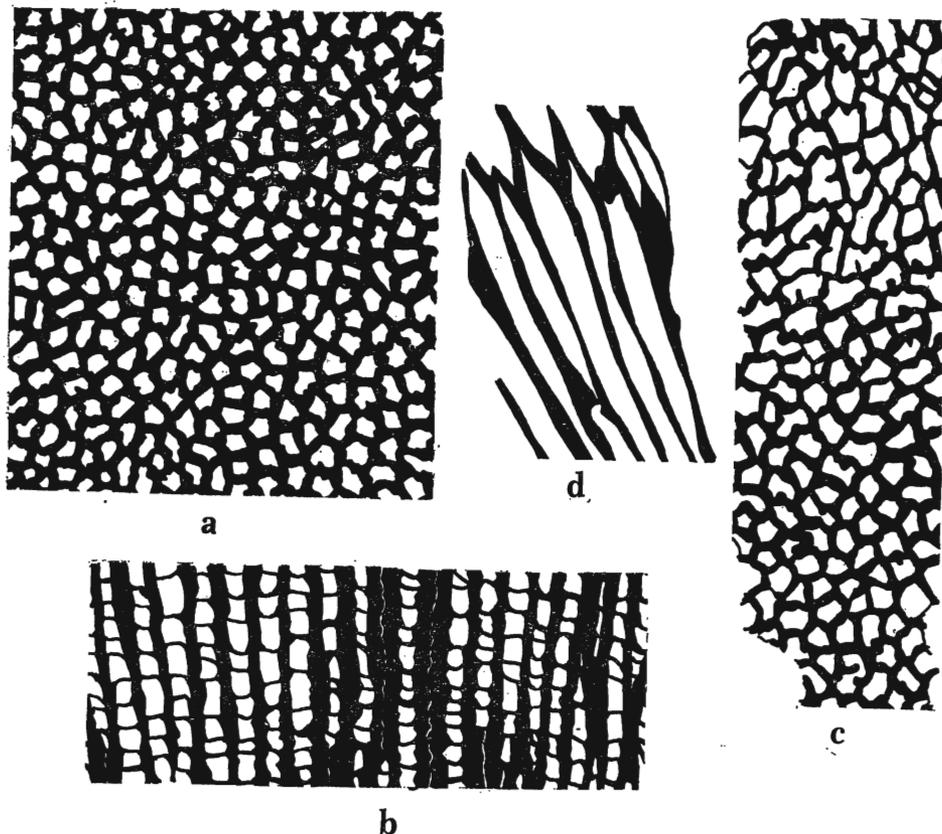


Fig. 2

Chaetetes (Boswellia) luganensis Vassilyuk. Specimen No. A-32138-12, $\times 10$; a — transverse section, b — longitudinal section

Chaetetes (Boswellia) sp. Specimen No. A-32138-13, $\times 5$; a — transverse section, b — longitudinal section

Remarks. — The above described colonies have slightly bigger and more irregular corallites than the ones from the Donetz basin. These are, however, differences of 0.05 mm and not so important. Other measurements and the structure in the longitudinal section are nearly identical. The species which is closest to them is *Ch. (B.) heritschi* Sokolov characterized by slightly bigger and more regular specimens.

Occurrence. — USSR (Donetz basin), $C_3^1 N$; Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasimovian.

Chaetetes (Boswellia) sp.
(Text-fig. 2c—d; Pl. 1, Fig. 3a—b)

Material. — One fragment of the colony measuring $12 \times 7 \times 15$ mm. The structure of the specimens mostly well preserved.

Description. — Transverse section (Text-fig. 2c; Pl. 1, Fig. 3a). Corallites polygonal, irregular in shape with thick, often curved walls. Their dimensions (in mm) are as follows:

Diameter of corallite	0.43—0.65	mostly 0.5
Light of the tube	0.20—0.45	„ 0.3
Thickness of the wall	0.07—0.1	„ 0.1

Some corallites elongated, perhaps not wholly separated during the budding. This parts of the colony looks similarly to the genus *Chaetetipora*. Pseudoseptal spines of different sizes. These appear sporadically as shown in successive transverse section through the colony.

Longitudinal section (Text-fig. 2d; Pl. 1, Fig. 3b). The walls between the specimens appear of differing thickness. In the 6 mm long section examined, fragments of corallites of a length up to 4.5 mm, show an absolute lack of tabulae. Trabecular microstructure of the type described above in *Ch. (B.) luganensis* Vassilyuk.

Remarks. — The described specimen differs from previously described species of the subgenus *Boswellia* in having very rare tabulae and comparatively large size. However, species with such weakly developed tabulae have been described from the nominal subgenus (e.g. *Chaetetes subcapillaris* Sokolov, *Ch. namuriensis* Sokolov). The specimen from Bjørnøya differs from Sokolov's species in the smaller size of the corallites, their regular shapes and thickness of wall. Somewhat similar is also *Chaetetes? irregularis* Yü. However, in this species the incomplete division of the specimens is so advanced that it seems to belong already to *Chaetetipora*. The specimen from Bjørnøya is probably a representative of a new species, but full study is impossible because of inadequate material.

Occurrence. — Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasi-movian.

Class Anthozoa Ehrenberg, 1834
Order Tabulata Milne-Edwards & Haime, 1850
Suborder Syringoporida Sokolov, 1947
Family Syringoporidae Nicholson, 1879
Genus KUEICHOWPORA Chi, 1933
Kueichowpora supracarbonica n. sp.
(Text-fig. 3a—c; Pl. 1, Fig. 1a—b)

Holotype: specimen No. A-32118.

Type locality: Spitsbergen, Bellisund, profile by Dibasodden.

Type stratum: Cyathophyllum Limestone.

Derivation of the name: *supracarbonica* — from the Upper Carboniferous.

Material. — One fragment of the fasciculate colony, measuring $15 \times 10 \times 4$ cm. Corallites siliceous, partly crushed.

Dimensions (in mm):

Space between the corallites	0.2—1.25	mostly 1.0
Diameter of corallite	1.9—2.3	„ 2.0
Diameter of the axial canal	0.3—0.6	„ 0.45
Thickness of the wall	0.2—0.3	„ 0.25

Diagnosis. — *Kueichowpora* with thickly placed transverse sections of tabulae; measurements as above.

Description. — Corallites slightly round or oval in shape, sometimes with rostriform protuberances. Connecting tubes rare. Tabulae in the transverse section, of different size, surround the axial canal, not always placed centrally. Thick wall. Septal spines not seen in the described material. Judging by the tubercular structure of the wall septal spines did exist but were destroyed by silicification. In the longitudinal section (Text-fig. 3b—c; Pl. 1, Fig. 1b) vesicular tabulae, placed one after another, like dissepiments in *Tetracoralla*, form the wall of the axial canal. At the points of increase, or in the connecting tubes, the tabulae are quite closely, horizontally arranged. They also divide the axial canal in these places.

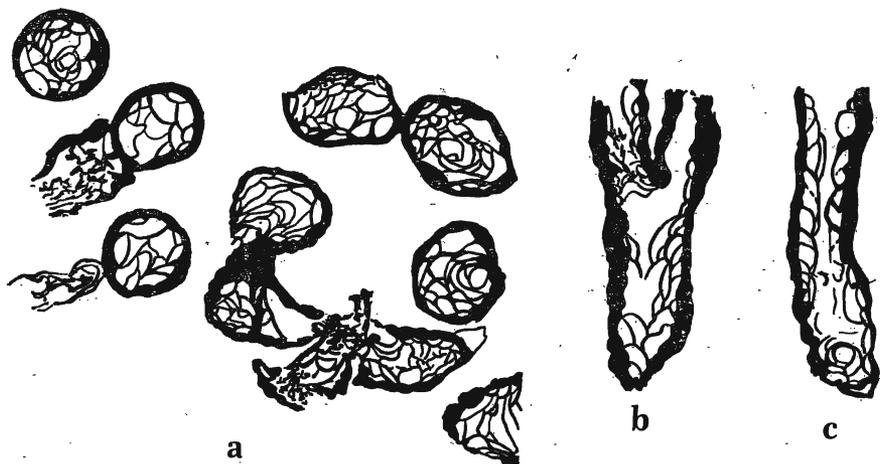


Fig. 3

Kueichowpora supracarbonica n. sp. Specimen No. A-32118, holotype, $\times 5$
a — transverse section; b, c — longitudinal sections

Remarks. — Genus *Kueichowpora* is not accepted by some specialists and is included in synonymy with the genus *Syringopora* by Hill & Stumm (1956), although this does not seem right to the author. The already described species and *K. supracarbonica* n. sp. described here, are well distinguished from the genus *Syringopora* by having a very distinct axial canal, nearly lacking axial tabulae. *K. supracarbonica* n. sp. is geologically the youngest of the described species. It differs from them as having many tabular sections in the transverse section and with the measurements which are intermediate between *K. tushanensis* Chi, and *K. rossica* Sokolov. Another difference may be the excentric place of the axial canal, often met here.

Occurrence. — Spitsbergen (Bellsund), profile by Diabasodden, Cyathophyllum Limestone.

Order *Tetracoralla* Haeckel, 1866

Suborder *Streptelasmatina* Wedekind, 1927

Family *Cyathopsidae* Dybowski, 1873 (s. l.)

Remarks. — Family *Cyathopsidae* is, as stated above, an unnatural unit. The existed data are insufficient, however, for any general revision of this group of corals. The author, therefore, decided to accept the traditional boundaries of the family with an explicit discussion of the differences of the individual genera.

Dobrolyubova & Kabakovich (*In*: Osnovy Paleontologii, 1962) included Cyathopsidae in the suborder Caniniina, order Cystiphyllida. Despite of the taxonomical range of Caniniina (the families designated to it may well be grouped in the superfamily Cyathopsicae) its connection with the cystiphyllids seems not correct to the author. The caninoids only show a general likeness to representatives of the Cystiphyllina, evident first of all, in the development of the marginal vesicles. Some specialists in the USSR (*e.g.* Ivanovskiy 1967) do not accept the taxonomy of the Osnovy Paleontologii either, leaving the Cyathopsidae in the suborder Streptelasma-tina.

Of the genera described in this paper the following are included in the Cyathopsidae (*s. l.*): "*Caninia*" in which the study of ontogeny was not successful; the phaceloid genus *Fomichevella* n. gen.; the solitary *Siedleckia* n. gen. and *Arctophyl-lum* n. gen. The last two genera differ in ontogeny and microstructure of *Caninia*, what they have in common is the caninoid ephebic stage.

Genus CANINIA Michelin *in* Gervais, 1840 (*s. l.*)

Type species: *Caninia cornucopiae* Michelin *in* Gervais, 1840

"*Caninia*" *nikitini* Stuckenberg, 1905

(Pl. 1, Fig. 4a—b; Pl. 2, Fig. 4)

1905. *Caninia nikitini* Stuckenberg; A. Stuckenberg, pp. 19 and 20; Pl. 2, Fig. 15.
 ?1927. *Caninia nikitini* Stuckenberg; F. R. C. Reed, pp. 27 and 28; Pl. 5, Fig. 6.
 ?1931. *Caninia nikitini* Stuckenberg; Y. S. Chi, pp. 19 and 20; Pl. 1, Fig. 5a—b.
 1936. *Caninia nikitini* Stuckenberg; F. Heritsch, pp. 147—150; Pl. 15, Figs 4—12; Pl. 16, Fig. 5.
 1939. *Siphonophyllia lonsdalei* (Keyserling); F. Heritsch, pp. 56 and 57; Pl. 3, Fig. 2; Pl. 19, Fig. 15.
 non 1939. *Siphonophyllia nikitini* Stuckenberg; F. Heritsch, pp. 48—53; Pl. 1, Figs 10—14; Pl. 2, Figs 1—2; Pl. 13, Figs 9—16; Pl. 14, Figs 1, 13—14; Pl. 17, Fig. 10; Pl. 19, Figs 14, 16—17.
 non 1937. *Caninia nikitini* Stuckenberg; S. Felsler, p. 17; Pl. 1, Fig. 12.

Material. — One simple horn-shaped coral, about 10 cm long, without calice and juvenile part.

Measurements (in mm):

Specimen No.	Diameter of		Number of septa
	corallite	tabularium	
A-32121	42 × 42	30 × 31	60 × 2
	42 × 46	30 × 31	60 × 2
	49 × 49	34 × 36	62 × 2

Description. — Transverse section (Pl. 1, Fig. 4a; Pl. 2, Fig. 4). Epitheca very thin with delicate growth lines. Major septa continuous, somewhat thicker in cardinal quadrants. Cardinal septum and two neighbouring major septa shortened. Cardinal fossula slightly narrowing towards the axis, open, hollowed to about 1/2 width of dissepimentarium. Minor septa long; they pass through nearly the whole dissepimentarium but they do not enter the tabularium. Dissepimenta minute, mostly rectangular, often pseudo-herringbone near epitheca. Microstructure diffuso-trabecular.

Longitudinal section (Pl. 1, Fig. 4b). Dissepiments placed vertically, mostly minute, protuberant, locally prolonged and flat in the neighbourhood of tabularium. Marginal part of tabularium vesicular, built of protuberant, slightly raised tabellae and occasional flat tabellae. In the axial part of the corallite, prolonged tabellae, flat or somewhat protuberant.

Remarks. — This species, as nearly all the species introduced by Stuckenberg needs a revision as it contains very different specimens under one name. It is also possible that the illustrated specimen of this species was lost as the author

did not find it either in the Stuckenberg collection in Tshernyshev's Museum in Leningrad or in the Mining Museum Institute in Leningrad, where parts of Stuckenberg's other collections are housed. In spite of this, the present author decided to assign his specimen to *C. nikitini*, as this name has been used many times for specimens resembling the ones described and illustrated by Stuckenberg (1905) and the available material was not satisfactory for making a revision of species.

The specimen from Bjørnøya differs from the one illustrated by Stuckenberg in having a larger number of septa with similar diameter. Other features are common. Larger number of septa and major septa slightly less thickened in tabularium, are the only differences between this specimen and the one described by Heritsch (1939) from Spitsbergen as *Siphonophyllia lonsdalei* (Keyserling). The specimen from the Carnic Alps (Heritsch 1936) have got very long minor septa in the earlier stages of development which, however, are shortened in the later development. They also differ from the specimen of Bjørnøya in smaller diameter and number of septa; the septal index, n/d , is however very close.

The Chinese specimens (Chi 1931, Reed 1927) were included in this species with a restriction. It seems that more related is the specimen described by Reed (*l. c.*) in the Lower Carboniferous of Yunnan. Reed's description and illustration are not, however, precise. It is also possible that the stratigraphic level established by Reed is not accurate. It seems quite impossible that the specimen described by Chi (1931) from Middle Carboniferous of China belongs to *C. nikitini*. In spite of secondary deformations, clear differences are seen in the structure of major septa, visibly thickened in cardinal quadrants. The specimens from Spitsbergen, described by Heritsch (1939) as *Siphonophyllia nikitini* Stuckenberg do not belong to this species and genus, and some of them, *e.g.* Pl. 2, Fig. 2 probably belong to *Pseudotimania*.

It has to be pointed out that all of the remarks given above concern mature specimens only. The stated similarity may be thus the result of homeomorphism.

Occurrence. — The USSR (Ural Mts), probably Upper Carboniferous; ? China, Lower to Middle Carboniferous; Carnic Alps, lower part of Upper Carboniferous; Spitsbergen (Green Harbour), Upper Carboniferous; Bjørnøya, Ambigua Limestone.

"*Caninia*" aff. *verneuili* Stuckenberg, 1895

(Pl. 2, Fig. 5)

Material. — One fragmental corallite with partly damaged internal structure.

Description. — Major septa long, continuous; in cardinal quadrants more thickened than in the counter ones. Septal thickening starts within the dissepimentarium so that the periaxial parts of septa are spindle-shaped. Cardinal fossula deeply cut into dissepimentarium; cardinal septum shortened. Minor septa very short, limited to the most peripheral part of corallite. Dissepimentarium occupies about $\frac{1}{3}$ of the diameter of the corallite; it consists mostly of crowded herringbone dissepiments.

In the described specimen one can observe certain pathological changes in the disorderly and unusually strong curving of the axial parts of major septa. Sometimes they are 180° curved. Also the middle line of septa undergoes the additional curving. Microstructure diffusio-trabecular.

Remarks. — Stuckenberg (1895) described under the same specific name a few specimens much differing in size and the number of septa mostly, however, very big. Apart from Stuckenberg's description and his generalized drawings, there exist three photographic illustrations of this species: Grek (1936), early ephebic stage; Fomichev (1939), early ephebic stage; Fomichev (1953), late ephebic stage. These give a good indication of the essential diagnostic features.

The specimen described in this paper was apparently preserved only in a part related to early ephebic stage, thus it is similar to Grek's illustration. It differs from that specimen in having different n/d ratio, more numerous thickened septa in cardinal quadrants, and in the appearance by some septa of lateral-cystose dissepiments. The bad state of preservation of the specimen and the above discussed differences make specific assignment questionable.

- *Occurrence.* — Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasi-movian.

"Caninia" ordinata (Ross & Ross, 1962)
(Pl. 2, Figs 1—3)

1962. *Pseudozaphrentoides ordinatus* Ross & Ross; C. A. Ross & J. P. Ross, p. 1178; Pl. 160, Figs 9, 11, 13—15; Text-fig. 6.

Material. — Three fragmentarily preserved corallites from which two transverse sections and one longitudinal section were prepared.

Measurements (in mm):

Specimen No.	Diameter of		Number of septa
	corallite	tabularium	
A-32138-2	29 × 31	18 × 20	44 × 2
A-32138-20	31 × 31	16 × 17	44 × 2

Description. — Transverse section (Pl. 2, Figs 1—2). Septa set on triangular bases in a thin outer wall. Major septa of more or less equal length, only slightly thickened. Very minute thickening of some pairs of major septa near cardinal septum begins in the dissepimentarium boundary. Cardinal septum evidently shortened, placed in the open cardinal fossula within dissepimentarium. Minor septa only 0.5—1.5 mm long, often curved. Dissepimentarium occupies $\frac{1}{4}$ — $\frac{1}{2}$ of corallite diameter. Dissepiments commonly herringbone, sometimes rectangular. Rectangular dissepiments prevail beside the outer wall, between major and minor septa, with additional small dissepiments by the septa. More seldom pseudo-herringbone ones appear. Microstructure diffuso-trabecular.

Longitudinal section (Pl. 2, Fig. 3). Dissepiments of various sizes, mostly small, protuberant, arranged in vertical rows. Tabularium wide, regular, loose, double-zonal. In the axial zone long tabellae are slightly concave in the middle. Tabellae in peripheral zone flat-concave, placed usually slightly diagonally toward the top. On the boundary of both the zones of tabularium they are usually placed alternately with tabellae of axial zone.

Remarks. — Specimens from Bjørnøya are similar to the holotype in: 1) size; 2) type of thickening and length of major septa; 3) very short minor septa; and 4) structure of dissepimentarium in cross section. They differ as having: 1) slightly larger number of septa at the given diameter (44:31 Bjørnøya, 38:30 Texas); 2) narrower dissepimentarium in some specimens; 3) cardinal fossula less hollow in dissepimentarium; and 4) less visible double-zonal structure of tabularium, where the axial tabellae in American specimens are slightly arched rather than concave. The remarks are again given on the mature specimens because none ontogenetic studies on American specimens were made and the specimens of Bjørnøya were only fragmentarily preserved.

Occurrence. — USA (Glass Mts, Texas), Virgilian; Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasimovian.

“*Caninia*” *radiata* n. sp.

(Pl. 3, Figs 4, 5a—c)

Holotype: specimen No. A-32135-1.

Type locality: : ørnøya, middle of the coast.

Type horizon: Ambigua Limestone, Lower Kashmivian.

Derivation of the name: Lat. *radiatus*, a, um — from the radial arrangement of septa.

Material. — Four big solitary corallites. Only tubular, ephebic parts were preserved. The longest fragment (*Holotype*) about 8 cm long. Ontogeny was not investigated because of the lack of proximal ends and calices. One specimen with slightly damaged inner structure.

Measurements (in mm):

Specimen No.	Diameter of		Number of septa
	corallite	tabularium	
A-32135-1	41 × 45	22 × 23	62 × 2
A-32135-2	34 × 38	21 × 21	60 × 2
”	41 × 45	22 × 22	60 × 2
A-32135-3	38 × 42	19 × 19	60 × 2
A-32123	about 42	about 23	63 × 2

Diagnosis. — Solitary corals with 60—63 major septa at the diameter 42—45 mm; dissepimentarium occupies about $\frac{1}{2}$ of the diameter of corallite; major septa placed radially; only cardinal septum shortened; minor septa very short; deep cardinal (tabular) fossula penetrating the axis of the corallite.

Description. — Transverse section (Pl. 3, Figs 4 and 5a). Epitheca very thin, nearly smooth. Major septa long, continuous, straight, thickest in dissepimentarium. One can distinguish from them only very shortened cardinal septum, the other major septa almost identical. Narrow cardinal fossula with the walls parallel or narrowing towards the axis of the corallite, bounded by two septa only. It is not deep in the dissepimentarium, but very deep in the tabularium. It may reach the axis of the corallite. Dissepiments adjacent to the cardinal septum are elongate, placed diagonally. Minor septa short, thin, complete, do not penetrate more than to $\frac{1}{3}$ — $\frac{1}{4}$ width of dissepimentarium. Dissepiments usually rectangular, rarely herringbone, most are minute and flat close to tabularium. Adjacent to epitheca pseudo-herringbone dissepiments may appear. The inner wall unseparated.

Longitudinal section (Pl. 3, Fig. 5b—c). Dissepiments of different size, more protuberant and usually bigger near epitheca. Flat close to tabularium, prolonged, situated vertically, hemisphere-like when peripheral. Tabularium double-zonal. In the wide axial zone tabellae are somewhat arched or flat; concave when tabular fossula is also marked. Tabellae in this part not numerous. Peripheral part of tabularium vesicular. Peripheral tabellae mostly horizontal and alternating with other peripheral tabellae or with axial ones.

Individual variability. — Ephebic stages of individual specimens are nearly identical morphologically and have very similar index of septa (n/d). The feature that is characteristic to all the specimens is the enlarging of the size from early ephebic stage, with the number of septa unchanged. Some differences may be observed only in the structure of the cardinal fossula, which may narrow and penetrate deep towards the corallite axis, or may be comparatively hollow and parallel-sided.

Remarks. — Lack of the early ontogenetic stages made precise generic classification of the species impossible. In the description to follow, comparison is made with species belonging to different genera, but having a similar caninoid ephebic

stage of development. "*Caninia*" *radiata* n. sp. is more related to caninoid stages of tetracorals from Upper Carboniferous and Lower Permian of Spitsbergen and the USSR, than to any American and European caninoids. From Donetz species the most similar one is *Caninophyllum domheri* forma "b" Fomichev. This differs from "*C.*" *radiata* n. sp. by the smaller number of septa and bigger diameter (different n/d ratio); the structure of cardinal fossula in which in addition to the cardinal septum 1—3 major septa also get shortened; and with more pinnate arrangement of major septa.

"*Caninia*" *radiata* n. sp. comes close to numerous species described by Stuckenberg (1888, 1895, 1904, 1905) from Ural Mts and Timan Mts. It is difficult, however, to make comparisons with the unrevised Stuckenberg's species. From among the revised ones, "*Caninia*" *kokscharowi* Stuckenberg has a different n/d ratio, shorter major septa in relation to the corallite diameter, characteristic thickening of septa in cardinal quadrants, and cardinal fossula of different structure. "*Caninia*" *nikitini* Stuckenberg having nearly identical n/d ratio, differs from "*C.*" *radiata* n. sp. in having evidently longer minor septa, and narrower dissepimentarium in which pseudo-heringbone dissepiments commonly develop. "*Caninia*" *verneuili* Stuckenberg differs in n/d ratio, narrower dissepimentarium as compared with the corallite diameter, major septa thickened in cardinal quadrants, the structure of cardinal fossula and unusually short minor septa in the advanced epehebic stage.

Gshelia hyperborea Gorsky of Novaya Zemlya, differs in having much shorter major septa, different dissepimentarium structure, n/d ratio, and evidently smaller size.

Bothrophyllum magnificum Gorsky, also from Novaya Zemlya, differs first of all, in the n/d ratio, dissepimentarium structure, and longer minor septa. Species of *Bothrophyllum* described by Dobrolyubova (1936, 1937), differ either with the lack of caninoid stages or with very long minor septa, narrow and complicated dissepimentarium, and other features.

Siedleckia longiseptata (Grek) differs in the n/d ratio, narrower dissepimentarium, and shortened counter septum. This species, however, along with "*Caninia*" *nikitini* Stuckenberg, is the form closest to "*Caninia*" *radiata* n. sp.

Occurrence. — Bjørnøya, Ambigua Limestone, Lower Kasimovian.

Genus *ARCTOPHYLLUM* n. gen.

Type species: *Campophyllum intermedium* Toula, 1875

Derivation of the name: *Arctophyllum* — described for the first time from Arctic.

Species assigned: by monotypy.

Geographic and stratigraphic distribution: Novaya Zemlya, Spitsbergen, Moscow basin; Carboniferous (not precised, most probably Upper) to Lower Permian.

Diagnosis. — Solitary corals, caninoid in epehebic stage; major and minor septa continuous; cardinal fossula open, cardinal septum shortened, counter septum less so; narrow dissepimentarium without lonsdaleoid vesicles; neanic stage of ontogeny plerophylloid with particularly well developed alar septa and shortened counter septum.

Remarks. — *Arctophyllum* n. gen. is one of the forms reaching caninoid epehebic stage as a result of a very distinct (and quite different from *Caninia*) ontogeny. The author gives the name "plerophylloid" to the neanic stage of this ontogeny. It is characterized by very strong development of alar septa and underdevelopment (shortening) of counter septum, owing to which counter-lateral septa are also marked. Cardinal septum differs from other septa in cardinal quadrants at least in thickness, and in some sections also in length.

A similar ontogeny was described by Dobrolyubova (*in*: Dobrolyubova T. A., Kabakovich N. V. & Sayutina T. A., 1966) for genus *Bifossularia*. This resemblance of the development of *Bifossularia* and *Arctophyllum* n. gen. may demonstrate the relationship of the taxons, in spite of quite noticeable differences in the morphology of the ephebic stage. Diagnostic features of *Bifossularia*, such as the development of lonsdaleoid vesicles, very long minor septa, arched tabulae, etc., here are considered as generic differences.

The similarity of the ephebic stage of *Arctophyllum* n. gen. to "*Caninia*" (*s. l.*) is considered the result of homeomorphizm; that is why the differences between this two genera (if "*Caninia*" may be treated as a genus) are not discussed here. In the present author opinion they should not be discussed until the ontogeny of "*Caninia*" (*s. l.*) is known.

It was imposible to find with certainty the microstructure, the material described was unfortunately greatly silicified and recrystallized. Better preserved fragments of septa have the structure closest to diffuso-trabecular.

Arctophyllum intermedium (Toula, 1875)
(Text-figs 4a—1; Pl. 3, Fig. 1a—c; Pl. 5, Fig. 3)

1875. *Campophyllum intermedium* Toula; F. Toula, pp. 50 and 51; Pl. 5, Figs 13—14.
1939. *Caninia intermedia* (Toula); F. Heritsch, pp. 70 and 71; Pl. 5, Figs 5—7; Pl. 13, Fig. 19; Pl. 14, Figs 4, 11—12; Pl. 17, Fig. 11.
1948. *Gshella rouillieri breviseptata* Dobrolyubova & Kabakovich; T. A. Dobrolyubova & N. V. Kabakovich, pp. 21—23; Pl. 12, Figs 1—4; Pl. 14, Figs 1—2 (pars).
non 1951. *Campophyllum intermedium* Toula; I. I. Gorsky, p. 38; Pl. 5, Fig. 5a—c; Pl. 6, Fig. 2.

Holotype. — The specimen illustrated by Toula (Pl. 5, Fig. 13 external view) and in the present paper, Fig. 4j—l (cross sections). The holotype is housed in the collection of the University Museum in Graz (Austria).

Material. — Four incomplete, silicified solitary corallites, some with broken structural elements during fossilization. One with a nearly complete proximal end.

Measurements (in mm):

Specimen No.	Diameter of corallite	Diameter of tabularium	Number of septa
A-32114	19 × 23	15 × 19	36 × 2
A-32115	28 × 28	22 × 23	43 × 2
A-32130	22 × 34	17 × 26	36 × 2
A-32131	22 × 23	18 × 19	36 × 2
"	10 × 11	without	29
"	8 × 8	dissepimentarium	27

Diagnosis. — *Arctophyllum* having (36—43) × 2 septa at a diameter of 22—28 mm; minor septa shortened; narrow dissepimentarium.

Description. — Transverse section (Text-fig. 4g, i, k, l; Pl. 3, Figs 1a—b; Pl. 5, Fig. 3). Major septa complete, slightly curved; thickened in tabularium, more in cardinal quadrants. Cardinal septum shortened, set in the open cardinal fossula, which is slightly widened towards the corallite axis. Counter septum generally not different from other major septa, it may, however, be visibly shorter or thinner than others in counter quadrants. The last pair of metasepta of cardinal quadrants and usually also counter ones are shortened. Minor septa of varying length in the same corallite. Some of them may reach the inner wall, usually however, they are shortened in ephebic stage. Dissepimentarium consists of 2—4 rows of dissepiments. Irregular dissepiments prevail, sometimes herringbone also occur.

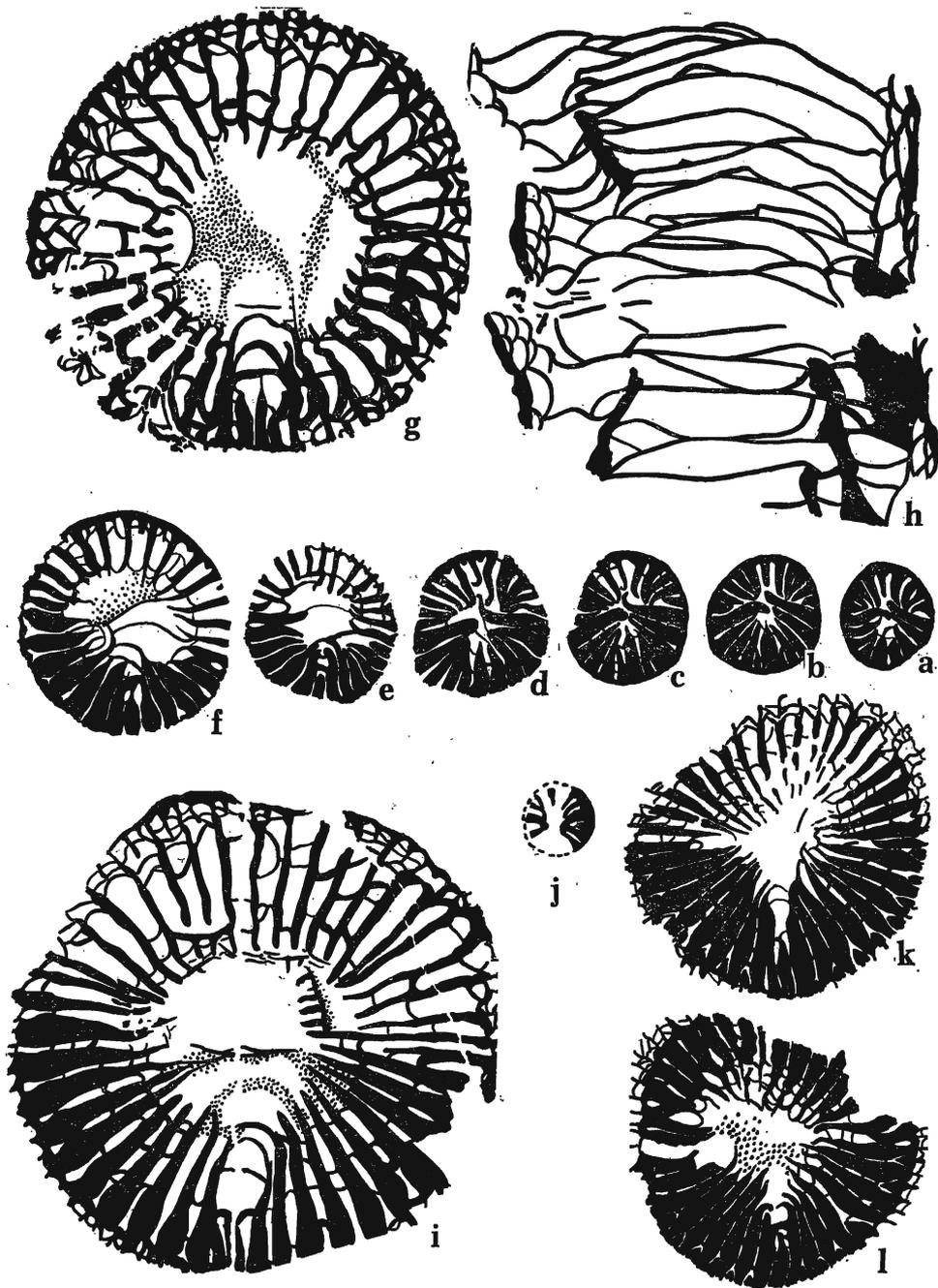


Fig. 4

Arctophyllum intermedium (Toula), $\times 2.5$

- a-d — successive transverse sections of the neanic stage of the specimen No. A-32131
- e, f — successive transverse sections of the early ephelic stage of the same specimen
- g — transverse section of the ephelic stage of the same specimen
- h — longitudinal section of the same specimen
- i — transverse section of the ephelic stage of the specimen No. A-32115
- j — transverse section of early neanic stage of the holotype (without number). Septa partly destroyed
- k, l — transverse sections of the early ephelic stage of the holotype

Longitudinal section (Text-fig. 4h; Pl. 3, Fig 2c). Arched dissepiments of different sizes, placed vertically. The inner wall is not distinguished. Tabulae incomplete, arched, with few accessory plates. In some fragments of corallite they are placed alternately at its periphery.

Ontogeny. — The youngest stage examined (Fig. 4a) with the diameter 3.5×4.5 mm and 18 septa is characterized by massive, well marked, thickened cardinal septum; dominating alar septa; and shortened counter septum. Counter-lateral septa are the longest septa of the counter quadrants. Based on the described development and arrangement of protosepta, the author gave this stage the name "plerophylloid". The position of septa is, on the other hand, very close to the one described by Sutherland (1958) in *Canadiphyllum*.

The described position and development of septa are characteristic of the whole neanic stage (Fig. 4b—d). The growth of metasepta is in this stage very slow. Still there is a lack of minor septa. The following sections (Fig. 4e—f) having the sizes given in the table, are in the author's opinion the youngest sections of ephebic stage. The morphology of corallite is changed here nearly radically. The position of septa becomes radial in the counter quadrants and pinnate in the cardinal ones. The thickness of septa undergoes differentiation; they remain thickened only in cardinal quadrants. Cardinal septum becomes much shortened and enclosed in the narrow cardinal fossula. The opposite is true of the counter septum, it becomes prolonged and similar to other major septa. Minor septa gradually start to appear from the position of the counter septum towards cardinal septum and following them, dissepiments. In the discussed sections dissepiments still appear only in the counter quadrants. Further development consists mainly of the enlarging of the size and development of the described structural elements.

Individual variability. — 1) measurable features: maximal sizes given in the table and n/d ratio for individual specimens gather along the straight line on the diagram. The specimen No. A-32130 is the only one which behaves differently. It may be enclosed to the discussed species incorrectly. Bad state of preservation makes any closer study of it impossible; 2) most important morphological differences are found in the length and the type of thickening of major septa. These differences are well illustrated in specimens Nos. A-32115 and A-32131 (Fig. 4g, i). The length of minor septa differs even in the same section of corallite. The width of dissepimentarium and its structure more or less equal for all corallites.

Remarks. — Owing to the kindness of Prof. H. Flügel from Graz University the author had a chance to examine Toula's originals and note their most important diagnostic features. The state of preservation of Toula's specimens, in this number also the one chosen for the holotype, is not perfect. In spite of this it was possible to find out that they have very related ontogeny, morphology and measurable features compared to the specimens from Spitsbergen, described by Heritsch (1939) and in this paper. The holotype is characterized with slightly longer and more thickened major septa in early ephebic stage, which was shown in the illustrations (Fig. 4k—l). This feature, as said above, undergoes a noticeable individual variability. The youngest examined developmental stage of the holotype (Fig. 4j) is quite incomplete, the characteristic development of protosepta — shortening of counter septum and domineering of alar septa — is visible. The holotype was not longitudinally sectioned, thus the illustration given by Toula (1875, Pl. 5, Fig. 14) is accepted here. The illustration was made by Toula from the second of his two described specimens.

Unusually similar to the Spitsbergen specimens were the ones described by Dobrolyubova & Kabakovich (1948) as *Gshelia rouilleri breviseptata* from the Mos-

cow basin. The ontogeny and morphology of these specimens are nearly identical with the Spitsbergen ones; thus they are considered conspecific.

Occurrence. — Novaya Zemlya, Carboniferous (exact position not known); Moscow basin, Upper Carboniferous, Teguliferina Beds; Spitsbergen, Gshelian to Lower Permian (here described from Bellsund, profile by Diabasodden, made by S. Siedlecki).

Genus *SIEDLECKIA* n. gen.

Type species: *S. bjornoyana* n. sp.

Synonyms: *Caninia* Michelin in Gervais, 1840 (pars).

Caninophyllum Lewis, 1929 (pars).

Derivation of the name: Named in honour of Professor Stanisław Siedlecki, the outstanding Polish explorer of the Arctic.

Species assigned: *Caninia longiseptata* Grek 1936; *Caninia mutafii* Gorsky, 1938; *Siedleckia bjornoyana* n. sp.

Geographic and stratigraphic range: Ural Mts, Novaya Zemlya, Bjørnøya; Upper Carboniferous.

Diagnosis. — Solitary corals with well developed dissepimentarium; major and minor septa continuous; cardinal and counter septa shortened from early development stages; in neanic stage metasepta are pinnately arranged in relation to alar protosepta; ephebic stage caninoid with more or less shortened counter septum; microstructure lamello-trabecular.

Remarks. — The genus *Siedleckia* n. gen. is difficult to define in the ephebic stage of growth. Counter septum becomes very slightly shortened or may even be somewhat prolonged on the tabulae in this stage. The development of septa in separate quadrants often appears asymmetrical because the counter septum is not always placed precisely opposite the cardinal one. The essential diagnostic feature thus is ontogeny, very similar in all the studied specimens (Grek 1936, Gorsky 1938 and in this paper). The principal features of this ontogeny differ at the same time from the ontogeny of other genera that reach the caninoid stage.

It seems that without detailed motivation the following genera may be eliminated from the group of the genera being compared: 1) *Bothrophyllum* with loose axial structure and usually elongated counter septum; 2) *Caninophyllum* considered by the author as a possible synonym of *Bothrophyllum*; 3) *Timania* with elongated counter septum; 4) *Gshelia* which has a columella in early neanic stage of development; 5) *Turbinatocaninia* passing in the development through dibunophylloid and koninckophylloid stages; 6) caninoid stages of *Cyathoclisia* described by Vojnovsky-Krieger (1956); 7) *Hornsundia*, genus with a different ontogeny, having some common features with *Yaworskia*; 8) *Pseudotimania* with closed cardinal fossula and elongated counter septum; and 9) *Pseudozaphrentoides*, which as was shown, is either the younger synonym of *Caninia* or should be cancelled.

A more detailed comparison with the genus *Caninia* is necessary owing to the fact that nearly all previously described species of *Siedleckia* n. gen., have been included in *Caninia*. The ontogeny of *Caninia* was examined in detail by Carruthers (1908) and Salée (1910) on the Tournaisian material and the following distinctive features are stated: 1) zaphrentoid arrangement of septa in neanic stage; 2) presence of amplexoid stage; 3) counter septum is never shortened during ontogeny, on the contrary, it is a little elongated in the earlier stages; 4) in the ephebic stage the counter septum is never shortened; 5) very narrow dissepimentarium with a tendency to form lonsdaleoid vesicles. None of the mentioned features, with the possible exception of the first one (the youngest ontogenetic stages of *Siedleckia* n. gen.

were not examined because of incomplete specimens being under study), develops in *Siedleckia*.

From among other genera more similar are those with shortened counter septum. They are: 1) *Arctophyllum* n. gen., which differs from *Siedleckia* n. gen. mainly by quite distinct ontogeny and microstructure; 2) Lower Carboniferous genera *Keyserlingophyllum*, *Vesiculophyllum*, *Enygmophyllum* and *Melanophyllum* differ from *Siedleckia* n. gen. by having more or less wide zone of lonsdaleoid vesicles, concave tabulae and different ontogeny in the causes when studied; 3) *Bifossularia* differences and similarities of which are discussed above; 4) some North American "*Caninia*" possessing shortened counter septum may belong to *Siedleckia* n. gen.

Siedleckia bjornoyana n. sp.

(Text-fig. 5a—g; Pl. 4, Fig. 4a—e; Pl. 8, Fig. 5a—b)

Holotype: specimen No. A-32129.

Type locality: Bjørnøya, middle of the coast.

Type horizon: Ambigua Limestone (lower part), Lower Kasimovian.

Derivation of the name: *bjornoyana* — described from Bjørnøya.

Material. — One well preserved specimen of which five thin sections and six peels were prepared.

Measurements (in mm):

	Diameter of	Number
	corallite	of septa
	tabularium	
14 × 15	12.5 × 13.5	28 × 2
18 × 18	15 × 15	41 × 2
26 × 26	21 × 22	48 × 2
27 × 31	21 × 23	51 × 2

Diagnosis. — *Siedleckia* having 51 × 2 septa at 31 mm in diameter; counter septum of differing length in ephebic stage, usually not shortened; minor septa penetrate nearly whole dissepimentarium.

Description. — Transverse section (Text-fig. 5f; Pl. 4, Fig. 4d—e). Major septa slightly spindle-shaped, thickened in cardinal quadrants. Cardinal septum slightly shortened, set in open cardinal fossula that is deep in the dissepimentarium. Counter septum is slightly shortened or equal to the other major septa of counter quadrants. Its length varied in different sections. Minor septa curved, very thin, extend into the neighbourhood of internal wall. Dissepimentarium narrowest adjacent to cardinal septum, consists mostly of regular dissepiments. Sporadically herringbone or pseudo-herringbone dissepiments appear.

Longitudinal section (Pl. 4, Fig. 4a). Small dissepiments flatly-arched placed vertically. Tabulae incomplete. Peripheral tabellae S-shaped, sometimes alternating with each other. In axial part of corallite tabulae are long, arched, with a few accessory plates.

Ontogeny. — Having the diameter of 9.0 × 10.5 mm (Fig. 5a), the young corallite has already one vertical ring of dissepiments and minor septa that penetrate the tabularium. The major septa fill the whole inside of corallite. Cardinal and counter septa are distinguished by their length. Already on this stage metasepta are pinnate in relation to alar protosepta. This position of septa is somewhat unclear because of their unusual length and slightly whorling in the axial part of the corallite. Counter septum placed asymmetrically in relation to the cardinal one. This feature is kept throughout growth.

About 2 mm above the before described section, the corallite has already got shortened counter and cardinal septa and typically placed metasepta — pinnate in

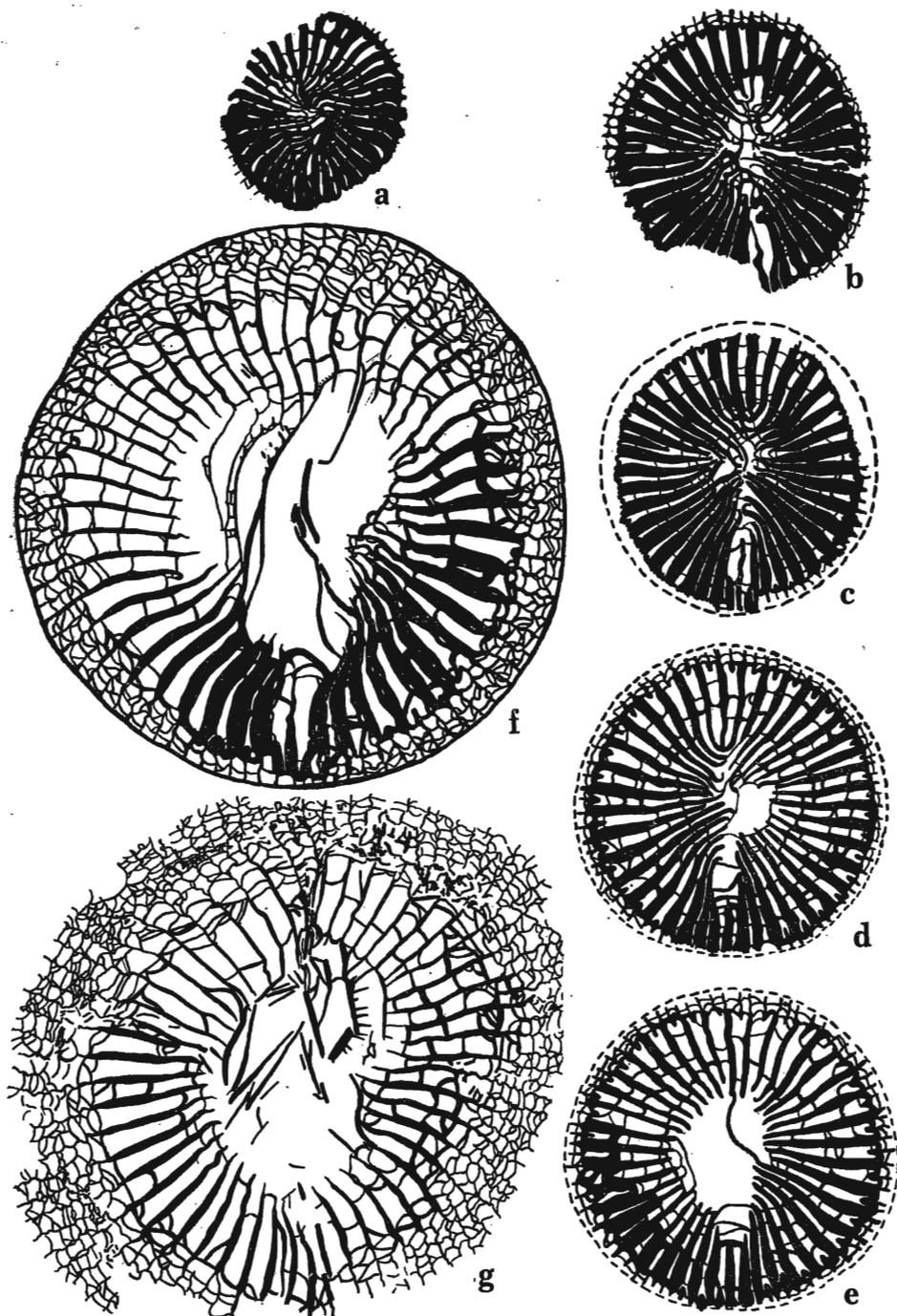


Fig. 5

Siedleckia bjornoyana n. sp. Specimen No. A-32129, holotype, $\times 2.5$

a-e — successive transverse sections of the neanic stage
 f, g — successive transverse sections of the epebic stage

relation to alar protosepta. The ends of elongated metasepta still form loose, irregular net in the axial area of corallite (Fig. 5b). Dissepimentarium widens slightly. Minor septa long, thickened in tabularium. Axial ends of counter-lateral septa are joined, closing the shortened counter septum in a kind of fossula. They remain jointed in this way, during nearly the whole neanic stage of development.

In the further development (Fig. 5c—d) the free axial field widens gradually, but the septa remain pinnate to the alar protosepta. The degree of thickening gradually differs in cardinal quadrants, as well as, in the counter ones. Close to the end of neanic stage the bridge of counter-lateral septa around counter septum is broken, counter septum remains shortened, however.

In ephebic stage (Fig. 5f) the strongest differentiation of metaseptal thickness in quadrants is marked. However, it is not equal on both sides of the cardinal septum. The layers of stereoplasmatic thickening of septa appear porous (Text-fig. 5f; Pl. 8, Fig. 5a). Open spaces are formed by the separation of individual growth lamellae. Cardinal septum slightly shortened and counter septum in this section does not differ in length from any others. Minor septa adjacent to the cardinal septum, still penetrate tabularium; in counter quadrants minor septa are already shortened. In the dissepimentarium rectangular dissepiments prevail, quite often also pseudo-herringbone are created. The next illustrated section (Fig. 5g) represents an ephebic stage as described above.

Remarks. — For the above described specimen a new species was formed, its features cannot be placed in the frames of individual variability of any of the other species, here included in *Siedleckia* n. gen. At the same time diagnostic features of the genus are shown in it clearly enough to consider it for the type species of the new genus *Siedleckia*.

The closest species seems to be *Siedleckia mutafii* (Gorsky). This differs in n/d ratio, very stable according to Gorsky for the specimens of Novaya Zemlya, also with much stronger layer of stereozone on septa and its early differentiation in individual quadrants.

Occurrence. — Bjørnøya, Ambigua Limestone (lower part), Lower Kasimovian of Kobbekbukta.

Siedleckia longiseptata (Grek, 1936)

(Pl. 4, Figs 2—3; Pl. 7, Fig. 2a—b)

1936. *Caninia longiseptata* Grek; N. Grek, pp. 12 and 13; Pl. 2, Figs 1—9; Pl. 3, Fig. 14.
non 1936. *Caninophyllum longiseptatum* (Grek); T. A. Dobrolyubova, pp. 111 and 112; Text-figs 36—37.

Material. — Five fragments of big solitary corals, without proximal ends and calices. Most specimens with partly damaged inner structure.

Measurements (in mm):

Specimen No.	Diameter of		Number of septa
	corallite	tabularium	
A-32125	42.0	24.5	52 × 2
"	44.0	33.0	52 × 2
A-32127	40.0	22.5	50 × 2
A-32135-0	50.0	30.0	61 × 2
A-32135-4	46.5	27.5	54
A-32135-5	44.0	26.5	56

Notice: some of corallites were partly crushed, therefore only bigger diameters are listed.

Description. — Very thin epitheca with fine growth striae and visible horizontal ribbings. Transverse section (Pl. 4, Figs 2—3; Pl. 7, Fig. 2a). Major septa complete, long, in the younger part of corallite pinnately arranged, thickened in cardinal quadrants. In more advanced ephebic stage thin in all quadrants and placed

nearly radially. Cardinal septum shortened to the shape of a small spine, is placed in a deep, open cardinal fossula. Counter septum usually visibly shortened, sometimes slightly. Tabular fossula is not formed round it. Other major septa more or less equal in length. Minor septa usually reach $1/2$ width of dissepimentarium, sometimes shorter, never longer. The relation of the tabularium diameter to dissepimentarium undergoes great changes during ontogeny. Rectangular dissepiments prevail in dissepimentarium. They are flat and crowded close to tabularium, the biggest in the middle part of dissepimentarium. Herringbone dissepiments developed differently in different corallites. Microstructure lamello-trabecular.

Longitudinal section (Pl. 7, Fig. 2b). Dissepiments of distinct sizes and differently arched. Close to tabularium most are flat and elongate. In peripheral part of dissepimentarium steep. Tabulae arched, long, with accessory plates in peripheral part and at the axis; placed irregularly, rather crowded.

Individual variability. — Apart from the differentiation appearing from the different rate of ontogenetic development it was noted that: 1) the structure of dissepimentarium is somewhat different in individual corallites, in which, more or less well developed herringbone dissepiments are formed; 2) different degree of shortening of counter septum. Some specimens have the septum almost not shortened. Usually, it is separated in some way owing to the tabula spread around it; 3) different stage of the shortening of cardinal septum and different depth of cardinal fossula. Some specimens (Pl. 4, Fig. 2) have the fossula only slightly deep, others (Pl. 7, Fig. 2a) have the cardinal septum so shortened that it does not extend past the inner margin of dissepimentarium.

Remarks. — In the described collection there are only corallites representing ephebic stage. Conspecificity of these fragments as well as the specific characters, may create some doubts as in most examples of description of caninoid forms based only on the description of mature forms. One diagnostic feature that is certain is the appearance of the shortened counter septum. The feature suggesting in some degree the congenerity with *S. bjornoyana* n. sp., may also be the same lamello-trabecular microstructure.

Apart from that it must be said that the specimens from Bjørnøya have more septa at a smaller diameter, than the Russian ones. From the measuring of the specimen presented by Grek (1936, Pl. 2, Fig. 8) it is possible that it has slightly shorter diameter than the one given by the author in the table. Its n/d ratio appeared very close to those of the specimens described in this paper. Some differences may be observed in the structure of dissepimentarium, in which for the specimens from Bjørnøya rectangular dissepiments are more common, and for the Russian the herringbone ones. The latter have also major septa that are slightly longer and thicker in cardinal quadrants; it represents, however, a somewhat younger stage of development.

The specimen described by Dobrolyubova (1936) as *Caninophyllum longiseptatum* (Grek), differs from the type specimen by the form of thickening of major septa, normal length of counter septum and different n/d ratio. It probably belongs to a different genus having caninoid ephebic stage.

Occurrence. — USSR, Upper Carboniferous; Bjørnøya, Ambigua Limestone (lower part), Lower Kasimovian.

Siedleckia mutafii (Gorsky, 1938)

(Pl. 5, Figs 1—2)

1938. *Caninia mutafii* Gorsky: I. L. Gorsky, p. 37; Pl. 5, Figs 2—6; Text-figs 21—23.

Material. — Three fragmentarily preserved corallites with partly damaged inner structure.

Measurements (in mm):

Specimen No.	Diameter of		Number of septa
	corallite	tabularium	
A-32138-19	21.0	16.0	38 X 2

Notice: specimens cut diagonally; shorter diameters were measured.

Description. — Major septa in cardinal quadrants very strongly thickened from the wall, wedge-shaped, straight or slightly curved towards cardinal fossula. In the younger stages of development, the layer of stereome on septa is appearing both in the cardinal and counter quadrants. In dissepimentarium major septa thin in all quadrants. Cardinal septum strongly shortened, set in deep cardinal fossula. It may widen slightly towards the corallite axis or have parallel walls in different sections of the same specimen. Counter septum shortened in varying degree, placed asymmetrically. Minor septa usually shorter, their length changes randomly with different specimens and during the ontogeny of the same corallite; in cardinal quadrants they may reach the internal wall. Dissepimentarium wider in the counter quadrants, still widens in ontogeny, consists mostly of the pseudo-herringbone dissepiments.

It was not possible to make the longitudinal section. In diagonal sections that were used tabellae are vesicular in peripheral area of tabularium and tabulae are long, flat or slightly concave in the axial area. Microstructure lamello-trabecular.

Remarks. — Specimens from Bjørnøya come close to the holotype with their measurable features, the type of thickening of septa, the width of dissepimentarium, the structure of tabularium and shortened counter septum. They differ in the asymmetric position of counter septum, more numerous appearing dissepiments of the herringbone type and irregular development of minor septa, which are shortened. These differences are quite noticeable, they do not however, exceed intraspecific variability.

Occurrence. — Novaya Zemlya, Upper Moscovian; Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasimovian.

Genus *FOMICHEVELLA* n. gen.

Type species: *Campophyllum hoeli* Holtedahl, 1913

Derivation of the name: *Fomichevela* — in honour of the late Professor V. D. Fomichev.

Synonyms: *Campophyllum* Milne-Edwards & Haime, 1850, *sensu*: Stuckenberg 1895; Holtedahl 1913; Reed 1927 (pars); Dobrolyubova 1936; Dobrolyubova & Kabakovich 1948; ? Gorsky 1951 (pars).

Caninia Michelin in Gervais, 1840, *sensu* Heritsch 1939.

Caninophyllum Lewis, 1928, *sensu* Heritsch 1939.

Stuckenbergia (subgenus) Fomichev, 1953, non Tschernyshev, 1896.

Species assigned: ?*Campophyllum schrenki* Stuckenberg, 1895 (may belong to *Diphyphyllum*); *C. orientalis* Stuckenberg, 1895; *C. nikitini* Stuckenberg, 1895; *C. kiaeri* Holtedahl, 1913; *C. hoeli* Holtedahl, 1913; ?*C. aff. schrenki* Stuckenberg in Reed, 1927 (may belong to *Diphyphyllum*); *C. uralicum* Dobrolyubova, 1936; *Caninia holtedahli* Heritsch, 1939; *C. volgensis* Stuckenberg *sensu* Heritsch, 1939; *Caninophyllum septentrionale* Heritsch, 1939; *Campophyllum(?) compositum* Dobrolyubova & Kabakovich, 1948; ?*C. extensum* Gorsky, 1951; *C. (Stuckenbergia) stuckenbergi* Fomichev, 1953.

Geographic and stratigraphic range: USSR (Novaya Zemlya, Ural Mts, Timan Mts, Russian Platform, Donetz basin); China; Svalbard; Bjørnøya. ?Upper Visean to Lower Permian.

Diagnosis. — Corals having phaceloid colonies; major and minor septa placed radially, complete; caninoid cardinal fossula with more or less shortened cardinal septum; well developed dissepimentarium; axial structure does not appear in any

stage; loose tabularium with arched tabulae; increase lateral; in the offset, outer parts of atavo-septa remain by the peripheral wall.

Remarks. — *Fomichevella* n. gen. is only by its name a new genus in the literature. Already Fomichev (1953) separated under the name *Stuckenbergia* the corals having phaceloid colonies from widely understood genus *Campophyllum*. Unfortunately the name used by him was previously given to *Spongia* (*Rhizomorina*) by Tschernyshev (1898) and it should have been changed.

Genus *Campophyllum* Edwards & Haime lately revised by Hill & Jull (1965) appeared to be the genus having very specific relation of major and minor septa, a little similar to that of *Palaeosmia*, to which some authors include it as a subgenus (Ivanovsky 1967). It has, on the other hand, nothing in common in its structure and ontogeny with numerous individual and phaceloid species of corals with caninoid structure in the mature stage, named *Campophyllum*. It seems indispensable to the author to exclude from that group of corals, first of all, the colonial species. The type of coloniality is in most of the so far known examples the feature of the range of the genus. Such an attempt was already done by Fontaine (1961) who analyzed colonial species "*Campophyllum*". The conclusion of the mentioned author who includes them all in genus *Diphyphyllum*, seems however absolutely unjustified. According to the present author only very slight convergence appears here between two genera belonging to different and unrelated families. The characteristic structure of tabularium in *Diphyphyllum*, unquestionable relation of this genus with *Lithostrotion*, being more evident in the common appearance of columella rudiments make the identification quite easy. None of the species here included in *Fomichevella* n. gen. develop such features.

These species are probably in phylogenetic relation with genus *Caninia*. Their morphology as well as, the tendencies of *Caninia* development prove this. The author has in his undescribed collection of Upper Visian Tetracoralla of Poland, the specimens with incipient colonial structure, morphologically related to both *Caninia* and *Fomichevella* n. gen. The incipient colonial structure is not, according to the author (Fedorowski 1971), the feature of the genus range, it proves, however, the development trends in its boundaries. Considering what was said above, it seems most probable to think of *Fomichevella* n. gen. as one of the forms separated from *Caninia* or its descendents.

Fomichevella orientalis (Stuckenber, 1895)
(Text-fig. 6a—l; Pl. 5, Figs 4—6)

1895. *Campophyllum orientale* Stuckenber; A. Stuckenber, pp. 60 and 61; Pl. 15, Fig. 2.

Material. — Four fragments of colonies or of corallites broken out of them. One fragment of colony with budding specimen.

Measurements (in mm):

Specimen No.	Diameter of		Number of septa
	corallite	tabularium	
A-32136	8.7	5.5	22 × 2
A-32138-7	10.0	8.5	25 × 2
A-32138-8	10.2	6.5	26 × 2
"	11.0	8.0	27 × 2
A-32138-9	7.0	5.5	20 × 2
"	8.5	7.0	22 × 2
"	10.0	7.5	23 × 2

Diagnosis. — *Fomichevella* having index of septa 22—27 : 8.5—11.0; dissepimentarium composed of 3—5 rows of dissepiments; minor septa shortened; cardinal septum differing in length; cardinal fossula not always well developed.

Description. — Transverse section (Text-fig. 6a, f, i, k; Pl. 5, Figs 4—6). The outer wall about 0.1—0.2 mm thick, fibrous. Triangular bases of septa penetrate it only slightly. Major septa in young corallites thickened in cardinal quadrants, in later ephebic stage identical in all quadrants, minimally thickened in tabularium, radially arranged. Cardinal septum may be very shortened or of the same length as the neighbouring major septa; tabular fossula is always marked. Minor septa do not reach the inner wall. Their lengths vary in the same section from 0.2 to 1.0 mm, passing through 1—4 rows of dissepiments. Dissepiments rectangular between the septa, over the shortened minor septa herringbone. The inner wall not thickened.

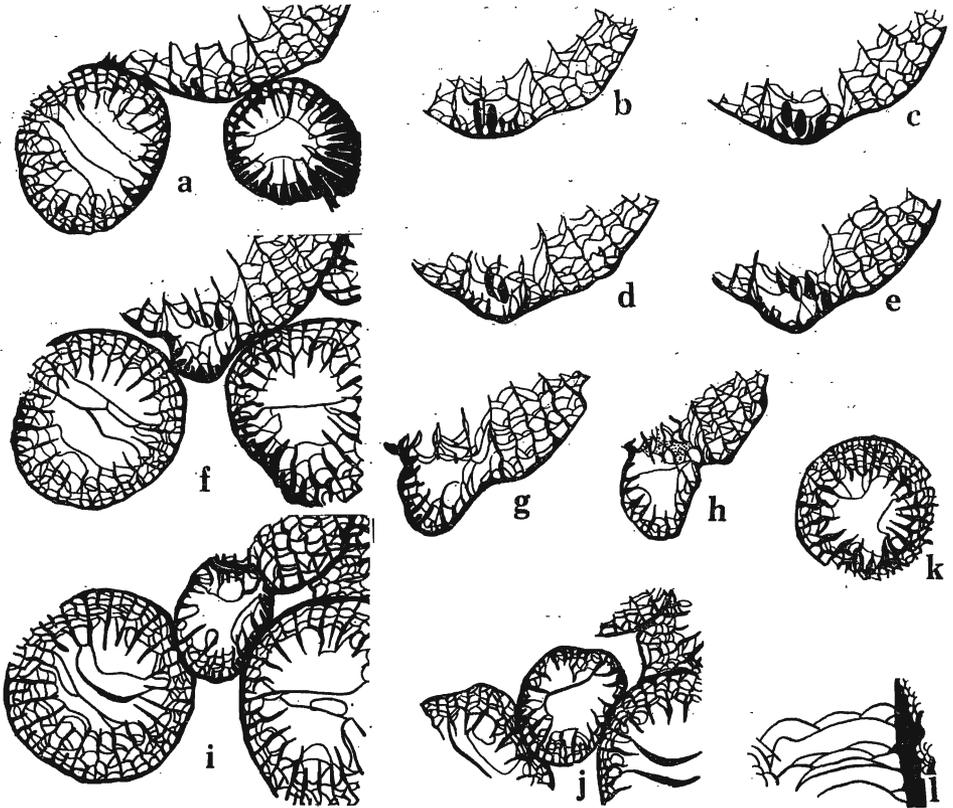


Fig. 6

Fomichevella orientalis (Stuckenberg), $\times 2.5$

a-j — successive transverse sections of the offsetting specimen, colony No. A-32138-9

a-g — hystero-breptic stage; h, i — hystero-neanic stage; j — late neanic stage

k — transverse section of the early ephebic stage of the specimen No. A-32136

l — longitudinal section of the specimen No. A-32138-8

Longitudinal section (Fig. 6l). Dissepiments very slightly arched, nearly equal in length, placed vertically. Tabulae semispherically arched with few accessory plates; they are vesicular in the axis and flat by the dissepimentarium.

Blastogeny. — Hystero-breptic stage (Fig. 6a—g). Region of increase at the beginning of blastogeny nearly does not protrude outside. New, very short and thick

septa appear there rather early. Simultaneously two major septa thicken, together with the minor septum between them (Fig. 6a—b). At the same time the dissepimentarium in the region of increase is rebuilt, as well as, the inner parts of major septa, which gradually atrophy until the final disappearance (Fig. 6a—e).

The development of the thickened sections of septa is different in time. They gradually undergo strong narrowing, close to the outer wall and then are divided into middle and peripheral sections (Fig. 6b—c). Peripheral sections in offset remain close to the peripheral wall and the middle sections, still thick, are placed on the boundary of the parent corallite and the offset, where they constitute the main part of the skeleton (Fig. 6d—e). The arrangement of septa in the early development stage (Fig. 6e—g) is very irregular. New septa appear only by peripheral wall. Quite an important detail is the fact that the counter septum is formed by a peripheral part of the divided parent at the beginning of blastogeny, and dominates in length. The cardinal septum is formed later (Fig. 6i—j) as a neo-septum by the dividing wall.

The thickened, middle sections of septa, are narrowed near the end of hysteronepionic stage and extended into the inside of the parent corallite. Thus they constitute an integral part of the whole blastogeny. The new septa of the offset are formed on the dissepiments, of the parent corallite side, among thick stereozone. It is difficult to distinguish them initially (Fig. 6h). Dividing wall is formed at the concavity of the walls on the boundary of the offset and the parent corallite. In the examined corallite this concavity is particularly pronounced on one side. It is from the very early stage of increase so distinct on the wall of the offset and the parent corallite, that separation is formed between the walls of the two individuals (Fig. 6i).

The septa in the neanic stage (Fig. 6i—j) and the second corallite (Fig. 6a) may be comparatively thin or quite thickened, bigger in cardinal quadrants. Apart from that, this stage is already very close to the ephebic stage.

Individual variability. — Even based on such limited material evident individual variation is observed. Apart from the changes observed during the growth of the specimen (differing length of cardinal septum and minor septa) the following differences among the corallites can be noted: 1) the index of septa; specimen No. A-32138-8 can be distinguished as having more numerous septa. This specimen has also comparatively long major septa; 2) specimen No. A-32138-7 can be distinguished as having evidently shorter from average, major septa and narrower dissepimentarium, with an intermediate index of septa. This specimen is morphologically close to "*Campophyllum*" *schrenki* Stuckenberg; 3) specimen No. A-32136 represents the early ephebic stage and differs in having well developed cardinal fossula and both shortened and thickened cardinal septum. As can be judged from the above survey all the structural elements undergo evident variability. Always, however, with the change of one element the others are built very similarly, as in the corallites of the other colonies.

Remarks. — The species was described for the first time by Stuckenberg (1895) from so-called Lower Carboniferous Limestone of Ural Mts. Its stratigraphic position is not sure and cannot be taken into consideration without revision. Morphological features and the index of septa of the Ural Mts. specimens and the specimens described above are very similar. They do not differ more than the individual specimens from Bjørnøya among themselves. Specimens Nos. A-32138-8 and -9 are nearly identical with the Ural Mts one.

Occurrence. — USSR (Ural Mts), ?Lower Carboniferous; Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasimovian.

Fomichevella hoeli (Holtedahl, 1913)

(Text-fig. 7; Pl. 5, Fig. 7)

1913. *Campophyllum hoeli* Holtedahl; O. Holtedahl, pp. 24 and 25; Pl. 9, Figs 1—4.
 ?1936. *Campophyllum hoeli* Holtedahl; T. A. Dobrolyubova, pp. 122 and 123; Text-figs 50—51.
 1939. *Caninia hoeli* (Holtedahl); F. Heritsch, pp. 57—62; Pl. 4, Figs 1—2; Pl. 21, Fig. 4.
 ?1941. *Campophyllum hoeli* Holtedahl; T. A. Dobrolyubova, In: Soshkina & al., pp. 130—132; Pl. 14, Fig. 1a—b.

Material. — One big fragment of phaceloid colony, No. A-32117, with strongly silicified and commonly crushed corallites. The diameters of corallites with ephelic features 13—20 mm, the number of septa (20—25) \times 2 (Fig. 7).

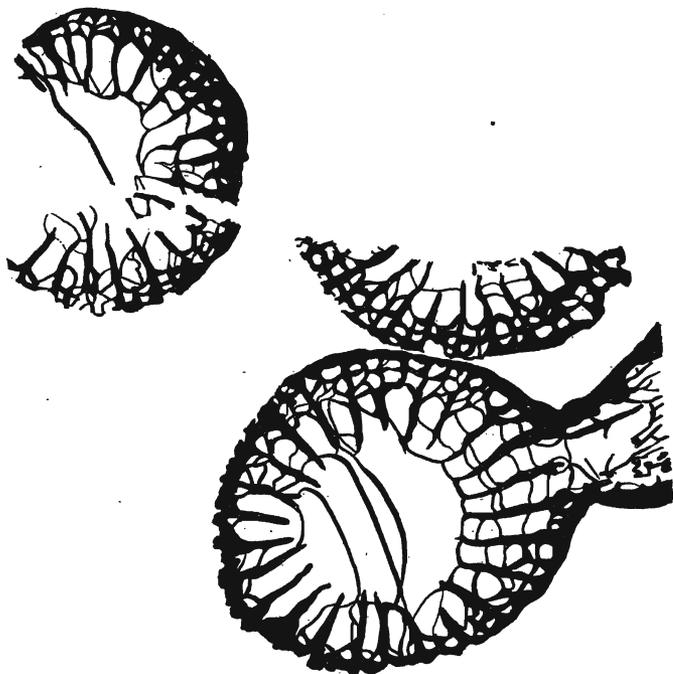


Fig. 7

Fomichevella hoeli (Holtedahl). Specimen No. A-32117, transverse section of the colony, \times 2.5

Remarks. — The species was described in detail by Heritsch (1939) who was also having at his disposal the specimens from Spitsbergen. The specimen discussed here has corallites of the same index of septa, width, and the structure of dissepimentarium as the previously described specimens from Spitsbergen. It differs with slightly more thickened structural elements which may be the result of fossilization, particularly silicification.

The Soviet Union specimens from the Lower Permian described twice (synonymy) were included in this species with question. They have, with similar index of septa, very complicated dissepimentarium with minute dissepiments, among which minor septa are absolutely lost. The other structural elements are similar.

Occurrence. — Spitsbergen: previously described from the base of the Fusulina Limestone, Gshelian; here described from Bellsund, profile by Diabasodden; ?USSR, Ural Mts, Lower Permian.

Family **Bothrophyllidae** Fomichev, 1953Type genus: *BOTHROPHYLLUM* Trautschold, 1879

Genera assigned: *Bothrophyllum* Trautschold, 1879; *Gshella* Stuckenberg, 1888; *Timania* Stuckenberg, 1895; *Caninostrotion* Easton, 1943; *Pseudotimania* Dobrolyubova & Kabakovich, 1948; *Yakovleviella* Fomichev, 1953; *Hornsundia* Fedonowski, 1965.

Geographic and stratigraphic range: Eurasia, North America, Arctic; ?Lower Carboniferous to Lower Permian.

Diagnosis. — Solitary corals, seldom phaceloid colonies; well developed dissepimentarium; cardinal fossula caninoid with shortened or elongated cardinal septum; counter septum prolonged, at least in the younger stages of ontogeny, when may form a kind of pseudocolumella; caninoid stage of development is frequently reached in maturity; beginning of ontogeny zaphrentoid.

Remarks. — Most of the genera here included in Bothrophyllidae was separated from the family Cyathopsidae Dybowski (s. l.) on the basis of ontogenetic development. Ontogeny was examined in these genera in some detail and sometimes completely (*Hornsundia*). Distinctive diagnostic features of ontogeny in all the genera included in Bothrophyllidae are much related. The family Bothrophyllidae is in close phylogenetic relation with the family Cyathopsidae.

Genus *BOTHROPHYLLUM* Trautschold, 1879Type species: *B. conicum* Trautschold, 1879

Synonyms: *Pseudocaninia* Stuckenberg, 1888.

Rossophyllum Stuckenberg, 1888.

Bothroclisia Fomichev, 1953 (subgenus).

?*Caninophyllum* Lewis, 1929.

Caninophyllum Lewis, 1929, *sensu* Yü 1933 (pars); Fomichev 1953 (pars).

Caninia Michelin *in* Gervais, 1840, *sensu* Stuckenberg 1895 (pars); Fomichev 1953 (pars).

Campophyllum Milne-Edwards & Haime, 1850, *sensu* Thomson 1883 (pars); Stuckenberg 1904 (pars).

?*Koninckophyllum* (*Histiophyllum*) Thomson, 1879, *sensu* Reed 1927.

non *Bothrophyllum* Trautschold, *sensu* Kostić-Podgorska 1957.

non *Bothrophyllum* Trautschold, *sensu* Kostić-Podgorska 1958.

Geographic and stratigraphic range: As for family.

Diagnosis. — Solitary corals with well developed dissepimentarium; in younger ontogenetic stages the arrangement of septa is zaphrentoid with cardinal, counter and some metasepta joined in the axis; in the ephebic stage counter septum typically elongated and cardinal septum shortened, but caninoid stage often developed; microstructure lamello-trabecular.

Species assigned: ?*Cyathophyllum archiaci* Milne-Edwards & Haime, 1852; *Bothrophyllum conicum* Trautschold, 1879; *Pseudocaninia trautscholdi* Stuckenberg, 1888; *Bothrophyllum baeri* Stuckenberg, 1895; *Caninia ruprechtii* Stuckenberg, 1895 (pars); ?*Campophyllum juddi* Thomson, 1893; *Campophyllum sinzowi* Stuckenberg, 1904; ?*Koninckophyllum* (*Histiophyllum*) *occultum* Reed, 1927; *Pseudocaninia longiseptata* Lewis, 1931; *P. brevisseptata* Yü, 1933; *Caninophyllum costatum* Yü, 1933; *Pseudocaninia yohi* Chi, 1935; *Bothrophyllum complexum* Dobrolyubova, 1937; *B. pseudoconicum* Dobrolyubova, 1937; *B. kashiricum* Kabakovich, 1937; *B. formosum* Gorsky, 1938; *B. superbum* Gorsky, 1938; ?*B. simplex* Fomichev, 1939; *B. rareseptatum* Dobrolyubova, 1940; *B. flexuosum* Dobrolyubova & Kabakovich, 1948; ?*B. magnificum* Gorsky, 1951; ?*Caninia nosovi* Fomichev, 1953; *Caninophyllum domheri* Fomichev, 1953; *C. calitvense* Fomichev, 1953; *C. dobrolyubovae* Fomichev, 1953; *Bothrophyllum equale* Fomichev, 1953; *Bothroclisia crassiseptata* Fomichev, 1953; *B. clisiophylloides* Fomichev, 1953; *B. stepanovi* Fomichev, 1953; ?*B. peripheroides* Fo-

michev, 1953; ?*Bothrophyllum berestovensis* Vassilyuk, 1960; *B. multiseptatum* Wu, 1964; *B. permicum* Fedorowski, 1965; *B. orvini* Fedorowski, 1967; ?*B. pater* Ivanovskij, 1967; *B. timantoides* n. sp.

Note: A part of the above listed species may be synonyms. It is also possible that some of them after examining of microstructure and full ontogeny will have to be excluded from the genus. Species of especially uncertain taxonomic position are quaried.

Remarks. — The genus *Bothrophyllum* together with its type species *B. conicum* Trautschold and some other species were described in detail by Dobrolyubova (1937, 1940). This author discussed genera *Pseudocaninia* and *Rossophyllum* and considered them to be synonyms of *Bothrophyllum*. She included in *Bothrophyllum*, *Pseudocaninia* species described by Lewis (1931) from the Upper Viséan of Great Britain. At the same time she suggested the evolutionary sequence of *Bothrophyllum* on the basis of the gradual elongation of minor septa considering Viséan species with short septa as the initial stage. Chinese Upper Viséan species of *Pseudocaninia* (Yü 1933, Chi 1935) were excluded from her developing sequence because of their long septa. The present author is of the opinion that more than one direction of development may exist within the genus and that particular morphological features may develop at different rates in different species. Early appearance of a feature does not eliminate a species from genus. Chinese species with long minor septa may be thus included in *Bothrophyllum* together with the short-septal ones. It has only to be mentioned that the congenerity of Lower and Upper Carboniferous and Permian species possessing *Bothrophyllum*-like morphology may be apparent. The existence of *Bothrophyllum* species in *Eumorphoceras* and *Reticuloceras* zones of the Donetz basin makes it more possible, although the appearance of homeomorphs within so long-ranging genus should not be excluded.

The subgenus *Bothrophyllum* (*Bothroclisia*) was introduced by Fomichev (1953) for corals differing from the typical *Bothrophyllum* in a smaller size, narrower dissepimentarium and more compound axial part of corallite. The first two of the mentioned features are not important even in the species nomenclature and the third is so variable within species that it cannot be used to separate a higher order taxonomic unit either.

The author includes here in *Bothrophyllum* those species of *Caninia*, *Caninophyllum*, *Campophyllum* and *Koninckophyllum* that show bothrophylloid ontogenetic and morphological features. This includes the type species of *Caninophyllum* — *C. archiaci* Milne-Edwards & Haime and *Campophyllum juddi* Thomson. Already Fomichev (1953) pointed out that the latter species may belong to *Bothrophyllum*. The congenerity of *Caninophyllum* and *Bothrophyllum* was previously suggested by Rowett (1969).

The author suggests inclusion in *Bothrophyllum* of species that are outwardly very different. However, after analyzing the main morphological features it appears that most of them are impermanent, typically varying with individuals or common to a number of species in different genera. Apart from these there appear a few constant, common and important features which must be said to be diagnostic for the genus. To the changeable features belong:

1. The stereoplastic thickening of major septa in cardinal quadrants. Good development of cardinal fossula and shortening of cardinal septum always go together. The opposite case is where the difference in thickness of major septa in cardinal quadrants does not. Cardinal fossula may then be better or worse developed, never, however, as well as in the specimens or species having the thickened septa in cardinal quadrants. Even within separate species (*Bothrophyllum conicum*, *B. pseudoconicum*, and others) exist numerous transitory forms among these types. Also different are the species which always have, strongly thickened major septa

in cardinal quadrants (e.g. the species described by Gorsky, 1938, 1951, from Novaya Zemlya). This feature then is not a diagnostic one.

2. The width of dissepimentarium. Dissepimentarium is always well developed, but its width and structure may differ much both within and between species. The most common types of dissepiments are herringbone and angulo-concentric ones, they are seldom concentric. Dissepiments of the pseudo-naotic type often develop near the epitheca; sometimes also lateral-cystose appears. As it seems from the illustrations of numerous species, most of them are able to develop nearly all the mentioned types of dissepiments. Thus the width of the dissepimentarium, as well as its structure are not diagnostic features. A well developed dissepimentarium is diagnostic, however.

3. Big variability is also marked in the structure of the axial region: the counter septum alone may extend toward the axis, a few or several major septa may be elongate, or the axial ends of most septa may form an axial structure. The variability in this case is apparently random but may, however, depend on the prevalence of some salts in the sea water as was suggested by Dobrolyubova (1937). It may be said that simple elongated counter septum is more common in the species having no stereozonal thickening of major septa in cardinal quadrants, but this feature is also seen in some species having it, e.g. in type species *B. conicum*. As in numerous Carboniferous genera, *Bothrophyllum* commonly reaches a caninoid stage; many species reach it near the end of their individual development, some of them however, comparatively early in the ontogeny.

4. Grouping of the species according to the length of minor septa as suggested by Dobrolyubova's (l. c.) studies may in some cases be right for showing the place of the species in the phylogenetic sequence. There are, however, species that do not fit this sequence; either they have shorter minor septa in geologically younger layers, or vice versa. These species may not belong to Dobrolyubova's sequence because they have had a different development, although they still belong to *Bothrophyllum* as shown by their morphology and ontogeny.

The constant diagnostic features, repeated in all the species are:

1. The joining of cardinal and counter septa in younger stages of ontogeny, and the zaphrentoid arrangement of septa in the early neanic stage.

2. The prolonging of the counter septum, from which a separated pseudo-columella is never formed in the mature or neanic stage. This septum may be shortened as the specimens reach caninoid stage.

3. Vesicular structure of tabularium in which the axial area is not separated as in *Dibunophyllum* or *Clisiophyllum*. However in younger ontogenetic stages the tabulae may be tent-shaped with an elongated counter septum as in *Koninckophyllum*. In caninoid stage the tabularium has wide, flat or arched tabulae.

Some authors compared only the holotypes of individual species in detail. The present author thinks that this leads to undue taxonomic splitting since it does not consider the often very wide individual variability in population. The finding of a set of constant features for a whole population and the comparison with a similar set of features of another taxon may only give the basis for judging their real similarity or difference.

Bothrophyllum timanioides timanioides n. subsp.
(Text-fig. 8a—c; Pl. 6, Fig. 1a—c; Pl. 7, Fig. 1a—b)

Holotype: Specimen No. A-32128.

Type locality: Bjørnøya, middle of the coast.

Type horizon: Ambigua Limestone (lower part), Lower Kasimovian.

Derivation of the name: *timanioides* — similar to the genus *Timania*.

Material. — Four incomplete solitary corals. The inner structure of advanced ephebic stages slightly damaged. Holotype having preserved late-neanic stage.

Measurements (in mm):

Specimen No.	Diameter of		Number of septa
	corallite	tabularium	
A-32124	39	24	about 56 × 2
A-32126	33	23	52 × 2
A-32128	16 × 16	14 × 14	41 × 2
"	20 × 20	17 × 17	45 × 2
"	35 × 36	23 × 23	55 × 2
A-32137	29 × 31	22 × 25	53 × 2
"	35 × 37	23 × 25	55 × 2

Notice: in the flattened specimens only bigger diameters of specimens and their tabularium are listed.

Diagnosis. — *Bothrophyllum* with (53—56) × 2 septa having diameter of about 35 mm; pinnate arrangement of septa in all the quadrants; cardinal septum shortened; counter septum varying in length; minor septa shortened; alar pseudofossulae may be marked.

Description. — Transverse section (Text-fig. 8c; Pl. 6, Fig. 7a, c; Pl. 7, Fig. 1a). Outer wall about 0.4 mm thick. Continuous septa set hollow in the wall. Major septa long, in cardinal quadrants placed pinnately, spindle shaped in tabularium. Thin dissepimental sections of major septa slightly wavy. Cardinal septum shortened, almost limited to inner row of dissepiments. Cardinal fossula open, half placed in dissepimentarium; in the younger development stage it contains 1—2 pairs of shortened metasepta in addition to the cardinal septum. In the advanced ephebic stage it is bounded by two metasepta only. Counter septum elongate in younger development stages gets shortened gradually. In the advanced ephebic stage differing in length, usually slightly longer from the neighbouring septa, commonly thinner than them. Some metasepta in counter quadrants may be extended almost to the tabulae. The last pair of metasepta in these quadrants is underdeveloped for a long time. Minor septa are thin, slightly wavy, occupying a little more than 1/3 of dissepimentarium width; during the ontogenetic development they are shortened. Dissepimentarium takes less than 1/3 of the corallite diameter. Dissepiments of herringbone and rectangular type. Close to the outer wall pseudo-herringbone ones may also occur.

Longitudinal section (Pl. 6, Fig. 1b). Dissepiments adjoined to epitheca arched and minute, become longer and flatter towards the inside. The inner wall thickened in places. Tabularium wide, simple. Tabellae are contratingent in the peripheral areas. In the axial area, early-stage semispherical vesicular tabellae, become flat, little arched, wide in the advanced ephebic stage.

Ontogeny. — In the described material the brephic and early neanic stages are missing. The examined neanic stage has typically bothrophylloid structure (Text-fig. 8a—b; Pl. 7, Fig. 1b). The septa of cardinal quadrants thickened, placed pinnately, do not close the cardinal fossula. Cardinal septum has prolonged, thin axial end, is longer than the last pair of metasepta in cardinal quadrants. Counter septum elongated past the corallite axis. The septa of the counter quadrants are only slightly thickened, differing in length. A dissepimentarium already exists and minor septa penetrate the tabularium in cardinal quadrants where their axial ends are thickened.

In the early ephebic stage (Pl. 6, Fig. 1a) the septa of the cardinal quadrants may still remain strongly spindle-shaped and are still pinnately arranged. Cardinal septum shortened; counter septum somewhat thinner and longer than the neighbouring major septa. Minor septa do not reach the inner wall.

Individual variability. — In spite of the small number of specimens which are available, one can say that this subspecies is very stable morphologically in the

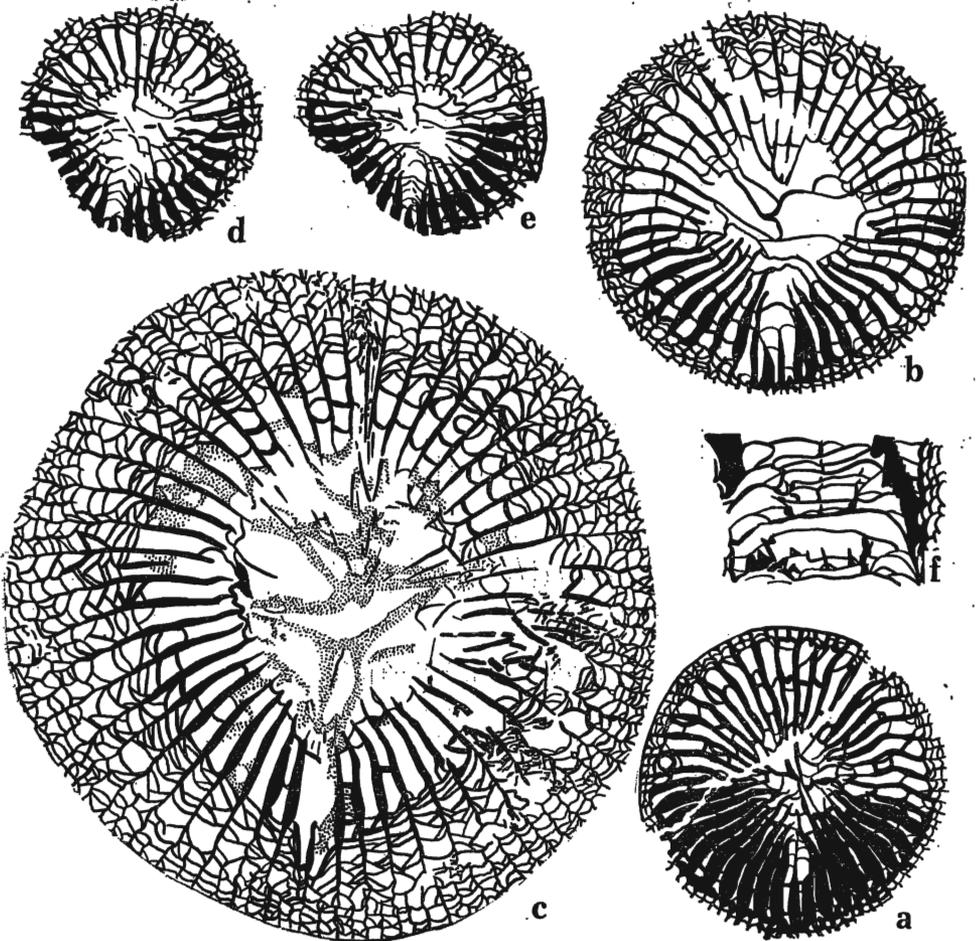


Fig. 8

Bothrophyllum timanioides timanioides n. subsp. Specimen No. A-32128, holotype,
 × 2.5

a, b — successive transverse sections of the late neanic stage
 c — transverse section of the ephobic stage

Bothrophyllum timanioides nanum n. subsp. Specimen No. A-32138-14, holotype,
 × 2.5

d, e — successive transverse sections of the ephobic stage
 f — longitudinal section

ephebic stage. Individual corallites have nearly identical parameters. At the same time evident heterochronism in development can be noted. The holotype for example reaches the maturity features at the same diameter and septal number at which the paratype No. A-32137 (Pl. 6, Fig. 1a) still has many juvenile features.

Remarks. — The described subspecies belong to the group of species having caninoid ephobic stage. Simultaneously it displays some features characteristic of

Pseudotimania or *Timania*: 1) the underdevelopment of the last pair of septa in counter quadrants in ontogeny remains for a long time unchanged; sometimes even slightly hollow pseudofossulae may be formed by them in the dissepimentarium; 2) more or less pinnate arrangement of septa in counter quadrants; and 3) the lack of septal structure in the axial part of corallite.

These timanioidal features are also found in many *Bothrophyllum* species from the Moscow basin, including some of the subspecies of the type species of the genus. The author includes this species in *Bothrophyllum* because it has typically bothrophylloid neanic stage and bothrophylloid cardinal fossula, bounded only by two septa, with cardinal septum shortened in ephebic stage.

Occurrence. — Bjørnøya, Ambigua Limestone (lower part), Lower Kasimovian.

Bothrophyllum timanioides nanum n. subsp.

(Text-fig. 8d—f; Pl. 6, Fig. 2a—b)

Holotype: specimen No. A-32138-14.

Type locality: Bjørnøya, middle of the coast.

Type horizon: Ambigua Limestone (Conglomerate), Lower Kasimovian.

Derivation of the name: Lat. *nanus*, *a*, *um* — small.

Material. — One incomplete specimen over 3 cm long. The preserved fragment represents the ephebic stage as shown by the subtubular shape, constant number of septa, and very similar morphology of all four cross sections.

Diagnosis. — *Bothrophyllum timanioides* having 32×2 septa at the diameter 14 mm; counter septum permanently elongated.

Description. — Transverse section (Text-fig. 8d—e; Pl. 6, Fig. 2a). Long major septa thickened in cardinal quadrants. Cardinal septum and one pair of the neighbouring metasepta shortened. Counter septum elongated, different in length; in one of the sections it reaches the corallite axis. The last pair of septa in counter quadrants shortened. Minor septa reach the inner wall, thickened in cardinal quadrants. Dissepiments rectangular, more seldom irregular, placed in 2—3 rows.

Longitudinal section (Text-fig. 8f; Pl. 6, Fig. 2b). Dissepiments arched, placed vertically. Tabularium wide, simple. Incomplete tabulae, strongly protuberant in the marginal parts; in the middle part of tabularium they are flat or slightly concave. At the corallite axis the separate sections of the counter septum occur.

Remarks. — The described subspecies is morphologically most close to the late neanic stage of development of nominal subspecies. It differs from this stage by its clearly smaller size, fewer septa and more distinct counter septum that permanently occurs later in ephebic stage. *B. pseudoconicum* Dobrolyubova has similar size and some similar morphological features (width and structure of dissepimentarium, length of minor septa). It differs in a much more complicated structure of the axial part and less well developed cardinal fossula.

B. timanioides nanum n. subsp. has many features similar to *Timania* or *Pseudotimania* as does the nominal subspecies. These are: permanently elongated counter septum, shortened last pair of metasepta in counter quadrants, cardinal fossula that is a little widened towards the axis. *B. timanioides nanum* n. subsp. is particularly related to Spitsbergen and North American species described as *Timania*. These species (Heritsch 1939, Fedorowski 1965, Rowett 1969, Tidten 1972) show many features intermediate between *Timania*, *Pseudotimania* and *Bothrophyllum*.

Occurrence. — Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasimovian.

Bothrophyllum sp. 1

(Pl. 4, Fig. 1a—b)

Material. — One specimen (two pieces catalogued under Nos. A-32132 and A-32133, respectively) with particularly well developed ephebic stage and partially preserved calice, without the early stages of development.

Measurements (in mm):

	Diameter of	Number
corallite	tabularium	of septa
54 × 63	35 × 36	62 × 2
58 × 66	35 × 41	62 × 2

Description. — Transverse section (Pl. 4, Fig. 1a—b). The outer wall very thin (about 0.1 mm), smooth. Major septa long, a little wavy, very thin in dissepimentarium, slightly thickened in tabularium, thickest near the cardinal septum. In the younger part of the ephebic stage they nearly reach the corallite axis, at the base of the calice they are a little shortened. Cardinal septum most thickened, does not extend beyond the inner row of dissepiments. Cardinal fossula narrow with more or less parallel walls set deep in dissepimentarium. Several pairs of metasepta close to fossula are gradually shortened towards the cardinal septum. Counter septum placed a little asymmetrically, slightly elongated. Some metasepta may also be elongated, particularly close to tabulae. Minor septa very thin, often curved, particularly in their more inner parts. Usually they penetrate 1/3, rarely 1/2 of dissepimentarium width. Dissepimentarium occupies about 1/3 of the corallite diameter. Near the tabularium it is built of flat, crowded, rectangular dissepiments, sporadically herringbone. Peripherally, between major and minor septa, rectangular dissepiments appear quite regularly, protuberant towards periphery.

In the longitudinal section tabularium is simple with flat to arched, diagonally placed axial tabulae. Marginal tabellae flat, with simple accessory plates, slightly raised to the axial tabulae.

Remarks. — The described specimen is too incomplete to form the basis for a new species, but it evidently differs from other representatives of the genus. The most similar species is probably *B. baeri* Stuckenberg from Lower Permian of Ural Mts and Spitsbergen. This species has a similar size and number of septa, but differs in the structure of cardinal fossula, more pinnate major septa, and vesicular tabularium in the longitudinal section. Some similarity is also shown to *B. superbum* Gorsky from the Upper Viséan — Lower Namurian of Novaya Zemlya. It differs in having narrower and differently built dissepimentarium, shorter minor septa, and the structure of cardinal fossula; it is similar in the structure of tabularium, particularly near the calice. Quite evident similarity is also displayed by *Caninophyllum* (i.e. *Bothrophyllum*) *domheri forma "b"* Fomichev. The subspecies from Donetz basin has different n/d ratio (less numerous septa), a little shorter and more thickened major septa in cardinal quadrants, longer cardinal septum, and differently built cardinal fossula.

Occurrence. — Bjørnøya, Kobbekbukta, Ambigua Limestone (lower part), Lower Kasimovian.

?Bothrophyllum sp. 2

(Text-fig. 9a—d; Pl. 6, Fig. 3a—d; Pl. 8, Fig. 4)

Material. — Two incomplete corallites without calices and proximal ends. Only transverse sections were made.

Measurements (in mm):

Specimen No.	Diameter of		Number of septa
	corallite	tabularium	
A-32138-17	13 × 16	10 × 12	32 × 2
"	16 × 20	12 × 13	36 × 2
A-32138-18	16	11	32 × 2

Notice: specimen No. A-32138-18 cut diagonally; smaller diameter is given.

Description. — In the advanced epehic stage (Text-fig. 9d; Pl. 6, Fig. 3c—d) major septa complete, sharply ended, short in relation to the corallite radius, leaving a wide free axial area. They are slightly thickened in tabularium in all the quadrants, most near the shortened cardinal septum. Counter septum differing in length, usually more elongate near the tabulae, other septa of counter quadrants equal in length. Minor septa very short, limited to far peripheral part of the dissepimentarium. Dissepimental tissue very complicated. In its inner part herringbone dissepiments more often appear. There are also sometimes big, regular dissepiments, particularly in the counter quadrants. In peripheral part of dissepimentarium pseudo-herringbone and irregular dissepiments of different size prevail.

Stereozonal thickenings are very prevalent in this specimen (probably also in the species). Best developed in the early part of the corallite, slightly less, near the end of the individual development. They cover not only the septa on which they form cloddy outgrowths in the dissepimentarium, in addition to the regular thickenings in tabularium, but also the dissepiments. In some parts of the cardinal quadrants of the corallite's earlier part, the thickenings are so strong that they nearly completely fill up the dissepiments.

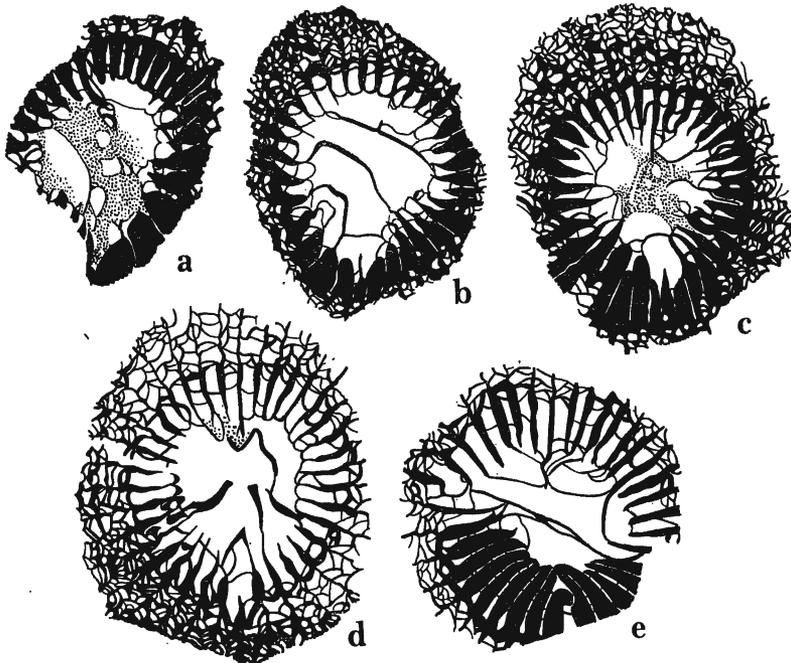


Fig. 9

?*Bothrophylum* sp. 2. Specimen No. A-32138-17, × 2.5

a-d — successive transverse sections from the early to late epehic stage

Pseudotimania mosquensis (Dobrolyubova). Specimen No. A-32138-4, × 2.5

e — transverse section of the early epehic stage

Microstructure is trabecular with slightly but evidently separated trabeculae (Pl. 8; Fig. 3). The filaments in trabeculae thin, arranged in fans.

Ontogeny. — The youngest examined sections (Fig. 9a—b) already belong to the early ephebic or late neanic stages. It seems that most distinguished features of ontogeny are: 1) the very fast increase in number of septa in the early development stages and the stabilization of their number in the ephebic stage; 2) early shortening of all the metasepta; and 3) very strong thickening of all the structural elements.

Remarks. — The description is made only on the basis of the illustrated specimen which is more characteristic and better preserved than the second one. The species belongs to those having caninoid ephebic stage. It differs from other species in this group in its much shortened major septa and strong thickening of dissepiments. It differs in the trabecular microstructure from all the already known *Bothrophyllum* species in which the microstructure was described. Because of that it is only conditionally included in *Bothrophyllum*.

Occurrence. — Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasi-movian.

Genus *PSEUDOTIMANIA* Dobrolyubova & Kabakovich, 1948

Type species: *Timania mosquensis* Dobrolyubova, 1937

Remarks. — This genus needs a revision which can be only done on the basis of the original Soviet Union materials. All the species described in this genus till now are from the USSR, but as it was mentioned, forms with different ontogeny and morphology have been included. It will be difficult to say, until the mentioned revision is completed, which species really belong into it and what is real geographic and stratigraphic range of the genus. Only those species which correspond in their features to the *Pseudotimania mosquensis* should be included in *Pseudotimania*.

Pseudotimania mosquensis (Dobrolyubova, 1937)

(Text-fig. 9e; Pl. 7, Fig. 3; Pl. 8, Fig. 2)

1937. *Timania mosquensis* Dobrolyubova; T. A. Dobrolyubova, pp. 22 to 24; Pl. 2, Figs 1—7.

Material. — One fragmentary corallite without the proximal end and with mostly damaged dissepimentarium. The examined sections are from the early ephebic stage.

Measurements (in mm):

corallite	Diameter of tabularium	Number of septa
13.0	12.0	30
14.0	13.0	32
17.0	13.0	56

Diagnosis. — In early ephebic stage cardinal fossula closed around the shortened cardinal septum; counter septum permanently elongated; major septa strongly thickened in the cardinal quadrants; microstructure fibro-normal.

Description. — Major septa in the cardinal quadrants very strongly thickened, arranged pinnately, curved around the cardinal fossula. Axial ends of some pairs of the major septa near the cardinal one overlap, completely closing the fossula, although their medial lines are not connected. Cardinal septum shortened. Counter septum elongated, thinner than the neighbouring major septa. The metasepta of the counter quadrants placed pinnately. The last pair of them shortened and set in the well marked alar pseudofossulae. These pseudofossulae are deep in the dissepimentarium, thus also real tabular fossulae are probably formed by them. Minor septa

were not found in the examined specimen. Probably they are very short and were destroyed along with the marginal area of the dissepimentarium. The dissepiments mostly herringbone. The inner wall thickened in all quadrants.

Remarks. — The described specimen precisely fits with its n/d ratio in the early-ephebic development stage, described by Dobrolyubova (1937). It also has very similar (for that stage) structure of the cardinal fossula, arrangement and type of the major septa thickening and the structure and length of the counter septum. The only difference found by the author is shorter minor septa and, connected with that fact, domineering of the herringbone dissepiments in the specimen from Bjørnøya. According to Dobrolyubova (*l. c.*) however, the lengths of minor septa increase with the ontogenetic development of the corallite and they never come through the whole dissepimentarium.

Occurrence. — USSR (Moscow basin), Upper Moscovian, Mjatschkov horizon; Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasimovian.

Family Aulophyllidae Dybowski, 1873
Genus ORYGMOPHYLLUM Fomichev, 1953
Type species: *O. convexum* Fomichev, 1953

Synonym: *Caninia* Michelin in Gervais, 1840, *sensu* Huang 1932.

non: *Orygmophyllum* (?) Fomichev, 1953 *sensu* Sando 1965.

Geographic and stratigraphic range: USSR (Donetz basin, Ural Mts); China; Bjørnøya. Middle Carboniferous to Lower Permian.

Species assigned: *Caninia* (?) *kungchiskanensis* Huang, 1932; *Orygmophyllum attshevskianum* Fomichev, 1953; *O. tröttskense* Fomichev, 1953; *O. convexum* Fomichev, 1953; ?*O. concavum* Fomichev, 1953; *O. bradyseptatum* n. sp.

Remarks. — Fomichev (1953) discussed the distribution of *Orygmophyllum* and suggested the inclusion in it of some species assigned by the present author and other specialists (Minato & Kato 1965, de Groot 1963) to *Amandophyllum*. Two species included conditionally by Fomichev (*l. c.*) and Sando (1965) in genus *Orygmophyllum* should be excluded from it. *Orygmophyllum* (?) *marjevkense* Fomichev is characterized by elongate counter septum and probably belongs to *Bothrophyllum*. *Orygmophyllum whitneyi* (White) according to Sando (1965) interpretation is a colonial species with phaceloid colonies. Sando (*l. c.*) included this species in *Orygmophyllum* and gave his own diagnosis of the genus as including species with phaceloid colonies and under condition solitary corals. This understanding of the genus is in disagreement with Fomichev's (1953) diagnosis, who made his genus for the solitary corals, thus it cannot be accepted. According to the present author *Lithostrotion* (*i. e.* *Orygmophyllum*) *whitneyi* White ought to be included in the genus *Heintzella* suggested for phaceloid colonies from Lower Permian of Spitsbergen and Upper Carboniferous — Lower Permian of USSR, having as the main feature loose, broken axial structure.

In this paper the author includes the genus *Orygmophyllum* in the family Aulophyllidae, as he previously did the genus *Heintzella*. This grouping is not certain and was accepted for two reasons:

1. *Orygmophyllum* cannot be kept in the family Campophyllidae as it has quite different structure of major septa and lack contratingent minor septa that are characteristic of *Campophyllum*. After all, even Fomichev (1953) includes this genus in the Campophyllidae with certain restriction. Neither does it belong to the family Durhaminidae, because of the different structure of septa and due to the appearance of a specific cardinal fossula which Durhaminidae lack as a rule.

2. Since the *Orygmophyllum* ontogeny was not fully examined, it is impossible to know how the axial structure originates and whether it may be considered the axial structure *sensu stricto* or simply randomly prolonged axial parts of major

septa. It seems probable that genera *Orygmophyllum* and *Heintzella* are the representatives of a new family. However, introducing such a unit without having precise studies of ontogeny, does not seem useful.

Orygmophyllum bradyseptatum n. sp.

(Text-fig. 10a—j; Pl. 3, Figs 2a—b, 3; Pl. 8, Fig. 3)

Holotype: specimen No. A-32138-15.

Type locality: Bjørnøya, middle of the coast.

Type horizon: Ambigua Limestone (Conglomerate), Lower Kasimovian.

Derivation of the name: *bradyseptatum* — with thickened major septa.

Material. — Two incomplete specimens of which numerous peels of transverse and longitudinal sections were made.

Measurements (in mm):

Specimen No.	Diameter of corallite	Diameter of tabularium	Number of septa
A-32138-15	15	12	42 × 2
"	17	12	42 × 2
A-32138-16	12.0 × 13.5	9.5 × 10.0	32 × 2
"	9.0 × 10.5	9.0 × 6.5	24 × 2

Notice: specimen A-32138-15 is partly destroyed; only one diameter was measured.

Diagnosis. — *Orygmophyllum* with 42 major septa with diameter of 15—17 mm, thickened in tabularium; in some sections loose septal structure in the axis; minor septa shortened; microstructure trabecular.

Description. — Transverse section (Text-fig. 10a—c, j; Pl. 3, Figs 2b, 3). Major septa of different length, wavy, often joined in groups with the sections of the axial tabellae. They are irregularly extended towards the corallite axis, forming in some sections loose structure. Stereozone on the septa asymmetrically placed; most thickened septa appear in one of cardinal quadrants. Cardinal septum somewhat shortened and visibly thinner than the neighbouring major septa. Cardinal fossula having the structure typical for the genus, widest in its medial part, gets sharply narrowed towards the corallite axis. The medial ends of the bordering septa are nearly joined. Minor septa thin, differing in length, do not come near to the inner wall, mostly very shortened. Dissepiments usually of the herringbone type, with the walls a little thickened. The inner wall usually thick, irregular.

Longitudinal section (Text-fig. 10d—e; Pl. 3, Fig. 2a) was done in the cardinal and counter septa plane. Tabularium asymmetrical. The diagonal placing of the tabulae shows that the calice was most shallow by the counter septum side and was getting deeper gradually towards the cardinal septum. Tabulae incomplete; in the peripheral part of corallite quite regular tabellae with prolonged accessory plates. In the axial area tabellae irregular, curved, sometimes slightly concave, having accessory plates of different size. The sections of the axial ends of septa form together with tabellae a kind of feebly developed and loose axial structure.

Individual variability. — The paratype differs from the holotype in slightly smaller size and smaller number of septa, which may find its explanation in its earlier ontogenetic stage. The most important difference is the shorter length of major septa of the paratype and the fact that they are not extended towards the corallite axis and do not ever form axial structure there; they are not joined by tabellae into groups. These features make the paratype very similar morphologically to the genus *Caninia* (s. l.). It has, however, like the holotype, trabecular microstructure of septa (Pl. 8, Fig. 2) and other similarities to the holotype as shows Fig. 10.

Remarks. — *O. bradyseptatum* n. sp. differs from all the previously described species of this genus in its strongly thickened major septa and n/d ratio and at the

same time the greatest number of septa generally. Simultaneously it has many morphological features typically developed; these are: 1) Characteristic structure of cardinal fossula; 2) The structure of dissepimentarium; 3) Forming of the loose

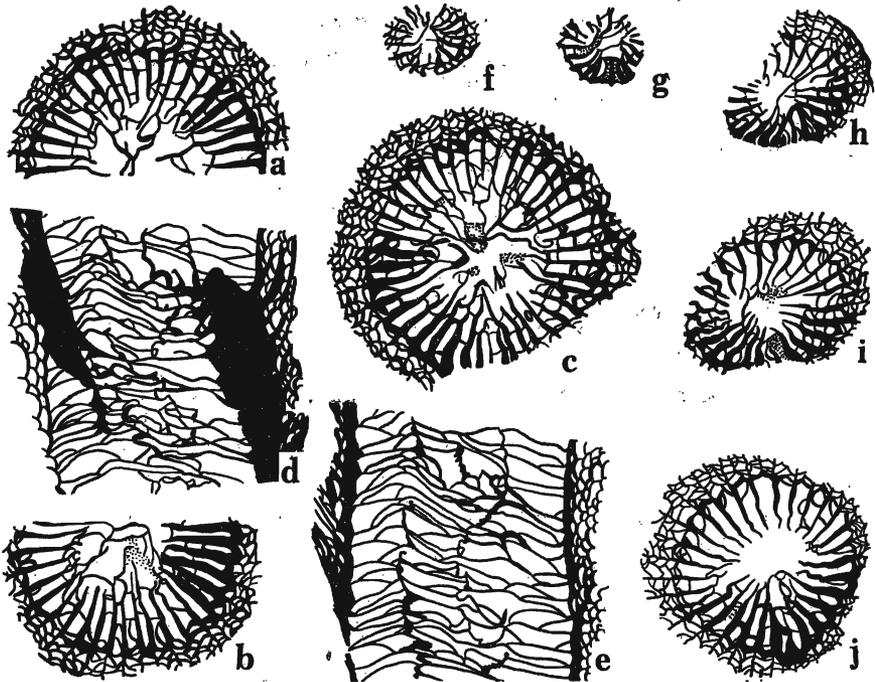


Fig. 10

Orygmophyllum bradyseptatum n. sp., $\times 2.5$

a-e — specimen No. A-32133-15, holotype

a-c — transverse sections

d, e — successive longitudinal sections prepared between cross sections "a" and "b" of this Fig.

f-j — specimen No. A-32133-16. Successive transverse sections from the neanic to the early ephebic stage

structure in the axis; and 4) The structure of tabularium very similar to tabularium of the type species of the genus (*O. convexum*).

Occurrence. — Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasi-movian.

Family **Geyerophyllidae** Minato, 1955

Genus **KIONOPHYLLUM** Chi, 1931

Type species: *K. dibunum* Chi, 1931

Synonyms: *Geyerophyllum* Heritsch, 1936.

?*Carniaphyllum* Heritsch, 1936.

?*Carinthiaphyllum* Heritsch, 1936.

Geographic and stratigraphic range: Eurasia, N. America, Arctic. Middle Carboniferous to Lower Permian.

Diagnosis. — See Chi 1931, p. 39.

Kionophyllum sp.

(Text-fig. 11a—e; Pl. 3, Fig. 6)

Material. — One incomplete, accidentally diagonally cut specimen No. A-32138-10 on which one thin section and some peels were prepared.

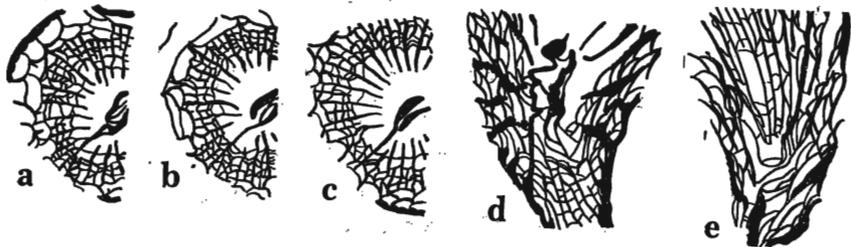


Fig. 11

Kionophyllum sp. Specimen No. A-32138-10, $\times 2.5$

a-c — successive transverse sections, the last at the calice
 d — oblique section of the cardinal septum side
 e — oblique section of the counter septum side

Description. — Transverse section (Fig. 11a—c). Septotheca about 0.2—0.4 mm thick, mostly strongly wavy. The septal nodules of septotheca related to the peripheral sections of major and minor septa, similarly visible. Major septa about 26 in number at a diameter of about 11 mm, nearly all separated from septotheca and gradually narrowed towards the corallite axis; they do not reach the axial structure. The last pair of major septa by cardinal septum, shortened. Cardinal septum elongated, thickened in the axial part, form a pseudocolumella, which in the calice, near its bottom is separated from the septum. The last pair of major septa of the counter quadrants, shortened until the end of the individual development. It may be possible that those shortened septa are actually alar septa. The author could not check the ribbing, since the specimen was not separated from the rock. Counter septum equal to the other major septa of the counter quadrants, which is shown in the diagonal section of these quadrants (Fig. 11e). At the corallite axis in addition to the cardinal septum, the axial end of another septum appears nearly to the end of development; it was not possible to find which one. Some sections of the axial tabellae, which connect these axial ends of septa, form together with them loose axial structure (Fig. 11a—c). Minor septa similarly to major ones are not usually connected with the outer wall, they reach the tabularium. The diameter of tabularium in the transverse section about 5 mm. Dissepimentarium occupies more than one half of the corallite diameter. It is made of two zones. Outer zone lonsdaleoid with biggest vesicles on the periphery, and the inner one, dissepimental, having rectangular and irregular dissepiments. Herringbone dissepiments are not formed even over the shortened minor septa. Cardinal fossula open, slightly penetrating the dissepimentarium similarly to the alar pseudofossulae.

Longitudinal section (Text-fig. 11d—e; Pl. 3, Fig. 6). Only two diagonal sections were prepared, none of which comes precisely through the middle of the corallite. Flat tabulae in the axial area and highly raised in the peripheral areas, so they are the same as in the holotype of the type species of the genus. Major and minor septa reach the outer wall in the younger stages of ontogeny (Fig. 11d). Arched dissepiments are placed vertically and come without a precise border into the sphere of peripheral tabellae.

Remarks. — The described specimen was accidentally found in a rock during cutting. Unfortunately a big fragment of its axial area was cut out making the

closer studies impossible. In the preserved state it was possible to find its generic features. It probably belongs to a new species as suggested by its simplified axial structure, shortened major septa and very small size. Slight marginal vesicles and the development of comparatively long minor septa make it most similar to *K. dibunum* Chi.

Occurrence. — Bjørnøya, Ambigua Limestone (Conglomerate), Lower Gshelian.

Family Plerophyllidae Koker, 1924

Genus and species indet.

(Text-fig. 12a—d; Pl. 7, Fig. 4a—c)

Material. — One specimen preserved in two pieces, which were numbered as specimens Nos. A-32119 and A-32120. State of preservation of the specimen bad. Inner structure damaged and silicified.

Measurements (in mm):

Length of specimen	Corallite diameter	Number of septa	Remarks
	56 × 27	—	margin of calice
130	50 × 27	47	over bottom of calice
	38 × 24	44	ephebic stage
	27 × 16	42	early-ephebic stage

Diagnosis. — Big solitary corals without dissepimentarium; counter and alar septa elongated; counter-lateral septa most shortened; funnel-shaped tabulae penetrating the axial area.

Description. — Transverse section (Text-fig. 12a—c; Pl. 7, Fig. 4a—b). The outer wall about 1.5 mm thick, recrystallized with microstructure destroyed. Major septa differing in length and thickness. Cardinal septum very slightly shortened nearly not differing from neighbouring major septa. Counter-lateral septa shortened. Most evident because of length and thickness are counter septum and alar septa. This differentiation of septa appears in all examined sections, also in the calice (Fig. 12a). The thickenings of septa are not too conspicuous and only exceptionally of a rhopaloid shape. Much more numerous are the septa in the counter quadrants. Mostly minor septa under the shape of nodules; slightly project from the septotheca. The microstructure destroyed by the recrystallization and silicification. No dissepiments.

Longitudinal section (Text-fig. 12d; Pl. 7, Fig. 4c). Rare tabulae, in the peripheral area of the corallite semicircularly raised towards the outer wall. In the axial area they fall down deeply in funnel form. The accessory plates appear only sporadically.

Remarks. — The described specimen is too poorly preserved to be the basis of a new genus. The lack of the younger stages of development and the damaged microstructure prevents it. The type of differentiation of protosepta length, the tabulae in funnel form penetrating the axis, and the big size of corallite are the new generic features. The most similar genus is *Soshkineophyllum* and particularly *S. tenuiseptatum* (Soshkina), which also has the concave tabulae.

Occurrence. — Spitsbergen, Bellsund, Axeløya. Profile at "Ammonitvika", Permian.

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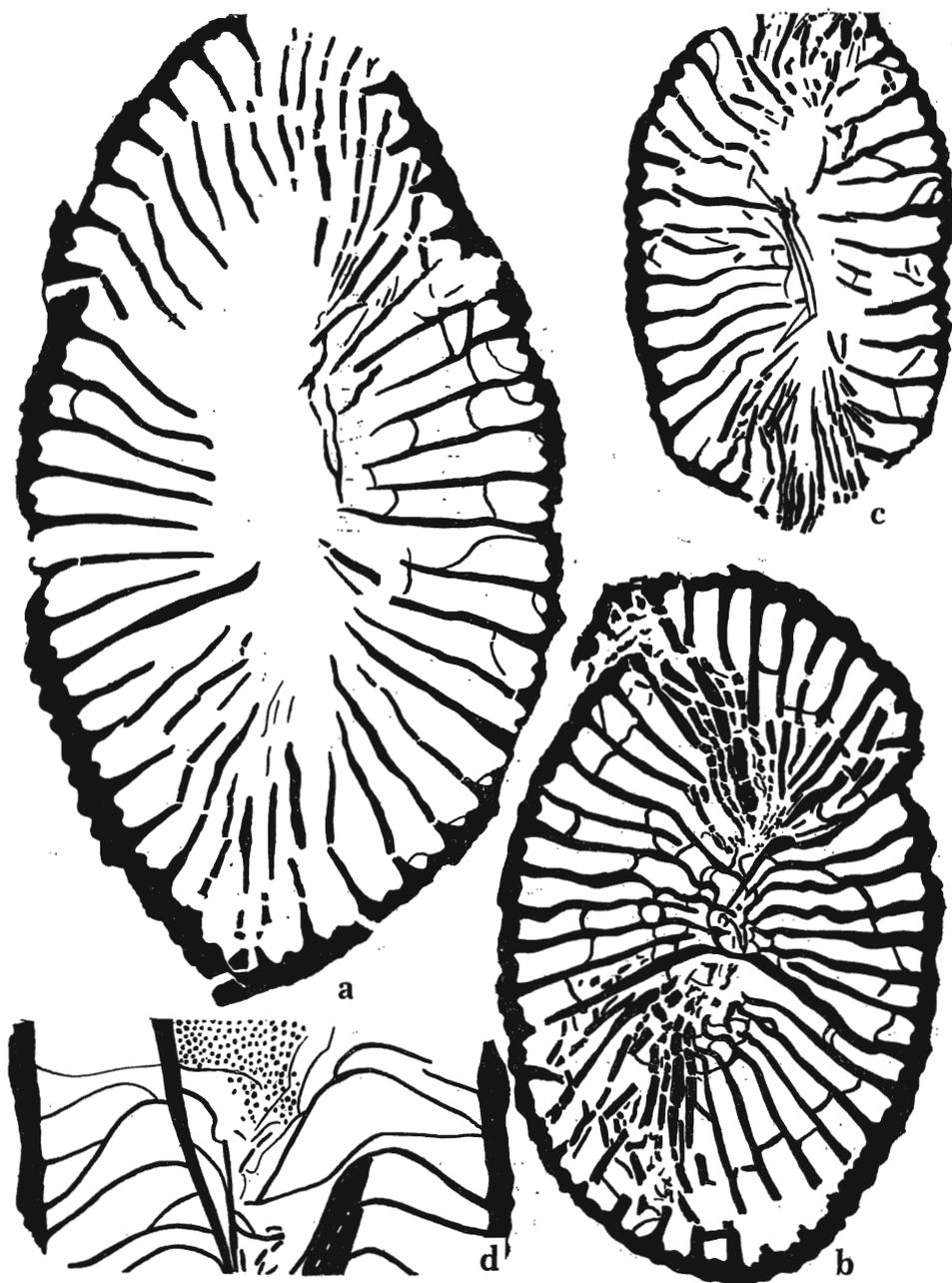


Fig. 12

Family Plerophyllidae Koker. Genus et species indet. Specimen catalogued under the numbers A-32119 and A-32120, $\times 2.5$

a-c. — transverse section
d. — longitudinal section

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**NIEKTÓRE GÓRNOKARBOŃSKIE COELENTERATA
Z WYSPY NIEDŹWIEDZIEJ I SPITSBERGENU**

(Streszczenie)

Publikacja niniejsza jest pierwszym paleontologicznym opracowaniem górno-paleozoicznych Coelenterata (Tetracoralla i Chaetetida) z Wyspy Niedźwiedziej, uzupełnionym opracowaniem niewielkiej kolekcji ze Spitsbergen (Tetracoralla i Tabulata). Opisano 15 gatunków (+ 1 podgatunek), 4 gatunki określono tylko do rodzaju, a 1 okaz, należący zapewne do nowego rodzaju, zaliczono tylko do rodziny. Wprowadzono 3 nowe rodzaje: *Arctophyllum* gen. n., *Siedleckia* gen. n. i *Fomichevella* gen. n. oraz 5 nowych gatunków: *Kueichowpora supracarbonica* sp. n., "*Caninia*" *radiata* sp. n., *Siedleckia bjornoyana* sp. n., *Bothrophyllum timanioides* sp. n. (+ *B. timanioides nanum* subsp. n.) i *Orygmophyllum bradyseptatum* sp. n.

Przeprowadzono analizę taksonomiczną tetrakoralii o kaninoidalnym typie struktury i stwierdzono, że tę formę strukturalną mogą w stadium efebicznym wytwarzać osobniki należące nie tylko do różnych rodzajów, ale nawet rodzin. Uznano rozwój ontogenetyczny za podstawowe kryterium taksonomiczne w tej grupie koralii.

Na podstawie stanu zachowania fauny koralowej i otwornicowej zaproponowano uznać powstanie zlepieńca Ambigua Limestone za niemal równowiekowe z tą fauną. Porównanie rozprzestrzenienia geograficznego poszczególnych gatunków pozwoliło stwierdzić istnienie swobodnej wymiany faun koralowych między morzami Arktyki, Uralu, Basenu Moskiewskiego i w mniejszym stopniu Zachodniej Prowincji Północnoamerykańskiej i Prowincji Śródziemnomorskiej. Koralowce zdają się wskazywać na nieco wyższą, niż dotychczas przyjmowano, pozycję stratygraficzną Ambigua Lst., który zaproponowano uznać za dolny Kasimovian.

DESCRIPTION OF PLATES 1—8

PL. 1

- 1 — *Kueichowpora supracarbonica* n. sp. Specimen No. A-32118, holotype. Bellsund, profile by Diabasodden (*Cyathophyllum* Limestone). $\times 5$.
a — transverse section, b — longitudinal section.
- 2 — *Chaetetes (Boswellia) luganensis* Vassilyuk. Specimen No. A-32138-12. Bjørnøya, Ambigua Limestone (Conglomerate, Lower Kasimovian).
a — transverse section, $\times 5$; b — longitudinal section, $\times 10$.
- 3 — *Chaetetes (Boswellia)* sp. Specimen No. A-32138-13. The same age and locality, $\times 5$.
a — transverse section, b — longitudinal section.
- 4 — "*Caninia*" *nikitini* Stuckenber. Specimen No. A-32121, Bjørnøya, Ambigua Limestone (lower part), Lower Kasimovian.
a — transverse section of the ephebic stage, nat. size; b — longitudinal section, $\times 2$.

PL. 2

- 1 — "*Caninia*" *ordinata* (Ross & Ross). Specimen No. A-32138-2, Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasimovian. Transverse section of the ephebic stage, $\times 2$.
- 2 — *Ditto*. Specimen No. A-32138-20. The same locality and age. Transverse section of the ephebic stage, $\times 2$.
- 3 — *Ditto*. Specimen No. A-32138-3. The same locality and age. Longitudinal section, $\times 2$.
- 4 — "*Caninia*" *nikitini* Stuckenber. Specimen No. A-32121. Bjørnøya, Ambigua Limestone (lower part), Lower Kasimovian. Transverse section of the ephebic stage, nat. size.
- 5 — "*Caninia*" aff. *verneuili* Stuckenber. Specimen No. A-32138-1. Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasimovian. Transverse section of the ephebic stage, $\times 2$.

PL. 3

- 1 — *Arctophyllum intermedium* (Toula). Specimen No. A-32131. Spitsbergen, Bellsund, profile by Diabasodden, $\times 2$.
a — transverse section of the ephebic stage, b — transverse section of the very early ephebic stage, c — longitudinal section.

- 2 — *Orygmophyllum bradyseptatum* n. sp. Specimen No. A-32138-15. Holotype. Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasimovian, $\times 2$.
a — longitudinal section, *b* — transverse section of the ephebic stage.
- 3 — *Ditto*. Specimen No. A-32138-16. The same locality and age. Transverse section of the early ephebic stage, $\times 2$.
- 4 — "*Caninia*" *radiata* n. sp. Specimen No. A-32135-3. Bjørnøya, Ambigua Limestone (lower part), Lower Kasimovian. Transverse section of the ephebic stage, nat. size.
- 5 — *Ditto*. Specimen No. A-32135-1. Holotype. The same locality and age.
a — transverse section of the ephebic stage, $\times 2$; *b* — longitudinal section close to the cardinal fosula, nat. size; *c* — longitudinal section in the middle part of specimen, nat. size.
- 6 — *Kionophyllum* sp. Specimen No. A-32138-10. Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasimovian. Oblique section by the counter quadrants, $\times 2$.

PL. 4

- 1 — *Bothrophyllum* sp. 1. Specimen Nos. A-32132 and A-32133 (one specimen in two pieces). Bjørnøya, Kobbekbukta, Ambigua Limestone (lower part), Lower Kasimovian.
a, b — transverse sections of the ephebic stage, nat. size.
- 2 — *Siedleckia longiseptata* (Grek). Specimen No. A-32125. Bjørnøya, Ambigua Limestone (lower part), Lower Kasimovian. Transverse section of the early ephebic stage, nat. size.
- 3 — *Ditto*. Specimen No. A-32135-5. The same locality and age. Transverse section of the ephebic stage, nat. size.
- 4 — *Siedleckia bjornoyana* n. sp. Specimen No. A-32129. Holotype. The same locality and age, $\times 2$.
a — longitudinal section, *b, c* — transverse sections of the neanic stage, *d* — transverse section of the ephebic stage, *e* — transverse section of the late ephebic stage.

PL. 5

- 1 — *Siedleckia mutafii* (Gorsky). Specimen No. A-32138-6. Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasimovian. Slightly oblique transverse section of the ephebic stage
- 2 — *Ditto*. Specimen No. A-32138-19. The same locality and age. Transverse section of the early ephebic stage.
- 3 — *Arctophyllum intermedium* (Toula). Specimen No. A-32115. Spitsbergen, Bellsund, profile by Diabasodden. Transverse section of the ephebic stage.
- 4 — *Fomichevella orientalis* (Stuckenbergl). Specimen No. A-32138-7. Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasimovian. Transverse section of the separate corallite.
- 5 — *Ditto*. Specimen No. A-32138-9. The same locality and age. Transverse section.
- 6 — *Ditto*. Specimen No. A-32138-8. The same locality and age. Transverse section.
- 7 — *Fomichevella hoeli* (Holtedahll). Specimen No. A-32117. Spitsbergen, Bellsund, profile by Diabasodden. Transverse section of the colony.

All figures $\times 2$

PL. 6

- 1 — *Bothrophyllum timanioides timanioides* n. subsp. Specimen No. A-32137. Bjørnøya, Ambigua Limestone (lower part), Lower Kasimovian.
a — transverse section of the ephebic stage, b — longitudinal section, c — transverse section of the late ephebic stage.
- 2 — *Bothrophyllum timanioides nanum* n. subsp. Specimen No. A-32138-14. Holotype. The same age (Conglomerate).
a — transverse section of the ephebic stage, b — longitudinal section.
- 3 — ?*Bothrophyllum* sp. 2. Specimen No. A-32138-17. The same age and locality.
a-d — successive transverse sections from the early to the late ephebic stage.

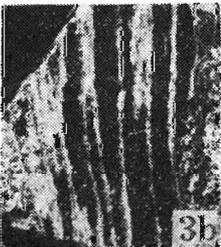
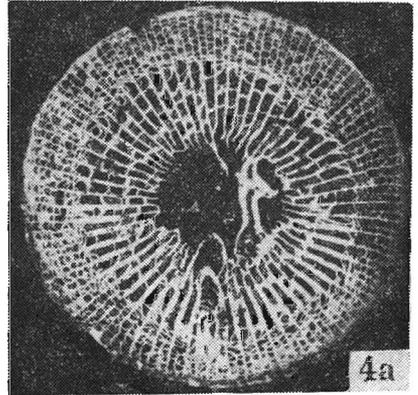
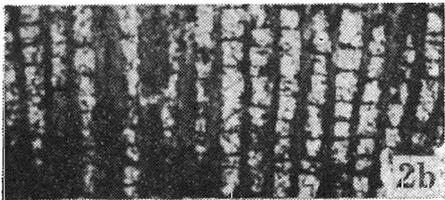
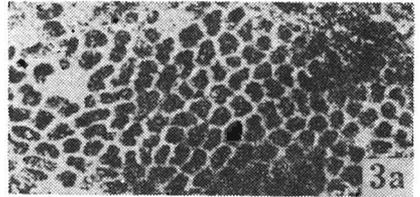
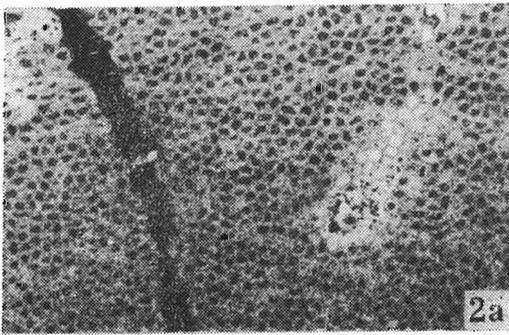
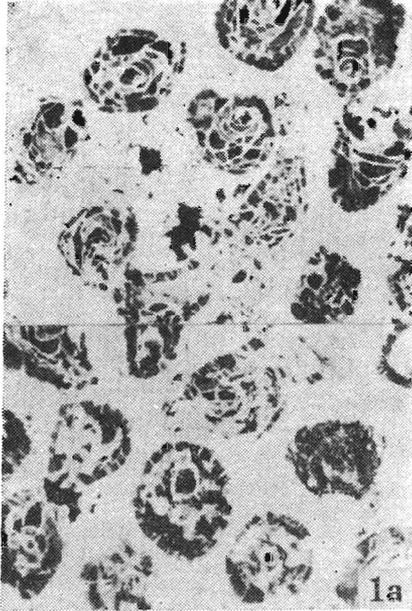
All figures $\times 2$

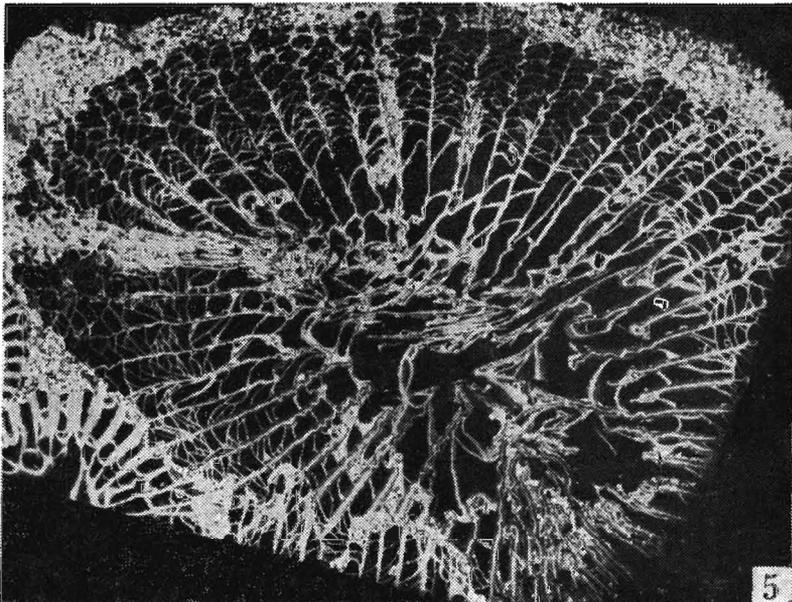
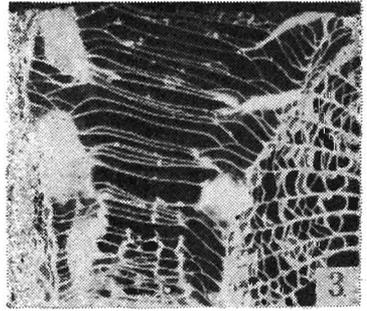
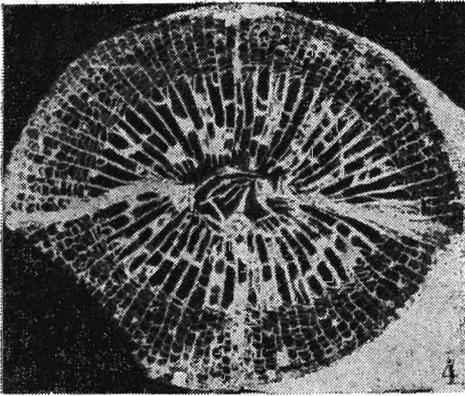
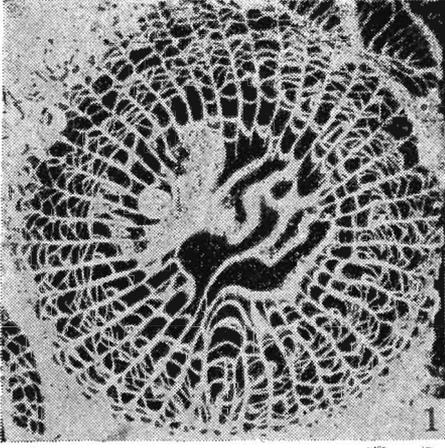
PL. 7

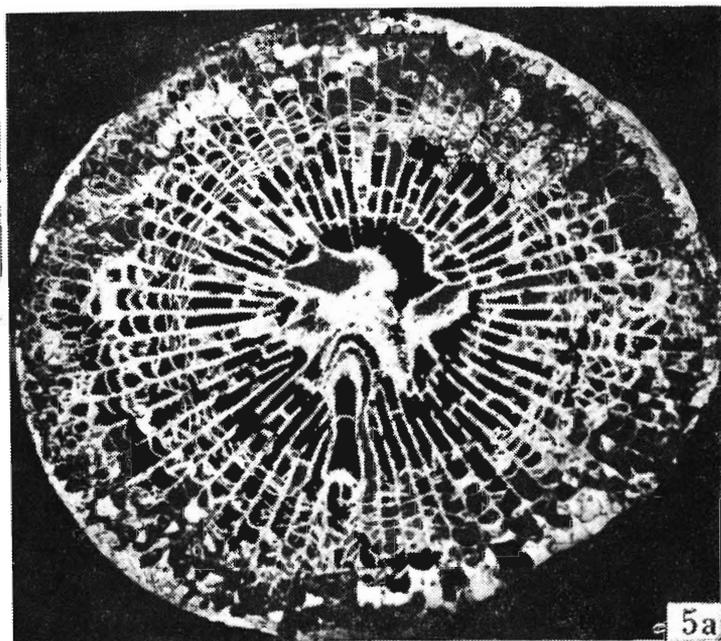
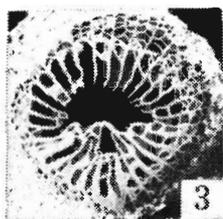
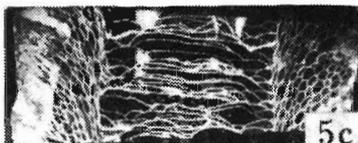
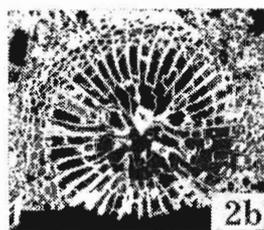
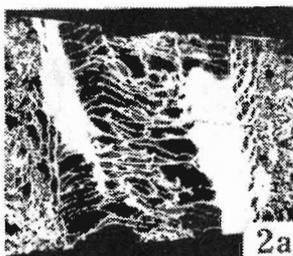
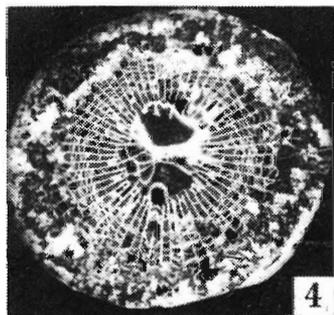
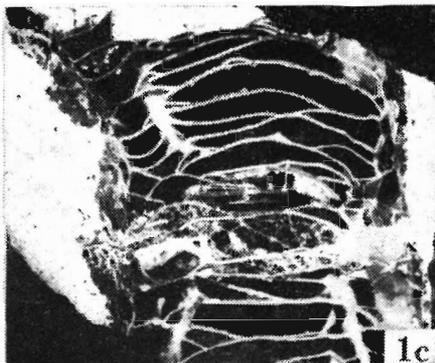
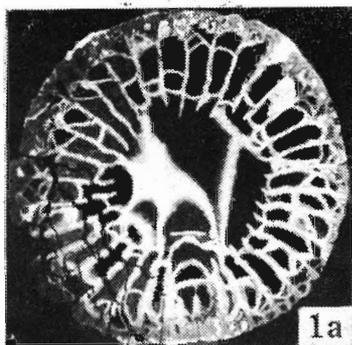
- 1 — *Bothrophyllum timanioides timanioides* n. subsp. Specimen No. A-32128. Holotype. Bjørnøya, Ambigua Limestone (lower part), Lower Kasimovian, $\times 2$.
a — transverse section of the ephebic stage, b — transverse section of the late nearctic stage.
- 2 — *Siedleckia longiseptata* (Grek). Specimen No. A-32135-0. The same locality and age, nat. size.
a — transverse section of the ephebic stage, b — longitudinal section.
- 3 — *Pseudotimania mosquensis* (Dobrolyubova). Specimen No. A-32138-4. Bjørnøya, Ambigua Limestone (Conglomerate), Lower Kasimovian. Transverse section of the early ephebic stage, $\times 2$.
- 4 — Plerophyllidae Koker. Genus et species indet. Specimen Nos. A-32119 and 32120 (one specimen in two pieces). Spitsbergen, Bellsund, Axeløya.
a — transverse section of the calice, b — transverse section of the early ephebic stage, c — longitudinal section.

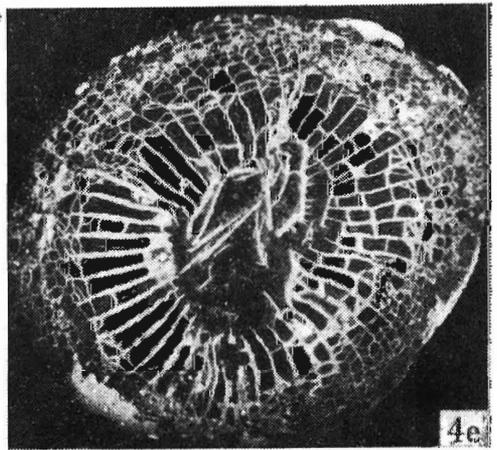
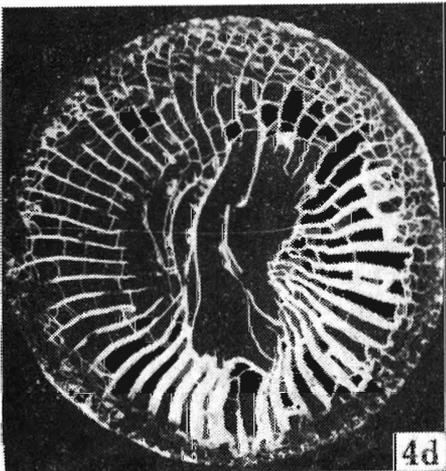
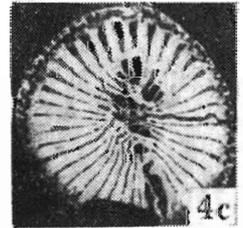
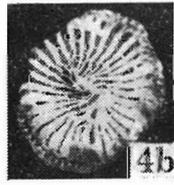
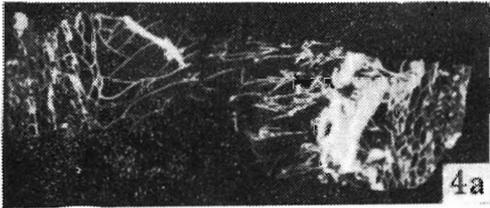
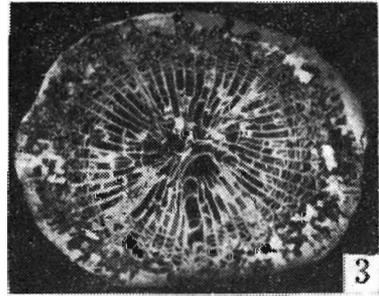
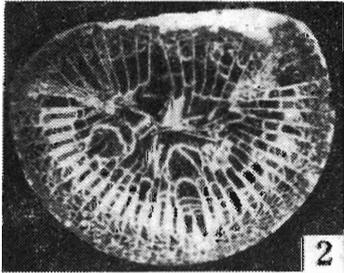
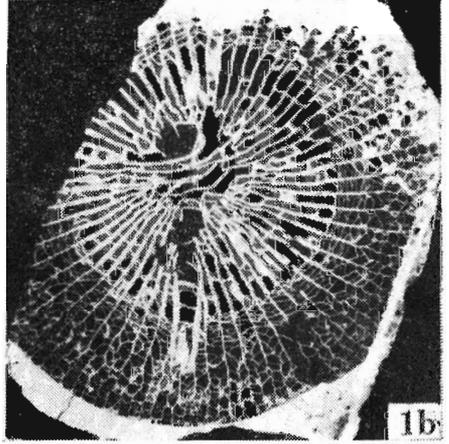
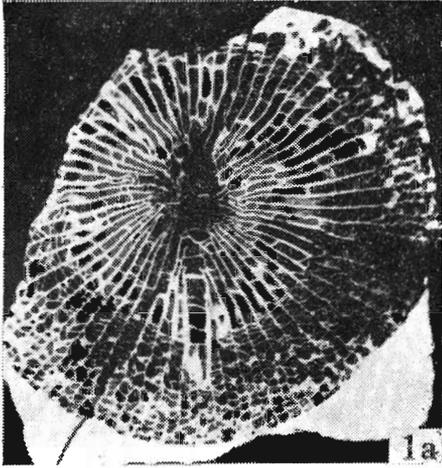
PL. 8

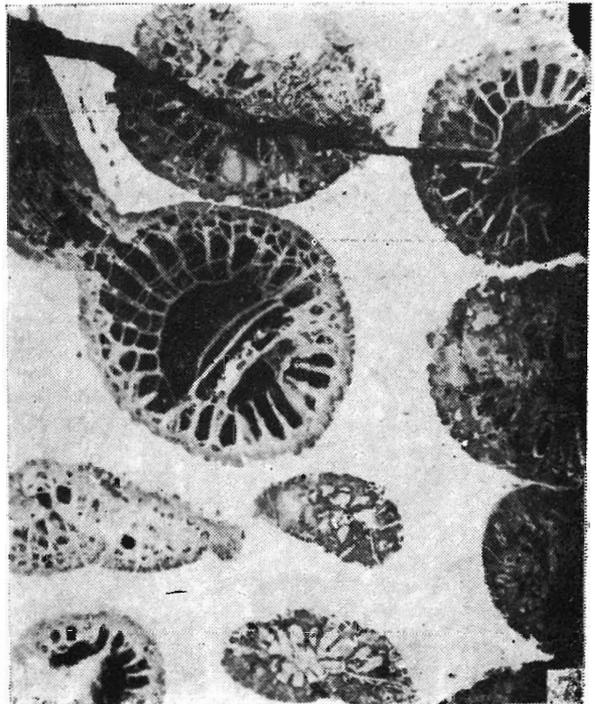
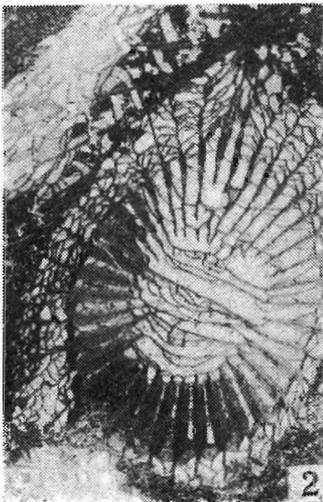
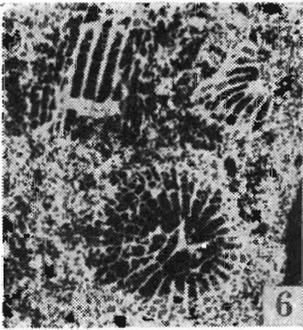
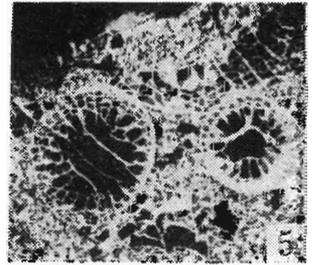
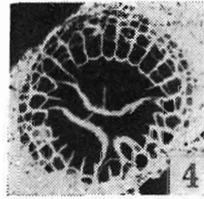
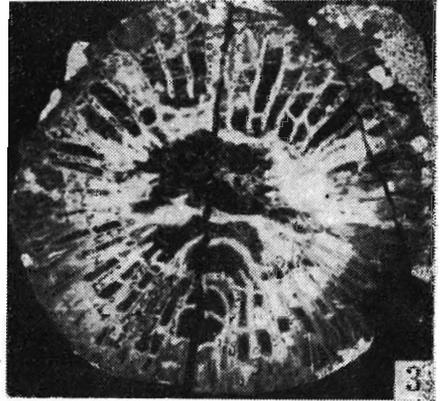
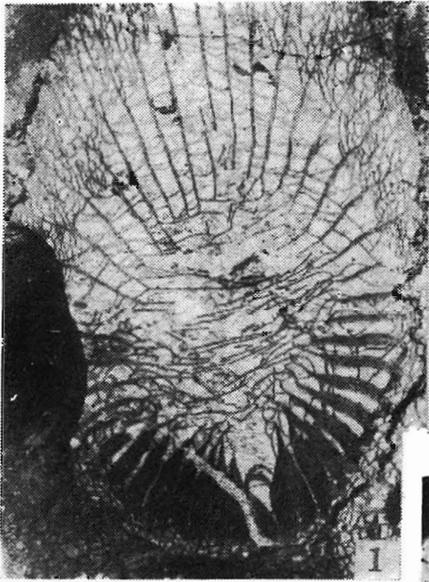
- 1 — *Chaetetes (Boswellia) luganensis* Vassilyuk. Specimen No. A-32138-12, $\times 100$.
a — transverse section of the selected corallite showing trabecular walls with no middle line dividing corallites, b — longitudinal section of the wall showing its trabecular structure with particular, very thin, calcite fibres obliquely up from the middle of the trabecula.
- 2 — *Pseudotimania mosquensis* (Dobrolyubova). Specimen No. A-32138-4 showing the fibro-normal fine structure in the transverse section of the septum. $\times 50$.
- 3 — *Orygmophyllum bradyseptatum* n. sp. Specimen No. A-32138-16 showing the trabecular fine structure in the transverse section of the septum. $\times 50$.
- 4 — ?*Bothrophyllum* sp. 2. Specimen No. A-32138-17 showing the trabecular fine structure in the transverse section of the septum. $\times 50$.
- 5 — *Siedleckia bjornoyana* n. sp. Specimen No. A-32129. Holotype.
a — transverse section of septum showing lamello-trabecular fine structure. On the left side of the septum the separate lamella is visible. $\times 50$; b — longitudinal section of septum showing the growth lines and short trabeculae perpendicular to them. $\times 50$.

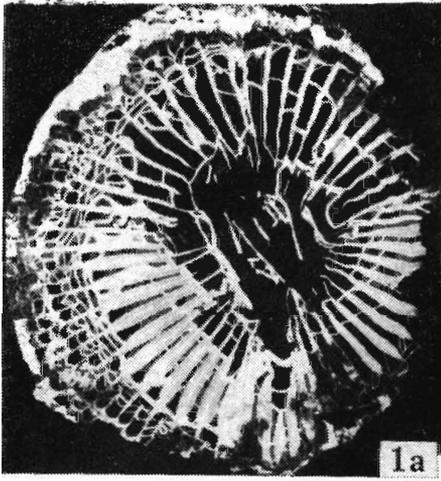




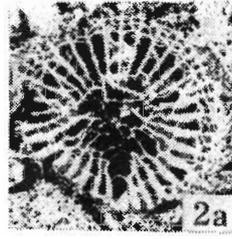




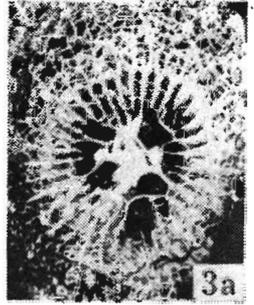




1a



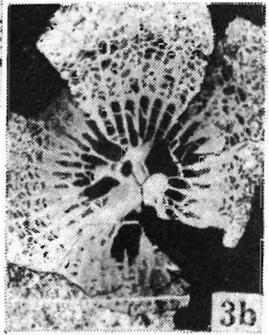
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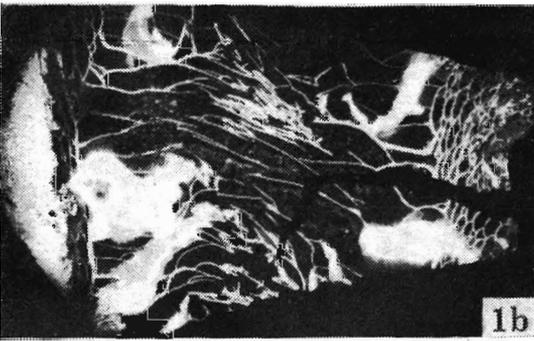
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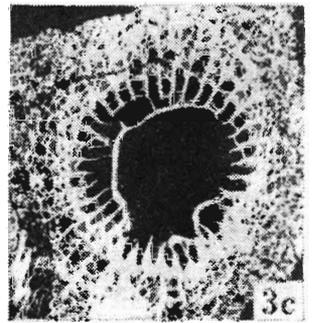
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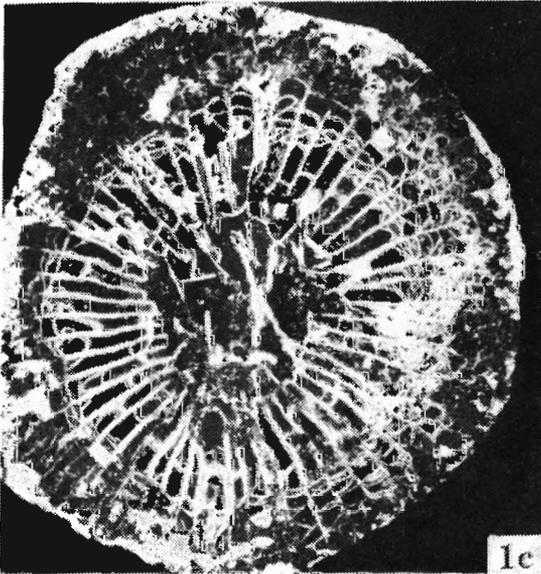
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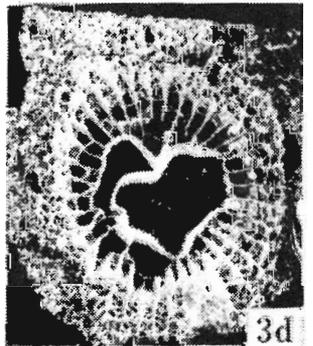
1b



3c



1c



3d

