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STAUROMATIDIUM AND STAUROMATIDIIDAE, NEW GENUS AND FAMILY OF UPPER SILURIAN AND LOWER DEVONIAN RUGOSE CORALS

A.E.H. PEDDER
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Preface

This report elaborates a new genus and family of Upper Silurian and Lower Devonian rugose corals. The family is widely distributed in North America in both the Eastern Americas and Old World faunal realms, and is represented also in central Asia. Almost all of the species discussed were known from previous geological literature, but understanding of them was such that they were referred to many unrelated genera and families.

A taxonomic work of this kind requires modern preparation and fresh study of old collections as well as investigation of new material. Results obtained from these studies provide correlation of rock units and give insight into the sedimentary environment in which the rock units were formed. Such data are of vital importance in preparation of geological maps and basin analyses which, in turn, contribute to inventories of the mineral and energy resources of Canada.

OTTAWA, July 1982

R.A. Price
Director General

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STAUROMATIDIUM AND STAUROMATIDIIDAE, NEW GENUS AND FAMILY OF UPPER SILURIAN AND LOWER DEVONIAN RUGOSE CORALS

Abstract

The Stauromatidiidae include seven named and at least two unnamed species assigned to two genera, ***Stauromatidium*** *and* ***Farabophyllum****. In earlier works, species of the family were referred, either firmly or tentatively, to no less than nine genera, representing seven families. Although stauromatidiid species range from upper Ludlow or early Pridolian to late Dalejan or early Eifelian and are found in both the Eastern Americas and Old World Devonian faunal realms, the family, on the whole, is rare and as currently known is confined to just four of twelve Early Devonian coral provinces. The stauromatidiidae probably evolved from the Tryplasmatidae and possibly gave rise to the Stringophyllidae. New species are* ***S. strigosum*** *from the upper Ludlow or early Pridolian part of the Road River Formation, Yukon Territory;* ***S. sentum*** *from the Pragian part of the same formation and region; and* ***S. montjolicum*** *from the Lochkovian Mont Joli Formation, Quebec.*

Résumé

La famille des Stauromatidiidae comprend sept espèces reconnues et au moins deux espèces non nommées attribuées à deux genres: ***Stauromatidium*** *et* ***Farabophyllum****. Dans les travaux antérieurs, les espèces de cette famille ont été assignées, soit fermement, soit avec une certaine hésitation, à pas moins de neuf genres représentant sept familles. Malgré, d'une part, que la répartition des espèces de la famille des Stauromatidiidae s'étend du Ludlovien supérieur ou Pridolien inférieur au Daléjien supérieur ou Eifélien inférieur et, d'autre part, qu'elles se trouvent à la fois dans les domaines fauniques dévoniens de l'Est des Amériques et du Vieux-Continent, la famille est, en gros, rare et est, d'après nos connaissances actuelles, confinée à seulement quatre des douze provinces coralliennes du Dévonien inférieur. Nous pensons que les Stauromatidiidae ont évolué à partir des Tryplasmatidae et qu'ils ont probablement donné naissance aux Stringophyllidae. Les nouvelles espèces sont:* ***S. strigosum*** *de la partie de la formation de Road River d'âge ludlovien supérieur ou pridolien inférieur dans le territoire du Yukon,* ***S. sentum*** *de la partie d'âge praguien de la même formation dans la même région et* ***S. montjolicum*** *de la formation de Mont-Joli d'âge lochkovien au Québec.*

INTRODUCTION

In early stages of the compilation of data for a jointly authored review of Devonian rugose coral distribution, given at the Palaeontological Association's Devonian symposium in Bristol, 1978, the present authors worked independently, with individual responsibilities divided on a geographical basis. Later, during integration of the data, it became clear that a new genus recognized by Oliver in the Eastern Americas Realm was the same as a new genus recognized by Pedder in the Old World Realm. Since then we have become aware of other examples of the genus, including forms referable to new species, which have increased our understanding of it considerably.

At first we were inclined to regard the new genus as a member of the Family Stringophyllidae. Now we believe that it, and another previously described but very poorly illustrated genus, from the Lower Devonian of Tadzhikistan, constitute a new family. The purpose of this work is to elaborate the new genus and family, and to establish the names **Stauromatidium** and Stauromatidiidae for them.

Seven named species are included in the Stauromatidiidae. Four of these, **Stauromatidium strigosum, S. rhopalium, S. montjolicum** and **S. sentum,** have untested biostratigraphic value because their known distribution is confined to one or a few closely situated localities. The other three, **S. marylandicum, S. trigemma** and **Farabophyllum farabicum,** have greater known distributions, although each is confined to a single faunal province, and can be shown by associated fossils to have restricted temporal ranges, giving them biostratigraphic utility.

Ages of all the species are discussed separately under the appropriate headings in the systematic paleontology section. Distribution of species is illustrated in Figure 1. In each case an attempt is made to express the age in terms of the standard European Silurian and Devonian stages, because these have become the world standard for this part of the geological column. In regions such as Yukon Territory, the Great Basin and Tien Shan, where the stratigraphical position of the stauromatidiid species is known relative to occurrences of zonally important graptolites and conodonts, correlations are likely to be more or less correct. However, in the other regions where Lower and Lower Middle Devonian faunas belong to the Eastern Americas Realm, correlations are no more than approximate, due to the highly endemic nature of the faunas.

Acknowledgments

The following geologists collected and made available to us some of the material used in this report: A.J. Boucot, United States Geological Survey at time of collecting (now Oregon State University, Corvallis); Z.P. Bowen, University of Rochester at time of collecting (now Beloit College, Wisconsin); B.A. Hall, University of Maine, Orono; A.C. Lenz, University of Western Ontario; P.J. Lespérance, Université de Montréal; H. Masursky, United States Geological Survey; W.B. Skidmore, Québec Ministère de l'Energie et des Ressources; J.F. Smith, United States Geological Survey.

The late B. Kummel arranged for the loan of specimens to Oliver, from the Museum of Comparative Zoology, Harvard University. Similar service was provided by D.B. Macurda and the late E.C. Stumm with respect to material curated at the Museum of Paleontology, University of Michigan.

G. Klapper, University of Iowa, Iowa City, identified conodonts that helped date two of our new species from Royal Creek, Yukon Territory. B.L. Mamet, Université de Montréal, identified species of **Sphaerocodium** and **Wetheredella** from the same area. Recognition of these species has given us a better understanding of the paleoecological provenance of one of the new species of

		North America						Asia
SYSTEM	SERIES STAGE	Northern Cordillera	Great Basin	Illinois Basin	Michigan Basin	Central Appalachians	Northern Appalachians	Southern Tien Shan
DEVONIAN	EIFELIAN			*S. trigemma*	*S. trigemma*	*S. trigemma*		
	DALEJAN AND ZLICHOVIAN							
	PRAGIAN	*S. sentum*						*F. farabicum* *S. sp. B.*
	LOCHKOVIAN		*S. cf. marylandicum*			*S. marylandicum* ?	*S. montjolicum* *S. sp. A.* *S. marylandicum* *S. rhopalium*	
SILURIAN	PRIDOLIAN	*S. strigosum*						
	LUDLOW							GSC

FIGURE 1. *Distribution of the known species of* ***Stauromatidium*** *and* ***Farabophyllum****. Correlation with the standard European stages and series should not be assumed to be precise. Columns include regions as follows:*

Northern Cordillera – Wernecke Mountains, Yukon Territory.
Great Basin – Tuscarora Mountains and Simpson Park Range, Nevada.
Illinois Basin – Jefferson County, Kentucky and Clark County, Indiana.
Michigan Basin – Brant Township and Howick Township, southern Ontario.
Central Appalachians – various outcrops in West Virginia, Maryland and Pennsylvania, and subsurface cores from northeastern Ohio.
Northern Appalachians – Somerset and Piscataquis Counties, Maine, and Percé Township, Gaspé, Québec.
Southern Tien Shan – western and central Zeravshan-Gissar region, Tadzhikistan and Uzbekistan.

No significance attaches to the order of the Lochkovian species in the Northern Appalachians column. ***Stauromatidium*** *sp. A occurs with* ***S. marylandicum*** *at one locality and with* ***S. rhopalium*** *at another; furthermore, the age relationship between these species and* ***S. montjolicum*** *is not known.*

Stauromatidium. M.V. Erina, Ministerstvo Geologii Uzbekskoy S.S.R., Tashkent, and A.I. Lavrusevich, Tadzhikskiy Gosudarstvennyy Universitet, Dushanbe, sent photographs of Russian corals studied by them to Pedder.

Thin sections for this study were prepared by R.D. Michie, Institute of Sedimentary and Petroleum Geology, Calgary, and W.C. Pinckney, Jr., United States Geological Survey. The North American material was photographed by R.H. Mckinney, H.E. Mochizuki and W.C. Pinckney, Jr., all of the United States Geological Survey, and by B.C. Rutley and W.B. Sharman, both of the Institute of Sedimentary and Petroleum Geology, Calgary.

It is our pleasure to acknowledge all these valuable services.

SYSTEMATIC PALEONTOLOGY

Names of institutions are abbreviated in the text and plate explanations as follows:

GSC - Geological Survey of Canada, Ottawa (locality numbers prefixed with the letter C are registered in the Calgary catalogue).
IGG AN Uz.SSR - Institut Geologii i Geofiziki, Akademiya Nauk Uzbekskoy S.S.R., Tashkent.
MCZ - Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
QMER - Québec Ministère de l'Energie et des Ressources, Québec.
UMMP - University of Michigan, Museum of Paleontology, Ann Arbor.
UGSM Tadzh.SSR - Upravlenie Geologii pri Sovete Ministrov Tadzhikskoy S.S.R., Dushanbe.
USGS - United States Geological Survey, Washington, D.C. (SD attached to locality numbers refers to the Silurian-Devonian catalogue).
USNM - United States National Museum of Natural History, Washington, D.C.

Phylum COELENTERATA Frey and Leuckart, 1847

Class ANTHOZOA Ehrenberg, 1834

Order RUGOSA Milne-Edwards and Haime, 1850

Family STAUROMATIDIIDAE new

Type genus. **Stauromatidium,** a new genus described herein.

Description. This family is proposed to accommodate **Farabophyllum**, erected previously by Lavrusevich (1971, p. 110), as well as the new genus **Stauromatidium**. Its members are characterized by having a septothecal marginarium that normally lacks dissepiments, and coarse monacanthine, locally bifurcating trabeculae. In **Farabophyllum**, the monacanths are broadly and markedly charactophylloid (term defined by Pedder, 1972, p. 698) and the septa are essentially lamellar throughout. In **Stauromatidium**, on the other hand, the monacanths are not only straight or less obviously charactophylloid, but adaxially tend to dissociate from each other to form discrete spines. Massive or luxuriantly fasciculate growth forms are not known in the family, probably because increase is normally parricidal and apparently never lateral.

Discussion. Oliver (1960) referred corals, that are here assigned to **Stauromatidium**, to the Tryplasmatidae, and Lavrusevich placed **Farabophyllum** in the same family. However, now we separate these genera from the Tryplasmatidae on the basis of their trabecular structure and well-formed septotheca, although we do not deny the possibility that **Stauromatidium**, the apparent root genus of the Stauromatidiidae, may have evolved from a tryplasmatid. Indeed, the rarity and, in several species, total absence of dissepiments in the Stauromatidiidae, together with the report of epithecal scales in **Farabophyllum farabicum**, suggest a close relationship between the two families. Because of its excessively curved trabeculae, **Farabophyllum** was assigned to the Phillipsastreidae in our review of Devonian rugose coral distribution (Oliver and Pedder, 1979, p. 242). However, we are satisfied now that this remarkable curving of the trabeculae is not associated with the presence of phillipsastreid horseshoe dissepiments.

As Wright (1966, p. 264) wrote, the Family Stringophyllidae is distinguished principally by lonsdaleoid dissepiments (presepiments of other authors), concave or flat tabularial floors, and septa consisting of stout, contiguous or separate, monacanthine trabeculae. With the exception of the absence of a stringophyllid dissepimentarium from the Stauromatidiidae, there are obvious similarities between the Stringophyllidae and a stauromatidiid such as **Stauromatidium trigemma** (see Plates 11-14 of this work) which has a variable septotheca, deeply concave tabularial surfaces, and a trabecular structure that is entirely typical of the Stringophyllidae. Did the Stringophyllidae evolve from a stauromatidiid? Were they derived from a ptenophyllinid genus, through **Melrosia rosae** or similar species? Or were they derived from a spongophyllinid genus, through a species such as **Melasmaphyllum mullamuddiense**? Both of the last two possibilities were considered by Wright (1966, p. 265). Present data are insufficient to establish which, if any, of these questions is answered correctly in the affirmative. Perhaps the Family Stringophyllidae is interpreted too broadly at present. If so, all three phylogenies could have operated. Certainly it would seem as easy for a stauromatidiid, like **S. trigemma**, to become a stringophyllid by loss of an already variable septotheca and addition of presepiments to its rare but elongate dissepiments, as it would be for a ptenophyllinid to modify its trabeculae, so that they become much coarser and disunited locally, as would be required for it to become a stringophyllid.

A few exceptions notwithstanding, such as the Upper Silurian sample from Yukon Territory shown in figures 5 and 9 on plate 1 of this work, the Family Stauromatidiidae was rare throughout its known time span of Late Silurian to Early or possibly earliest Middle Devonian. Indeed, no Zlichovian or certain Pridolian occurrence can be cited, and the known geographic range of the family is restricted to only four of the twelve Lower Devonian coral provinces tentatively recognized by us (Oliver and Pedder, in press).

Genus **STAUROMATIDIUM** gen. n.

New genus 6 Oliver and Pedder, 1979, p. 244.

Type species. **Cyathophyllum marylandicum** Swartz, 1913.

Additional included species. **Zaphrentis trigemma** Davis, 1887, **Tryplasma rhopalium** Oliver, 1960, **Stauromatidium strigosum** sp. n., **S. montjolicum** sp. n., **S. sentum** sp. n. and at least two unnamed species.

Name. Formed from an arbitrary combination of letters.

Description. Ceratoid to cylindrical corallites, increasing parricidally in some species to form a weakly fasciculate corallum. Septal apparatus abundant, in some species excessively so, essentially radial in arrangement, consisting entirely of coarse trabeculae. Trabeculae may bifurcate within the plane of a septum and commonly exhibit charactophylloid flexing; that is to say, they tend to be directed at a low angle to the wall peripherally, to be bent inward periaxially, and be reflexed to initial orientation as they approach the axis. Wherever septal microstructure is preserved, it is invariably monacanthine. In the outer region of the corallite, trabeculae are contiguous with those above and below and are aligned in a single series to form continuous septa; towards the axis, however, they commonly separate to form discrete spines. Peripherally septa of both orders unite to form a septotheca of variable width. Rare elongate dissepiments are present in some species; in other species, dissepiments of any kind are totally lacking. Tabulae abundant in most forms, suppressed or almost suppressed by septal elements in others. Tabularial surfaces variously curved, normally depressed axially, except where excessive development of septal spines in the axial region apparently forces them over the axial boss.

Discussion. Inspection of the synonymy lists given for species of **Stauromatidium** shows that in the past these corals have been assigned, either firmly or tentatively, to no less than nine genera, belonging to seven different families according to current classification. Years in which these assignments were first published, the assignments themselves, and the familial classification of the genera are:

1887, **Zaphrentis**, Zaphrentidae
1913, **Cyathophyllum**, Cyathophyllidae
1960, **Tryplasma**, Tryplasmatidae
1961, **Synaptophyllum**, Stauriidae
1965, **Calostylis**, Calostylidae
1969, **Porpites** (incorrectly used in favour of **Palaeocyclus**), Palaeocyclidae
1972, **Wenlockia**, Tryplasmatidae
1976, **Kodonophyllum**, Streptelasmatidae?
1978, **Farabophyllum**, Tryplasmatidae

Zaphrenthis (= **Zaphrentis**), which has been discussed by one of us in earlier publications (Oliver, 1960, p. 17, 18; 1976, p. 114), has relatively attenuate, lamellar and strongly carinate septa, pinnately arranged about a prominent cardinal fossula. Stumm (1965, p. 34, pl. 27, figs. 1, 2) claimed that the unsectioned neotype of the type species lacks dissepiments; nevertheless, a narrow dissepimentarium of small globose dissepiments is commonly developed in the calicinal wall of other specimens from the type locality. In all these respects **Zaphrenthis** is distinct from **Stauromatidium**.

The genus **Cyathophyllum** and its type species have been revised by Birenheide (1963, p. 369-381, pl. 46, figs. 1-3; pl. 50, figs. 19-21; pl. 51, figs. 22-24; 1978, p. 73, 75, 76, text-fig. 40, pl. 10, fig. 3). They have thin septa comprising fine monacanths that may disintegrate into individual trabeculae near the periphery; spines are lacking,

and the wide dissepimentarium contains abundant, relatively small dissepiments. Clearly, there is no resemblance between **Cyathophyllum** and our new genus.

A neotype has been chosen for the type species of **Tryplasma** by Ivanovskiy and Shurygina (1975, p. 15). This and other material of the same species figured by these authors (1975, pl. 1, figs. 1-6) are not unlike some species of **Stauromatidium,** but **Tryplasma** is distinguished by having shorter spines that do not fill the corallite to the extent that those of **Stauromatidium** do; nor do they modify the tabularial morphology as do those of **Stauromatidium.** The most important differences, however, are that the spines are rhabdacanthine, not monacanthine, and do not form a continuous septotheca, as much lamellar stereome is incorporated in the outer wall of **Tryplasma.**

McLaren (1959, p. 16-22, text-figs. 2-6, pl. 7; pl. 8, figs. 1-5; pl. 10, figs. 1, 2) and Oliver (1976, p. 46-51, pls. 2-7) have revised **Synaptophyllum** and the synonymous genus **Placophyllum.** In **Synaptophyllum,** corallites increase by nonparricidal lateral budding to produce truly phaceloid coralla, and are commonly joined to each other by lateral connections. Furthermore, the septa of **Synaptophyllum** are thin, lamellar, distinctly amplexoid, and apparently consist of extremely fine trabeculae (monacanths?) overlain by lamellar skeleton that continues onto the interior surface of the outer wall. **Stauromatidium** and **Synaptophyllum** are distinguished also by their tabulae, which in **Synaptophyllum** are broad, commonly complete, with a flat, or broadly arched axial and periaxial surface, and have an unmistakable downward-sloping periphery.

A thorough revision of the Calostylidae, including selection of a lectotype for the type species of the genus **Calostylis** was given by Weyer (1973). An English translation (provided by the Translation Bureau, Department of the Secretary of State, Canada) of his (Weyer, 1973, p. 24) definition of **Calostylis** reads "Solitary or, less often, fasciculate-colonial Rugosa with everted calice (therefore with a perisarc = "edge-zone"), with low, spongy (synapticular) columella, with synapticulotheca and externally with incompletely developed epitheca, whose occasionally developed, pinnately arranged longitudinal costae correspond to the septa ("costae"); septa arranged radially, fairly distinctly individualized, trabecular (trabeculae arranged as a fan), everywhere heavily porous, with axial and lateral synapticulae; minor septa usually distinctly contratingent; simple tabulae flat in the centre, slightly domed or sagging, in the periphery distinctly raised and approximately repeating the profile of the upper rim of the septa and occasionally broken up into dissepiment-like tabellae". In view of Weyer's work, there is little likelihood of **Stauromatidium** being confused with **Calostylis** again.

Many authors have accepted Lang, Smith and Thomas's (1940, p. 104) designation of **Porpites haemisphericus** from the "Übergangskalkstein" (Silurian, presumably Visby Marl) of Gotland, as type species of the genus **Porpites** Schlotheim. Nevertheless, the selection is invalid, because of Wells's (1936, p. 127) prior designation of **Porpites globulatus.** The species chosen by Wells is a scleractinian coral, first described from Maestrichtian strata at Aachen, Germany, so that the name **Porpites** is not available for Silurian discoid corals with monacanthine trabeculae, such as **Porpites haemisphericus.** The correct genus for these corals is **Palaeocyclus** Milne-Edwards and Haime, which is based on **Madrepora porpita** Linnaeus. British and Gotland examples of **Palaeocyclus porpita** were well described and figured by Hill (1936, p. 193-196, text-figs. 8, 11, 14, 18, 26, pl. 29, fig. 36). Subsequently, several authors have given additional figures of identical or similar, certainly congeneric, species from late Llandovery to early Wenlock age beds of Gotland and North America (Bassler, 1937, pl. 30, figs. 1-6, 10-12; Ehlers and Kesling, 1957, pl. 10, figs. 9-11; Bolton, 1972, pl. 12, figs. 13, 16, 21; Ehlers, 1973, pl. 1, figs. 7, 8; Merriam, 1974, pl. 1, figs. 12-21; Sheehan, 1977, fig. 1). Without exception, these figures show **Palaeocyclus** to be discoid, to have broadly fanned, and at the periphery, outwardly projecting trabeculae, and to lack both dissepiments and tabulae. The discoid form, trabecular arrangement and absence of tabulae distinguish **Palaeocyclus** from **Stauromatidium.**

The genus **Wenlockia,** proposed by Kato (1966, p. 257, 258), has monacanthine septal apparatus that peripherally helps form a thick "stereowall" and adaxially produces discrete septal spines. **Wenlockia** also has complete concave tabulae and is without dissepiments. This much of the morphology likens it to **Stauromatidium.** The two genera are distinguished by the presence of a prominent cardinal fossula in **Wenlockia.**

Kodonophyllum has been discussed by one of us elsewhere (Oliver, 1962). It lacks dissepiments and has a broad peripheral septotheca, as in **Stauromatidium,** but differs in having attenuate lamellar septa inside the septotheca, and consistently elevated, rather than sagging tabulae in the axial and periaxial region.

In addition to these genera that have been confused with **Stauromatidium** (**Farabophyllum** is treated later in this work), three others, **Coelostylis, Hillophyllum** and **Bowanophyllum,** need consideration in connection with the establishment of **Stauromatidium.**

Coelostylis and its type species, **C. toernquisti** (Lindström) from the upper Middle Ordovician (Upper Viruan, middle Caradocian) of Sweden, have been revised by Neuman (1967). His diagnosis of the genus reads "Solitary, small to medium-sized rugose corals with curved or nearly straight conical corallite. Cardinal side convex. Calice deep. Septa of large monacanthine trabeculae heavily dilated during the early ontogeny. The spinose inner edges of major septa form a rather loosely constructed axial structure and a calicular boss. Minor septa short, typically confined to the stereozone. Tabulae absent" (Neuman, 1967, p. 454). Much of this applies equally well to **Stauromatidium,** but the absence of tabulae in the more open distal part of the corallite, the consistently well developed minor septa in adult stages, not to mention the much greater geological age of **Coelostylis,** separate the genera. Weyer has also revised **Coelostylis,** but his revision differs from Neuman's in two significant respects. Firstly, he claimed that **C. toernquisti** has septal pores, which place it in the Superfamily Calostylaceae, and gave drawings to support this (Weyer, 1973, pl. 11, figs. 6-8; pl. 15, figs. 3-5). And secondly he included a photograph (Weyer, 1973, pl. 11, fig. 9), which he interpreted as showing rhabdacanthine microstructure in the rim of the calice. Weyer's material is from Pleistocene drift. If it is correctly identified and if **C. toernquisti** does, in fact, have porous septa and some rhabdacanths, the similarity between **Coelostylis** and **Stauromatidium** is much reduced.

The genus **Hillophyllum** was described by Webby (1971) from upper Middle Ordovician (Gisbornian and Eastonian, lower Caradocian) strata of New South Wales. It has coarse monacanthine trabeculae that form a septotheca at the periphery and free septal spines inside it. However, the septa are very short, the tabularium is open and comprises mostly complete tabulae, and budding is commonly lateral and nonparricidal.

Bowanophyllum, described by McLean and Webby (1976, p. 239), is another Caradocian genus from New South Wales. It is solitary and has long holacanthine trabeculae that almost entirely fill the corallite, so that there are no dissepiments

and only one or two tabulae just below the calice and at points of rejuvenescence. We assume, as McLean and Webby did, that it is related to the tryplasmatid genus **Rhabdocyclus,** and that if the holacanthine microstructure is secondary, it was probably rhabdacanthine originally.

Although the ancestry of **Stauromatidium** is unknown, it is likely to involve a tryplasmatid genus with monacanthine trabeculae. **Hillophyllum** is suitably unspecialised, but the chronological gap between it and **Stauromatidium,** as these genera are now known, is essentially middle Caradocian to Ludlow. The intervals separating **Palaeocyclus,** which is placed in the Family Palaeocyclidae by many authors, and **Wenlockia** from **Stauromatidium** are less (upper Wenlock and most of the Ludlow Series), but both are more specialised than **Hillophyllum - Palaeocyclus** because of its discoid form and fanned trabeculae, and **Wenlockia** because of its cardinal fossula.

Stauromatidium marylandicum (Swartz, 1913)

Plates 3-5

Cyathophyllum marylandicum Swartz, 1913, p. 204, Pl. 21, figs. 1, 2.

Tryplasma rhopalium Oliver, 1960 (in part), p. 13, 14, Pl. 4, fig. 3 (not Pl. 4, figs. 1, 2, 4, 5 which are **Stauromatidium rhopalium,** nor Pl. 4, figs. 6, 7 which are **S.** sp. A of this work).

Tryplasma cf. **rhopalium** Oliver, 1960, p. 14, Pl. 4, figs. 8, 9.

Porpites (?) **rhopalium** (Oliver); Ivanovskiy, 1969 (in part), p. 52 (also includes **Stauromatidium rhopalium** and **S.** sp. A of this work).

Type series. Lectotype (here designated), USNM 155499, which is the original of Swartz, 1913, pl. 21, fig. 1; Keyser Limestone, Hyndman, Pennsylvania. Paralectotype, USNM 155500, which is the original of Swartz, 1913, pl. 21, fig. 2; Keyser Limestone, Cash Valley, Maryland.

Additional material. USNM 137836, the original of **Tryplasma** sp. cf. **T. rhopalium** Oliver (1960, pl. 4, figs. 8, 9); Keyser Limestone, Keyser, West Virginia.

USNM 314001, 314002; loc. 8 of Bowen (1967, p. 67), Keyser Limestone, north side of the Baltimore and Ohio Railroad at Pinto, Maryland; collected by Z.P. Bowen.

USNM 314003; loc. 12 of Bowen (1967, p. 68), type section of the Keyser Limestone, western quarry of two quarries along the south side of the Baltimore and Ohio Railroad, about 500 m ("0.33 mile") east of Keyser, West Virginia; collected by Z.P. Bowen.

USNM 137832, paratype of **Tryplasma rhopalium** (figured Oliver, 1960, pl. 4, fig. 3); USGS loc. 3601-SD (outcrop 22 of Boucot, Harper and Rhea, 1959, p. 17), Beck Pond Limestone, on trail that runs from Spencer Lake, south of Beck Pond, to east of King and Bartlett Lake, central ninth of Spencer Quadrangle, Somerset County, Maine; collected by A.J. Boucot.

USNM 314004-314006, 314008; USGS loc. 8992-SD, limestone of Lochkovian (Helderbergian) age, Indian Pond, Churchill Lake Quadrangle, Piscataquis County, Maine; collected by B.A. Hall.

USNM 314007; USGS loc. 7880-SD, limestone of Lochkovian (Helderbergian) age, Indian Pond, Churchill Lake Quadrangle, Piscataquis County, Maine; collected by B.A. Hall.

Distribution and age. **Stauromatidium marylandicum** is common in the upper part of the Keyser Limestone in the outcrop belt extending north and south of Keyser, West Virginia, from Cumberland in Maryland, to New Creek, West Virginia.

The upper part of the Keyser Limestone has generally been considered to be Lower Devonian (Gedinnian; Lochkovian; Helderbergian) (Bowen, 1967; Berry and Boucot, 1970, chart columns 129, 130). Recently, Helfrich (1978) has presented evidence of Late Silurian (Pridolian) age based on the occurrence of **Ozarkodina remscheidensis eosteinhornensis** (reported as **O. steinhornensis eosteinhornensis**) in the upper part of the Keyser Limestone, and on the incoming of **Icriodus woschmidti** at, or near the top of the same unit. However, the Appalachian **Icriodus woschmidti** is a different subspecies from the nominate subspecies and its incoming can be interpreted as being time transgressive (Helfrich, 1978, p. 1138). Furthermore, recent work on conodont ranges in Czechoslovakia, in the vicinity of the stratotype section of the Silurian-Devonian boundary, shows that O. **remscheidensis eosteinhornensis** ranges into the Lower Devonian, and overlaps with such Lochkovian forms as **Monograptus uniformis, Icriodus woschmidti woschmidti, Ozarkodina remscheidensis remscheidensis** and **Warburgella rugulosa.** The upper part of the Keyser Limestone, then, may be either Late Silurian or Early Devonian, since none of the key Devonian elements has yet been found in it.

Other specimens are from the Beck Pond and equivalent limestones in Somerset and Piscataquis Counties, Maine. Boucot and Johnson (1967, p. 56) identified Helderbergian (Lochkovian) brachiopod faunas from the Beck Pond Limestone, but were uncertain as to whether they are middle or late Helderbergian.

Description. Ceratoid-cylindrical, solitary species of **Stauromatidium** with long major septa that virtually fill the axial part of the lumen. Minor septa one-half to two-thirds as thick as major septa, essentially restricted to wide peripheral stereotheca. In periaxial zone, spaces between major septa occupied by sagging tabulae; tabulae may be arched axially. In specimens from the Keyser Limestone, diameters vary from 4.7 to 9.1 mm and number of major septa from 22 to 34 (N=41).

Specimens from Maine that are assigned to this species differ only in having longer minor septa and somewhat greater dilation of the major septa in the periaxial zone, leaving little space for the development of tabulae. In known specimens, the diameter ranges from 5.8 to 8.6 mm, and number of major septa from 26 to 30 (N=6), well within the ranges of the Keyser specimens.

Discussion. Charactophylloid monacanths are particularly well developed in this species. The nature of the tabulae is obscured by the length and thickness of the major septa. Comparisons with other species accompany descriptions of those species.

Stauromatidium sp. cf. **S. marylandicum** (Swartz, 1913)

Plate 6, figures 1-8

Kodonophyllum sp. b Merriam in Merriam and McKee, 1976 (in part), p. 30, Pl. 5, figs. 23, 24 (not fig. 22).

Calostylus? sp. Merriam in Merriam and McKee, 1976, p. 37, Pl. 7, figs. 7, 8.

Material. USNM 166481, 314009, 317276-317278, possibly as many as ten specimens, mounted on five thin sections, studied by Merriam (in Merriam and McKee, 1976); USGS collection M-1314, middle coral-brachiopod zone of Merriam and McKee (1976), Roberts Mountains Formation, Bootstrap Hill, southern Tuscarora Mountains, Elko County, Nevada.

USNM 314010; lower part of Windmill Limestone, as defined by Johnson (1965, p. 369-372), Coal Canyon, northern Simpson Park Range, Eureka County, Nevada; collected by H. Masursky, 1960.

USNM 314011, 314012; upper(?) part of the Roberts Mountains Formation, Elko County, Nevada; collected by J.F. Smith.

Age. The middle coral-brachiopod zone is 60 m thick on Bootstrap Hill, where it is said to be 180 m above the base of the Roberts Mountains Formation section, and to be near the base of the upper 275 m lithologic division of the formation (Merriam and McKee, 1976, p. 17, 30). Merriam believed that the faunas of the zone "fall in line" with a Silurian age. However, W.B.N. Berry (Merriam and McKee, 1976, p. 18) identified **Monograptus angustidens** and **M. uniformis** from about 175 and 185 m above the base of the Bootstrap Hill section, so that the middle coral-brachiopod zone is not older than the Lochkovian **uniformis** Zone. Furthermore, it appears to be about 125 m below the **Carlinastraea tuscarorensis** bed of the same section, which is likely to be a correlative of the late Lochkovian part (**pesavis** conodont zone) of the Windmill Limestone in the Simpson Park Range of Nevada. In view of these data, the Bootstrap Hill material seems certain to be Lochkovian, and almost as certainly early Lochkovian.

The specimen from the lower Windmill Limestone in Coal Canyon is also unequivocally Lochkovian, since it derives from beds that overlie graptolites of the **uniformis** Zone and conodonts of the **hesperius** Zone, and underlies graptolites of the **hercynicus** Zone and conodonts of the **pesavis** Zone (Berry and Murphy, 1975; Klapper and Johnson, 1977).

Description and discussion. Merriam described and illustrated fragmentary specimens of **Stauromatidium** from the upper part of the Roberts Mountains Formation as **Kodonophyllum** sp. b and **Calostylis**? sp. All of the material came from one collection, and now consists of five thin sections, four of which were illustrated by Merriam. Two of these thin sections are oriented longitudinally (both illustrated herein); the other three include transverse or slightly oblique sections of seven corals (three illustrated herein). It is not known whether the longitudinal sections are from any of the specimens represented by transverse sections. In view of this, each slide has been assigned a separate type number. One of the specimens, a transverse section figured by Merriam as **Kodonophyllum** sp. b (Merriam and McKee, 1976, pl. 5, fig. 22), is rejected from our taxon **Stauromatidium** sp. cf. **S. marylandicum** because its septa are lamellar rather than acanthine.

As seen in the transverse sections, the corallite diameters vary from 4.9 to 7.9 mm, and the number of major septa, from 25 to 29 (N=3). In most respects, the specimens resemble **S. marylandicum** and we compare them to that species pending acquisition of more adequate material. The three other specimens from Nevada are larger than Merriam's specimens (8.0 to 10.8 mm diameter, with 32 to 36 major septa), but are otherwise similar. Again, more material is required to ascertain their relationship to **S. marylandicum.**

Stauromatidium strigosum sp. n.

Plates 1, 2

Wenlockia sp. Lenz and Pedder, 1972, p. 20.

Type series. Holotype, GSC 65054 and ten paratypes, GSC 65055-65064; GSC loc. C-63178, Road River Formation, 91.5-93.3 m above base of section 2, Royal Creek headwaters area, Yukon Territory, 64°46'30"N, 135°14'10"W; collected by A.E.H. Pedder, 1976.

Six paratypes, GSC 65065-65070; GSC loc. 69306, Road River Formation, 91.8-95.5 m above base of same section; collected by A.C. Lenz, 1965.

Four paratypes, GSC 65071-65074; GSC loc. C-12880, Road River Formation, 93.6-95.4 m above base of same section; collected by A.E.H. Pedder, 1972.

Distribution and age. All of the available material, which includes additional specimens from GSC loc. 69306, C-12880 and C-63178, is from 91.5-95.5 m above the base of the section known as Royal Creek 2, in the Wernecke Mountains, Yukon Territory. A probable Ludlow **siluricus** Zone conodont fauna is present 70.88-71.08 m above the base of this section (GSC loc. C-63172), and a Pridolian **index** Zone conodont fauna has been obtained from 118.64-119.25 m above the base of the same section (GSC loc. C-12881). Age of all the specimens so far collected of **Stauromatidium strigosum** is, therefore, Upper Silurian, within the range of upper Ludlow to early Pridolian.

Name. Latin adjective **strigosus,** meaning thin, lean, slender, etc.

Description. Ceratoid-cylindrical corallites with strong tendency to form weakly colonial coralla by axial parricidal increase. As far as has been observed, a corallum produces only one generation of offsets, even though lengths of the daughter corallites may exceed that of the protocorallite. The number of offsets is usually two to four, but may be as many as eight; in exceptional instances, budding is limited to the production of a single offset. Decreases in corallite diameter associated with rejuvenescences are slight and of short vertical extent. Maximum length of corallite is between 25 and 30 mm; diameters of adult corallites range from 4.0 to 5.5 mm.

Septal apparatus appears to comprise thick spinose trabeculae exclusively. The outer wall of the corallite, which is 0.4 to 0.7 mm thick, is probably a septotheca, but its original structure has been destroyed by silicification in the type material. Septal arrangement radial, without trace of fossulae. There are 18 to 21, usually 19 or 20 major septa, the longest of which reach the axial region, where they may be reduced to isolated spines. Profuse development of septal skeleton in the axial region commonly produces a dense axial boss. Minor septa vary considerably. Most are assumed to be entirely confined to the septotheca, or are represented by a solitary spine. The number of minor septa that can be seen protruding inwards from the silicified septotheca is less than ten and in most specimens less than five. Trabeculae straight or slightly flexed, and only rarely bifurcating. Normally they are inclined, making an angle of 40° to 70° with the wall. The longest trabeculae extend from the periphery to the inner edge of a major septum; the thickest have diameters of 0.4 to 0.55 mm. Microstructure of the trabeculae has been destroyed by recrystallization even where not silicified; nevertheless there is no reason to doubt that it was originally monacanthine.

No dissepiment has been observed. Tabulae are well developed in the outer periaxial region between septotheca and axial boss; here they may or may not be complete, and generally form asymmetrically depressed tabularial surfaces. Tabulae in the axial region are scarce and more or less flat.

Discussion. **Stauromatidium strigosum** is the geologically oldest species presently assigned to the genus. Its corallites are the same size as those of **S. rhopalium** and have only slightly fewer septa (20 to 23 major septa in **S. rhopalium**). In **S. rhopalium,** however, the trabeculae are shorter and flatter lying, and therefore do not form an axial boss. This distinction reflects in the morphology of the tabularia. In **S. rhopalium** there is an open central tabularium, whereas in **S. strigosum** the tabularium is much better developed in the interseptal loculi of the peripheral zone.

Only the brachiopods of the flora and fauna associated with **S. strigosum** have been studied systematically (Lenz, 1977a, b). As far as it is presently known, the assemblage is: **Sphaerocodium munthei** Rothpletz, **Wetheredella silurica** Wood, **Favosites** sp., **Heliolites** sp., **Aphyllum** ? sp., **Stauromatidium strigosum** Pedder and Oliver, **Stereoxylodes** sp., **Protocortezorthis carinatus** Smith, **Dalejina** sp. 2, **Resserella** sp., **Schizophoria** sp., **Aesopomum** sp. cf. **A. prongsi** Lenz, **Anastrophia** sp., **Rhynchotreta** sp. aff. **R. cuneata** (Dalman), **Stegerhynchus angaciensis** Chernyshev, **Cryptatrypa triangularis** Johnson, Boucot and Murphy, **C.** ? sp., **Coelospira** sp. cf. **C. pusilla arctica** Lenz, **Metaplasia lenzi** Johnson, Boucot and Murphy, **Delthyris** sp. and **Howellella** sp. aff. **H. laeviplicata** (Kozlowski). This is one of the assemblages included in Lenz's (in Jackson et al., 1978, p. 27, 28) **Cryptatrypa triangularis** Fauna, which was regarded by Lenz (1977a, p. 45) as being "more or less the exact equivalent" of, among others, the Llandovery **Clorinda** Community of Ziegler et al. (1968) and the Ludlow **Dicoelosia** Community of Calef and Hancock (1974). Both of these communities are BA 5 in the Boucot Benthic Assemblage Scale (Boucot, 1975, p. 11-19). The assemblage containing **S. strigosum** includes abundant algae, and the quantitative data given by Lenz (1977a, b) indicate that the Pentamerida and Spiriferida in the assemblage are outnumbered almost 2:1 by the Orthida, Strophomenida and Rhynchonellida. On the basis of Fürsich and Hurst's (1974) study of the environmental factors determining the distribution of brachiopods in the British Ludlow, and on consideration of the light requirement of algae, a strong case can be made for referring the **S. strigosum** assemblage at Royal Creek to a shallower BA 4 position in the Boucot Benthic Assemblage Scale.

Stauromatidium rhopalium (Oliver, 1960)

Plate 6, figures 9, 10

Tryplasma rhopalium Oliver, 1960 (in part), p. 13, 14, Pl. 4, figs. 1, 2, 4, 5 (not Pl. 4, fig. 3 which is **Stauromatidium marylandicum,** nor Pl. 4, figs. 6, 7, which are **S.** sp. A of this work).

Porpites (?) **rhopalium** (Oliver); Ivanovskiy, 1969 (in part), p. 52 (also includes **Stauromatidium marylandicum** and **S.** sp. A of this work).

Type series. Only two of the five specimens in the original type series are retained in the species. These are the holotype, USNM 137831 (figured Oliver, 1960, pl. 4, figs. 1, 2) and paratype USNM 137833 (figured Oliver, 1960, pl. 4, figs. 4, 5); both from USGS loc. 3499-SD (outcrop 10 of Boucot, Harper and Rhea, 1959, p. 11), Beck Pond Limestone, on trail that crosses outlet stream of Beck Pond 0.16 km south of the pond, just west of the stream at an altitude of 531 m (1740 feet), central ninth of Spencer Quadrangle, Somerset County, Maine; collected by A.J. Boucot.

Distribution and age. As revised here, the species is known only from the Beck Pond Limestone at the type locality. Boucot, Harper and Rhea (1959, p. 10, modified in Boucot and Johnson, 1967, p. 56, table 1, column E1) reported that the brachiopod fauna at this locality (their outcrop 10) is characterized by **Hedeina** sp. cf. **H. macropleura, Levenea** sp., **Orthostrophia** sp. cf. **O. strophomenoides** and **Ancillotoechia bialveata.** In the earlier of these publications, Boucot comments that this fauna is so similar to that found in the New Scotland Formation (Lochkovian world stage; Helderbergian local stage) of eastern New York, that the correlation of the two appears to be as well founded as such correlation can be.

Description. Small, solitary, cylindrical species of **Stauromatidium** with very short septa, composed of stout, blunt monacanths. The monacanths are directed inward at a high angle to the wall and do not show charactophylloid flexures, presumably because of their shortness. The septa extend one-half of the distance to the axis, or a little more, leaving an open axial area occupied only by the broadly sagging, complete tabulae. Minor septa are short and wedge-shaped, and much thinner than the major septa. One transverse section shows a distinct bilateral septal arrangement, but we cannot confirm that the plane of apparent symmetry is the cardinal-counter plane. Diameters and numbers of major septa in two available specimens are 5.5 and 4.0 mm, and 23 and 20 septa (holotype and paratype respectively).

Discussion. The above description is based on the only two specimens available. As originally described and illustrated, **Stauromatidium rhopalium** was a composite of three species. At that time, only one other specimen was known of what we now consider to constitute the genus, and the concept of the species was essentially our present concept of the genus.

Stauromatidium rhopalium is similar to **S. strigosum** in size and number of septa, but its trabeculae are less steeply inclined and shorter, and thus leave a much more open axial region. Also, its tabulae are more or less complete and sagging, whereas in **S. strigosum,** tabulae are incomplete and form an axially elevated tabularium, giving the impression of being supported by the long, steeply inclined spines of the axial boss.

Stauromatidium montjolicum sp. n.

Plates 7-9

Type series. Holotype, GSC 65077 and four paratypes, GSC 65078-65081; QMER loc. 62-L12, base of type exposure of Mont Joli Formation, sea-cliff about 155-160 m ("450 feet") southwest of Mont-Joli Headland, northeast Percé Township, Gaspé, Québec; collected by P.J. Lespérance, 1962.

Four paratypes, GSC 65082-65084 and USNM 314014; QMER loc. 62-L28, Mont Joli Formation, base of sea-cliff, 61 m ("200 feet") southeast of Grande Coupe Brook, northeast Percé Township, Gaspé, Québec; collected by P.J. Lespérance, 1962.

Five paratypes, GSC 65085, 65093-65095 and USNM 314015; QMER loc. S-62-F37a, Mont Joli Formation, Lochkovian (Helderbergian) age, Percé North Beach, below

high-tide level, 61 m ("200 feet") southeast from northwest end of outcrops near Baird's Wharf, northeast Percé Township, Gaspé, Québec; collected by W.B. Skidmore, 1962.

Distribution and age. The species is apparently common at several sea-cliff localities in northeast Percé Township, Gaspé, Québec. Boucot and Johnson (1967, p. 59) reported that the Mont Joli Formation carries a small non-diagnostic brachiopod fauna indicating a probable Helderbergian age. Associated corals include **Breviphrentis** sp. cf. **B. variabilis** Oliver and **"Lyrielasma"** sp. cf. **L. annulatum** Oliver. As both of these species are known from Lochkovian (Helderbergian) beds in Maine, the coral evidence supports Boucot and Johnson's assessment of the age of the Mont Joli Formation.

Name. Adjective coined from Mont-Joli Headland and the possessive suffix **-icus, -ica, -icum.**

Description. Corallum solitary, ceratoid-cylindrical; diameter ranging from 7.5 to 14.2 mm. Calice unknown.

Septal apparatus radially arranged, completely trabeculate. Trabeculae well preserved in type material, coarsely monacanthine, locally bifurcating, more or less straight or slightly flexed in the charactophylloid manner, generally making angles of 45° to 70° with the wall. Major and minor septa peripherally dilated to form a septotheca of variable width. Septa less thick in periaxial and axial zones, leaving much open space. Minor septa restricted to septotheca in individuals of small diameter, but extend into periaxial zone in larger specimens. Number of major septa 29 to 36 (N=14).

A few of the most peripherally situated horizontal elements resemble tabulae especially in their sinuosity, but they are steeply inclined and at their lower end attach to the septotheca or another dissepiment-like horizontal element. Whether these are tabellae or dissepiments is an open question. The indisputable tabulae are broad to complete and variably, but on the whole, closely spaced; the surfaces they form are broadly sagging, or periaxially arched with axial and peripheral sags.

Two forms are present in the collection. One form tends to have shorter major septa extending only one-half to three-quarters of the distance to the axis, and is larger (d = 10.5 to 14.2 mm, n = 31 to 36, N = 5). The second form has septa extending to the axis and is smaller (d = 7.5 to 12.4 mm, n = 29 to 34, N = 9). As a result of having shorter septa, the first form has a more open lumen and more complete septa. The two forms do not seem to represent growth stages in spite of the size difference, but we nevertheless interpret them as variants within a single population and species.

Discussion. **Stauromatidium montjolicum** and **S. sentum** differ from other species of the genus principally in having septa that are thin enough to leave much open space in the lumen and, as a result, in having a broad clearly defined tabularium. They are also larger than other species. The large form of **S. montjolicum** differs from **S. sentum** in having more open space inside the septotheca; the smaller form is smaller and has fewer septa.

Stauromatidium sentum sp. n.

Plate 10, figures 4, 5, 7, 8, 11, 12

Type series. Holotype, GSC 65075 and paratype GSC 65076; both from GSC loc. 69303, Road River Formation, 207.4-211.4 m above the base of section 1, Royal Creek headwaters area, Yukon Territory, 64°46'10"N, 135°12'00"W; collected by A.C. Lenz, 1965.

Distribution and age. This species is known only from its type occurrence in the Wernecke Mountains of Yukon Territory. **Eognathodus sulcatus kindlei** occurs 210.3-211.4 m above the base of Royal Creek section 1 (GSC loc. C-4281), and **Monograptus yukonensis** has been identified from 199.8-201.3 m and 301.9-305.0 m above the base of the same section (Lenz and Pedder, 1972, p. 16, 18). Both of these important index fossils are late Pragian, which must also be the age of **Stauromatidium sentum.**

Name. Latin adjective **sentus,** meaning thorny or spiny.

Description. Corallum solitary, probably ceratoid-cylindrical but early ontogeny not known. Maximum corallite diameter of both specimens 13.0 mm. Calice unknown.

Septa of both orders expanded at the periphery forming a continuous septotheca 1.5 to 2.5 mm thick. Arrangement of septal apparatus radial, without trace of a fossula. Recrystallization and silicification have destroyed much of the fine structure, but where preservation is adequate septa are seen to be entirely constructed of monacanthine trabeculae. Locally, trabeculae are more or less straight and make angles in the order of 45° to 50° with the wall; elsewhere they bifurcate and arch inwards, or show charactophylloid flexing. Their diameter diminishes from 0.5 to 0.7 mm near the periphery to .05 to .2 mm in the axial region. There are 32x2 septa in a transverse section of the holotype where its diameter is 10 mm, and 35x2 at 13 mm diameter. Major septa lamellar and mostly smooth sided in the peripheral region, but as the trabeculae begin to separate in the periaxial region, they assume a somewhat beaded or rhopaloid appearance as viewed in transverse section; their breakdown to discrete spines is complete in the axial region. Minor septa well developed, but shorter, thinner and adaxially produce fewer spines than do the major septa.

A few elongate dissepiments, not more than two rows deep, appear sporadically in longitudinal sections. Tabulae broad, commonly almost complete, closely spaced, forming axially depressed tabularial surfaces.

Discussion. **Stauromatidium sentum** closely resembles **S. montjolicum,** but has narrower interseptal loculi, a more spinose septal apparatus and a slightly different tabularial morphology.

The similarity between these species, and the marked differences separating them from others of the same genus, raise the question as to whether there was incursion of North Americas Realm faunal elements into the Pragian faunas of Yukon Territory, as there was into contemporaneous faunas of the Great Basin, Nevada (Oliver and Pedder, in press). The fauna with which **S. sentum** is associated at Royal Creek, Yukon Territory, includes a large number of identified species, especially brachiopods, listed as follows: **Favosites** sp., **"Oculipora"** sp., **Cystiphylloides** sp. aff. **C. americanum** (Edwards and Haime), **Pseudamplexus** sp., **Vepresiphyllum** sp., **Werneckelasma multiseptata** Pedder, **Dohmophyllum** sp., **Xystriphyllum** sp., **"Dolerorthis" borealis** Lenz, **Skenidioides variabilis** Lenz, **Protocortezorthis carinatus** Smith, **Cortezorthis norfordi** Lenz, **C. perryi** Lenz, **Dalejina** sp. 1, **Schizophoria** sp. cf. **S. paraprima** Johnson, Boucot and Murphy, **S.** sp. 1, **Salopina submurifer** Johnson, Boucot and Murphy, **Muriferella** sp. aff. **M. masurskyi** Johnson and Talent, **Kayserella costatula** Lenz, **Leptagonia** sp. 1, **"Nervostrophia"** sp., **Mesodouvillina (Protocymostrophia)** sp. cf. **Cymostrophia stephani** of Lenz, 1977, **M. (P.) stelcki** (Lenz), **Brachyprion (B.)** sp., mesodouvillininid gen. et sp. nov., **Phragmostrophia mucronata** Lenz, **Aesopomum varistriata** Johnson, **A. regularis** Lenz, **Grayina magnifica arctica** Lenz, **Gypidula boucoti** Lenz,

Latanotoechia ludvigseni Lenz, **Thliborhynchia julli** Lenz, **Nymphorhynchia nympha** (Barrande), **Werneckeella hartensis** Lenz, **Athyrhynchus** (?) sp., **Katunia** (?) **postmodica** (Scupin), **Atrypa aspiformis** Lenz, **A. virilicosta** Lenz, **Spinatrypina** (?) **alatiformis** Lenz, **Desquamatia filistriata** Lenz, **Totia** sp. aff. **T. intermediafera** (Khodalevich), **Davidsoniatrypa johnsoni** Lenz, **Cryptatrypa** sp. 1, **Nucleospira laevigata** Lenz, **Ambocoelia** sp. aff. **A. praecox** Kozlowski, **Plicoplasia acutiplicata** Lenz, **Reticulariopsis** sp. and **Eognathodus sulcatus kindlei** Lane and Ormiston. Apart from the presence of the form identified as **Cystiphylloides** sp. aff. **C. americanum** this assemblage is typical of the **Skenidioides-Spirigerina-Vagrania** Community (defined by Lenz, 1966) and pertains unequivocally to the Old World faunal realm.

Stauromatidium trigemma (Davis, 1887)

Plates 11-13; Plate 14, figures 1-9, 12

Zaphrentis trigemma Davis, 1887, legend, pl. 130, figs. 1, 2.

Synaptophyllum grabaui Fagerstrom, 1961 (in part), p. 13, pl. 3, figs. 11-14 (excluding unfigured holotype).

Calostylis (?) **trigemma** (Davis); Stumm, 1965, p. 47, pl. 43, figs. 8-11.

"Synaptophyllum" grabaui Fagerstrom; Oliver, 1976, p. 15, table 5.

Type series. Lectotype (selected by Stumm, 1965, p. 47), MCZ 7548 which is the original of Davis, 1887, pl. 130, fig. 2 and Stumm, 1965, pl. 43, fig. 8. Paralectotype, MCZ 7547 which is the original of Davis, 1887, pl. 130, fig. 1. Both specimens are from the Jeffersonville Limestone, Falls of the Ohio, Louisville, Kentucky.

Additional material. UMMP 5274, hypotype of Stumm, 1965, pl. 43, figs. 9-11; upper coral zone, Jeffersonville Limestone, Charlestown Landing, Clark County, Indiana.

UMMP 36116, 36117, figured paratypes of **Synaptophyllum grabaui** Fagerstrom, 1961, pl. 3, figs. 11-14; loc. 12 of Fagerstrom (1961, p. 4), Amherstburg Formation, Formosa reef facies, abandoned quarry on the south side of Greenock Creek (Lots A and B, Con. IIIS), Brant Township, Bruce County, Ontario.

UMMP 64446-64449 and two unillustrated specimens; Columbus Limestone, coral zone (Zone C), subsurface cores from Avon Township, Lorain County, northeastern Ohio.

USNM 314016-314018; USGS loc. 5063-SD (C-36 of Oliver, 1976, p. 145), Amherstburg Formation, small quarry on east side of Maitland River (Lot 11, Con. VIII, Howick Township), 2.56 km east of Gorrie, Wingham East map sheet, Ontario.

Distribution and age. The text to Davis's work on Kentucky Silurian and Devonian corals was never published. In the explanation to plate 130, the occurrence of the type was cited as "Lower Devonian rocks, Falls of the Ohio". However, annotations in Davis's own copy of the work make it clear that the type stratum is in the lower 10 feet (3.05 m) of the Jeffersonville Limestone. This includes zones A and B of Oliver (1976, p. 20), but because other known occurrences of the species are in correlatives of zone B, that is, the **Prismatophyllum prisma** Zone of Oliver, the types also are believed to have come from this zone.

In southern Ontario, the species occurs in the Amherstburg Formation of the Detroit River Group near Gorrie and around Formosa (Formosa reef facies).

Stauromatidium trigemma also has been found in two well cores from the coral zone (Zone C) of the Columbus Limestone in Lorain County, northeastern Ohio. The stratigraphy of these cores was discussed in Oliver (1976, p. 13, 14), where **S. trigemma** is listed in table 5 as **"Synaptophyllum" grabaui** Fagerstrom.

All of these occurrences are believed to be in correlatives of the Edgecliff Member of the Onondaga Limestone (Oliver, 1976, fig. 3, p. 6, 7). That is to say, they are Lower Southwoodian (Rickard, 1975, pl. 3). But this stage, like other Lower and Middle Devonian stages defined in areas, that in Devonian times were part of the Eastern Americas Realm, cannot be correlated precisely with European stages, because of the high degree of endemicity of the Eastern Americas Realm faunas.

The Edgecliff Member has been regarded tentatively as early Eifelian by many authors, including Rickard (1975) and Oliver (1976). But conodonts, which would seem to be the most promising fossil group for resolution of the problem, suggest that the Edgecliff may be Dalejan, that is pre-Eifelian. The reason for this suggestion is that the first appearance in New York of **Polygnathus costatus patulus** is in the overlying Nedrow Member of the Onondaga Limestone, whereas in the standard European sequences this subspecies enters in the Dalejan (Klapper and Ziegler, 1979, p. 206, 207, text-figs. 3, 4). However, the absence of **Polygnathus costatus patulus** from the Edgecliff Member may well be due to the shallow facies of the member rather than to its age.

The age of the known specimens of **Stauromatidium trigemma**, then, is either late Dalejan, or early Eifelian, certainly Southwoodian, and almost certainly Couvinian, on the grounds that this Belgian stage has an older base than the Eifelian.

Description. Corallites cylindrical with diameter 5.2 to 10.2 mm (N=26). Some definitely form weakly fasciculate coralla by peripheral parricidal budding; other specimens may be solitary, but none is so complete at the apex that this can be demonstrated.

Septa radially arranged, entirely trabeculate, and dilated peripherally, forming a thick septotheca. Major septa long, relatively attenuate inside the septotheca, commonly rhopaloid and broken down to spines towards the axis, 25 to 33 in number (N=26). Minor septa mostly confined to the septotheca, but in large specimens may extend into the lumen. Trabeculae monacanthine; monacanths tend to be straight and inclined at about 45°, but display charactophylloid flexures in some sections.

Rare solitary elongate dissepiments may develop on the interior of the septotheca. Tabulae commonly complete, generally rather widely spaced, broadly sagging, forming tabularial surfaces that appear U- or V-shaped in longitudinal section.

Discussion. Fagerstrom (1961) described specimens of this species as **Synaptophyllum grabaui,** but selected an unsectioned specimen from another area as holotype. The holotype (figured pl. 14, figs. 10, 11 herein) is a stauriid and unrelated to **Stauromatidium.** Oliver (1976) listed the northeastern Ohio specimens as **"Synaptophyllum" grabaui** because of their obvious similarity to Fagerstrom's illustrated specimens.

The only other species of **Stauromatidium** known to produce fasciculate coralla is **S. strigosum.** However, the species are not likely to be confused, because of the smaller

size (diameter 4.0 to 5.5 mm), relatively much more pronounced septal apparatus and the periaxially elevated tabularium of **S. strigosum.**

Stauromatidium montjolicum and **S. sentum** have a few dissepiments, as **S. trigemma** does, but **S. montjolicum** and **S. sentum** are solitary, larger (diameter 7.5 to 14.2 mm), have more septa (n = 29 to 36), and a different tabularial morphology.

Stauromatidium trigemma is the youngest species of the genus of which we have knowledge. It is also the closest, from a morphological standpoint, to the Family Stringophyllidae. Whether these observations signify an evolutionary relationship between the Stauromatidiidae and the Stringophyllidae is not known. Certainly **S. trigemma,** itself, is not likely to be a direct forerunner of the stringophyllids, because of its Dalejan or Eifelian, rather than Zlichovian age, and its apparent isolation in the Eastern Americas Realm.

Stauromatidium sp. A

Plate 10, figures 1-3

Tryplasma rhopalium Oliver, 1960 (in part), p. 13, 14, Pl. 4, figs. 6, 7 (not Pl. 4, figs. 1, 2, 4, 5 which are **Stauromatidium rhopalium,** nor Pl. 4, fig. 3 which is **S. marylandicum**).

Porpites (?) **rhopalium** (Oliver); Ivanovskiy, 1969 (in part), p. 52 (also includes **Stauromatidium rhopalium** and **S.** sp. A of this work).

Material. USNM 137834, paratype of **Tryplasma rhopalium** (figured Oliver, 1960, pl. 4, figs. 6, 7); USGS loc. 3499-SD (outcrop 10 of Boucot, Harper and Rhea, 1959, p. 11), Beck Pond Limestone, on trail that crosses outlet stream of Beck Pond 0.16 km south of the pond, just west of the stream at an altitude of 531 m (1740 feet), central ninth of Spencer Quadrangle, Somerset County, Maine; collected by A.J. Boucot.

USNM 314013 and two unillustrated specimens; USGS loc. 7880-SD, limestone of Lochkovian (Helderbergian) age, Indian Pond, Churchill Lake Quadrangle, Piscataquis County, Maine; collected by B.A. Hall.

Two unillustrated specimens; USGS loc. 8993-SD, limestone of Lochkovian (Helderbergian) age, Indian Pond, Churchill Lake Quadrangle, Piscataquis County, Maine; collected by B.A. Hall.

Distribution and age. Known only from the Beck Pond and equivalent limestones in Somerset and Piscataquis Counties, Maine. The Lochkovian (Helderbergian) age of these limestones is discussed in our treatment of **Stauromatidium marylandicum** and **S. rhopalium.**

Description. Ceratoid or cylindrical, solitary species of **Stauromatidium** with long major septa that virtually fill the lumen. Minor septa are nearly as thick as the major septa and one-quarter to one-half as long. Where open spaces between septa do exist, tabulae sag periaxially. Corallite diameters vary from 4.0 to 7.0 mm, and numbers of major septa, from 22 to 27 (N=6).

Discussion. Although at first this form was included in **"Tryplasma" rhopalium,** now it is seen to be morphologically closer to **Stauromatidium marylandicum.** It differs from **S. marylandicum** in having major and minor septa of almost equal thickness and in having a less open space in the periaxial part of the lumen. In this last character, **S.** sp. A is very close to specimens of **S. marylandicum** from Maine.

Stauromatidium sp. B

Plate 10, figures 6, 9, 10, 13

Farabophyllum farabicum Lavrusevich; Erina in Kim et al., 1978a, loose fig. 3b.

Farabophyllum farabicum Lavrusevich; Erina in Kim et al., 1978b, Pl. 32, figs. 3a, b.

not **Farabophyllum farabicum** Lavrusevich, 1971, p. 110, 111, Pl. 10, figs. 1a-3v; Pl. 11, figs. 6a, b.

Material. Through the kindness of M.V. Erina, we have been able to study photographs, reproduced here on Plate 10, of two specimens: IGG AN Uz.SSR II-6/860z/364 (figured as **Farabophyllum farabicum** by Erina in Kim et al., 1978b, pl. 32, figs. 3a, b) and IGG AN Uz.SSR II-6/860z/370; both from the Kushnova Horizon, evidently about 150 m above the base and 100 m below the top of it, Zinzilban Gorge, left side of Dzhindy-Darya River Valley, Uzbekistan S.S.R.

Distribution and age. We are not aware of any occurrence of this form other than at Zinzilban Gorge. The shelly fauna of the Kushnova horizon is correlated with that of the Pragian Koneprusy Limestone of Czechoslovakia (Kim et al., 1978a, p. 38). It overlies faunas with **Neomphyma originata, Spirigerina marginaloides** and other Lochkovian species in the underlying Bursykhirma Horizon, and underlies late Pragian graptolites, identified as **Monograptus craigensis, M. thomasi, M. telleri** and **M. yukonensis,** in the overlying Zinzilban Beds of the Kitab Horizon. The first occurrence in the region of the important late Pragian and early Zlichovian conodont **Polygnathus dehiscens** is also in the overlying Zinzilban Beds. On this evidence, which is drawn from Kim et al. (1978b, especially loose figs. 3a, b), the figured specimens of **Stauromatidium** sp. B are certainly Pragian, and probably early Pragian.

Description and discussion. From photographs and magnifications inscribed on them, the corals are deduced to be solitary and to have adult diameters of 5.0 to 6.0 mm and lengths in excess of 45 mm. The septal apparatus, of long, probably monacanthine trabeculae, appears to fill the entire subcalicular part of the corallite, leaving no space for either dissepiments or tabulae. In longitudinal sections, the trabeculae are seen to be either straight, or more commonly show gentle charactophylloid flexures; most project inwards and upwards at 45° to 70° to the axis of growth. In transverse sections, trabeculae are seen to be contiguous and radial in arrangement. Because of the indistinct boundary between the contiguous septa we have not been able to consistently recognize minor septa, or estimate the number of septa present.

The excessive development of septal apparatus and consequent absence of tabulae differentiate this from other species of **Stauromatidium. Farabophyllum farabicum** is illustrated on plate 15 of this work. By comparison it has much more strongly flexed or arched, and relatively shorter trabeculae; it has also an open axial and periaxial region with a well-developed tabularium.

Genus **FARABOPHYLLUM** Lavrusevich, 1971

Farabophyllum Lavrusevich, 1971, p. 110 (in part?).

Type species. **Farabophyllum farabicum** Lavrusevich, 1971, p. 110, 111, pl. 10, figs. 1a-3v; pl. 11, figs. 6a, b. Shut Horizon, **Farabophyllum(?) intermedium** Zone (Pragian); holotype from Obi-Khunda Ridge, left side of the Farab River Valley, Zeravshan-Gissar region, Tadzhikistan S.S.R.

Original description. "Fasciculate colonies produced by internal budding. Septa consisting of closely overlying, arcuate trabeculae embedded in profuse stereoplasm with which they together form a wide rim. Interseptal apparatus pleonophorous. Tabulae planoconcave" (Translation provided by Translation Bureau, Department of the Secretary of State, Canada). Internal budding is presumed to be parricidal and the wide rim is a septotheca in our terminology.

Discussion. Lavrusevich's description of the type species mentions the presence of an epithecal scale, about 1.0 mm long on the holotype, and also notes that "at some points one may distinguish dissepiments fading among strongly developed septa". Unfortunately, the original photographs of the genus were so crudely reproduced in printing that very little is visible in the published plates. However, we have additional prints, generously sent by A.I. Lavrusevich, and these are reproduced on plate 15 of this work. They do not show fine trabecular structure, probably because it is inadequately preserved, nor do they reveal the presence of any dissepiments. But they do show highly arched and locally strongly flexed trabeculae forming a dense peripheral septotheca, and an open tabularium comprising broad, mostly complete tabulae. In contrast to most species of **Stauromatidium** that have a similarly open central region, septal spines are conspicuously absent.

The generic identity of **Farabophyllum intermedium,** which occurs with **F. farabicum** in Tadzhikistan and was the only other species referred to the genus by Lavrusevich, is in doubt. We have not seen material. Our knowledge of it comes from Lavrusevich's description (1971, p. 111, 112, pl. 11, figs. 1-5) and a photograph of the original plate sent by the author. The description states that the trabeculae are rhabdacanths and that they are not significantly bent. Another distinction between the species, which is clearly visible in the photograph, is that the stereotheca is not well developed in F. **intermedium.** In one specimen in particular, septa are thin throughout the marginarium, and as many as five rows of small dissepiments are present in the wide interseptal loculi.

Erina (in Kim et al., 1978b, pl. 35, figs. 5a-v; pl. 41, figs. 4a, b) figured two corals from the Devonian of Uzbekistan as species of **Farabophyllum,** in addition to the form we refer to as **Stauromatidium** sp. B. Their fine trabecular structure is unknown to us, but their overall morphology is tryplasmatid.

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PLATE 1

Stauromatidium strigosum sp. n.

All specimens are from GSC loc. C-63178, which is from the upper Ludlow or early Pridolian part of the Road River Formation, Royal Creek headwaters area (section 2 of authors), Yukon Territory.

Figures 1, 3. Transverse and longitudinal sections of paratype GSC 65055; x5.

Figures 2, 4. Transverse and longitudinal sections of the holotype, GSC 65054; x5.

Figure 5. Exterior view of many specimens from GSC loc. C-63178. The specimen with three buds, indicated by an arrow, is paratype GSC 65062; x1.

Figures 6, 11 (middle specimen only). Longitudinal and transverse sections of paratype GSC 65056; x5.

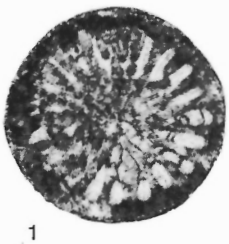
Figures 7, 8. Longitudinal and transverse sections of paratype GSC 65059; x5.

Figure 9. Exterior view of many specimens from GSC loc. C-63178. The specimen indicated by an arrow, on the left, with eight buds, is paratype GSC 65063; the other specimen indicated by an arrow, to the right, with two buds, is paratype GSC 65064; x1.

Figure 10. Longitudinal section of paratype GSC 65060; x5.

Figure 11 (upper specimen only). Transverse section of paratype GSC 65057; x5.

Figure 11 (lowermost specimen only). Transverse section of paratype GSC 65058; x5.



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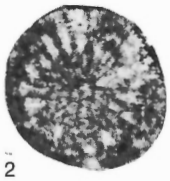

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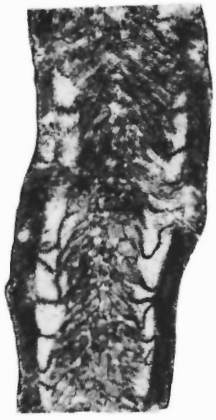

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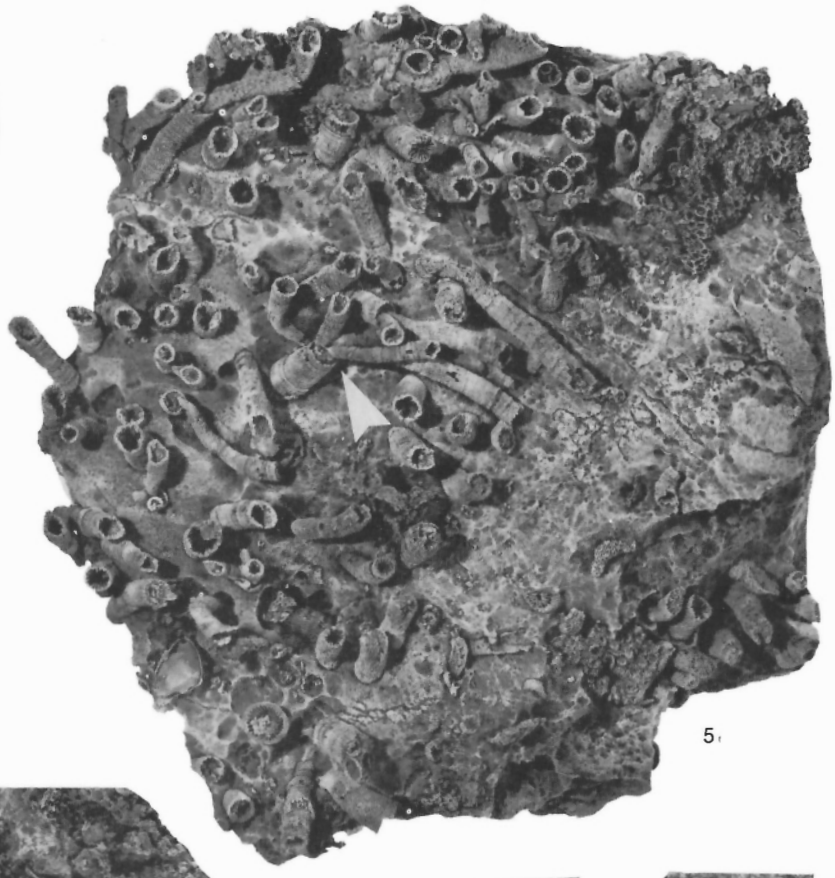

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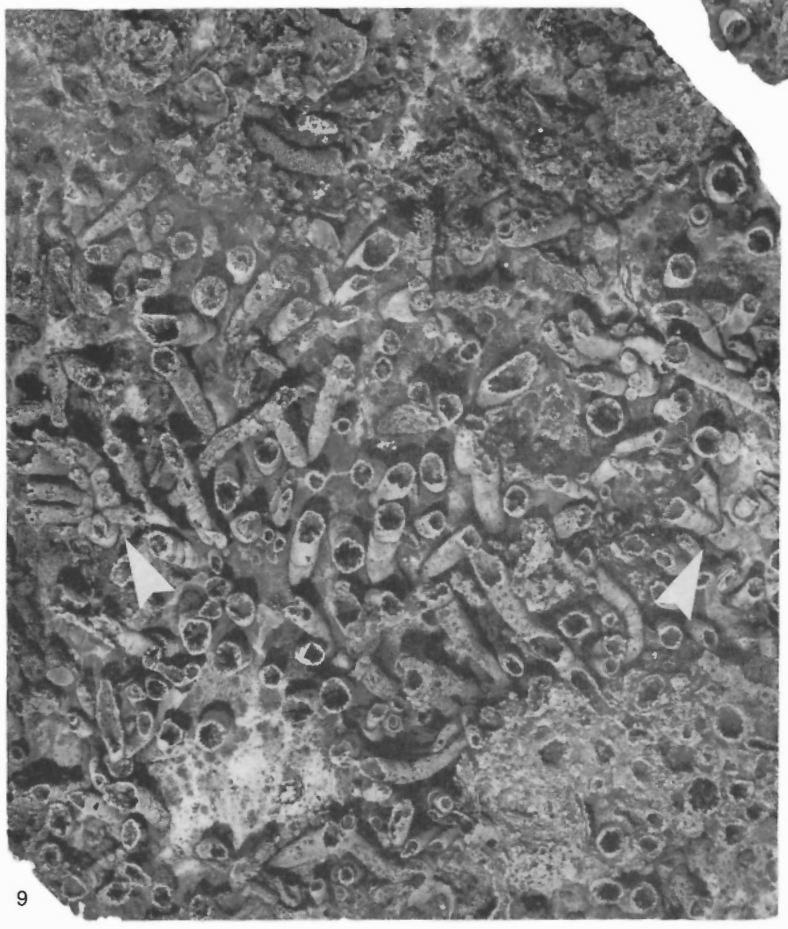

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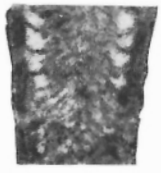

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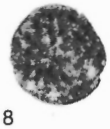

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11

PLATE 2

Stauromatidium strigosum sp. n.

All specimens are from the upper Ludlow or early Pridolian part of the Road River Formation, Royal Creek headwaters area (section 2 of authors), Yukon Territory.

Figures 1, 4. Longitudinal and transverse sections of paratype GSC 65065; GSC loc. 69306; x5.

Figures 2, 3. Off-centred longitudinal section and transverse section of paratype GSC 65066; GSC loc. 69306; x5.

Figure 5. Transverse section of paratype GSC 65067; GSC loc. 69306; x5.

Figure 6. Transverse section of paratype GSC 65068; GSC loc. 69306; x5.

Figure 7. Exterior view of specimen with two buds, paratype GSC 65064; GSC loc. C-63178; x3.

Figure 8. Transverse section of paratype GSC 65061; GSC loc. C-63178; x5.

Figure 9. Transverse section of paratype GSC 65071; GSC loc. C-12880; x5.

Figure 10. Exterior view of specimen with eight buds, paratype GSC 65063; GSC loc. C-63178; x3.

Figure 11. Longitudinal section of paratype GSC 65072; GSC loc. C-12880; x5.

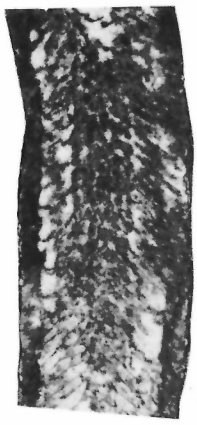
Figure 12. Longitudinal section of paratype GSC 65069; GSC loc. 69306; x5.

Figure 13. Transverse section of paratype GSC 65073; GSC loc. C-12880; x5.

Figure 14. Exterior view, in lower left of photograph, of specimen with three buds, paratype GSC 65062; GSC loc. C-63178; x3.

Figure 15. Longitudinal section of paratype GSC 65074; GSC loc. C-12880; x5.

Figure 16. Transverse section of paratype GSC 65070; GSC loc. 69306; x5.



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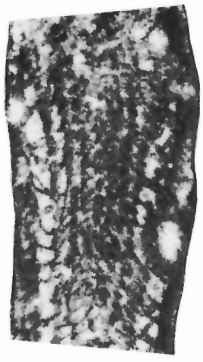

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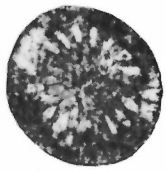

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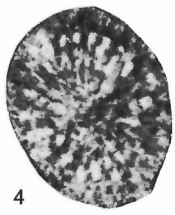

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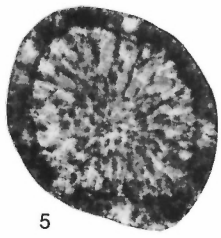

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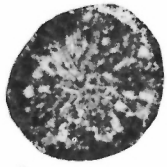

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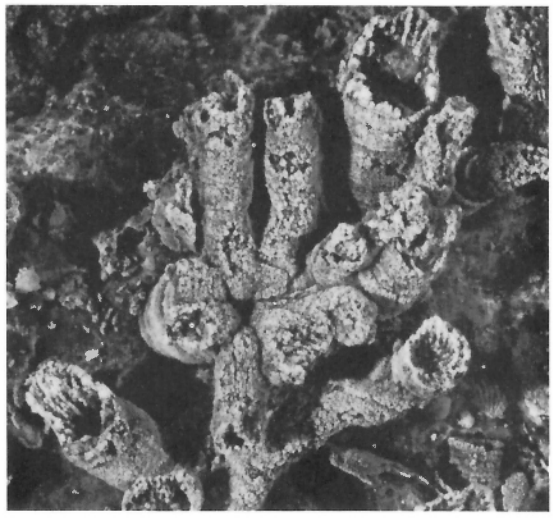

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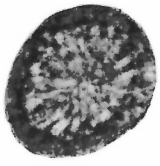

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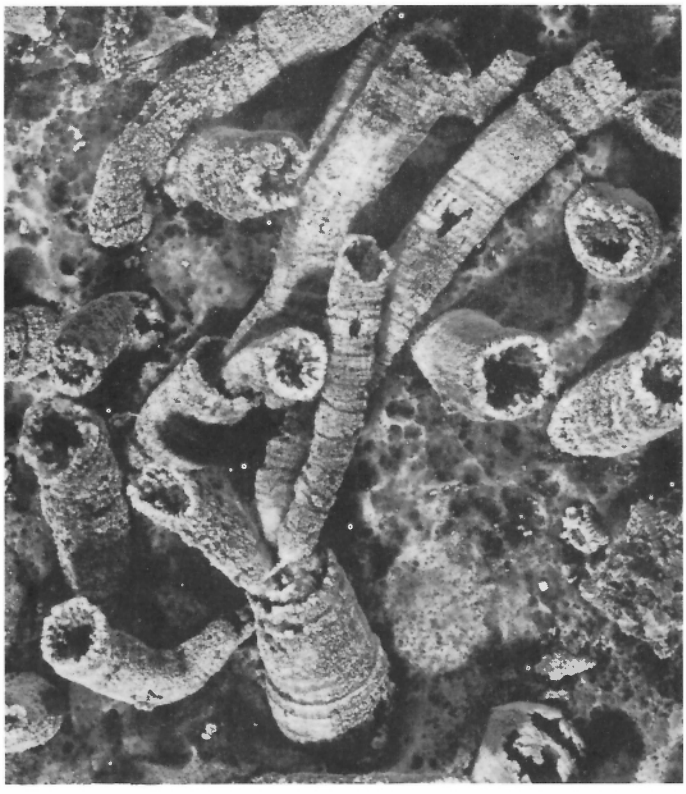

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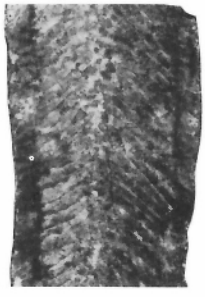

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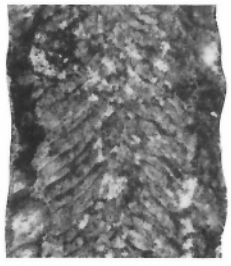

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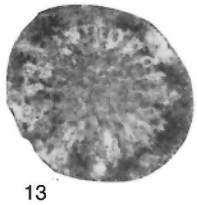

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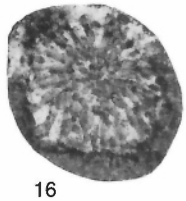


16

PLATE 3

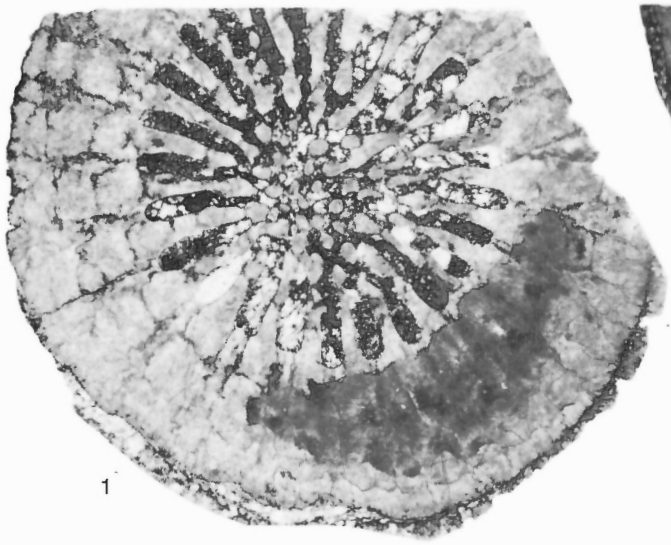
Stauromatidium marylandicum (Swartz, 1913)

Figures 1, 2. Transverse and longitudinal sections of the lectotype (here designated), USNM 155499 (exterior figured Swartz, 1913, plate 21, figure 1); Keyser Limestone, late Pridolian or early Lochkovian (Helderbergian) age, Hyndman, Pennsylvania; x10.

Figures 3, 4. Longitudinal and transverse sections of the paralectotype, USNM 155500 (exterior calicular view figured Swartz, 1913, plate 21, figure 2); Keyser Limestone, late Pridolian or early Lochkovian (Helderbergian) age, Cash Valley, Maryland; x10.

Figure 5. Transverse section of USNM 314004; USGS loc. 8992-SD, limestone of Lochkovian (Helderbergian) age, Indian Pond, Piscataquis County, Maine;x10.

Figure 6. Longitudinal section of USNM 314005; USGS loc. 8992-SD, limestone of Lochkovian (Helderbergian) age, Indian Pond, Piscataquis County, Maine; x10.



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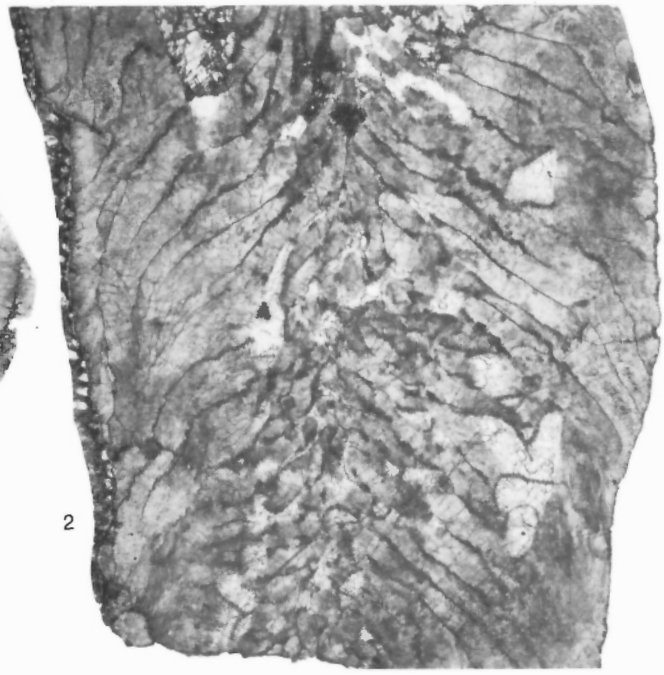

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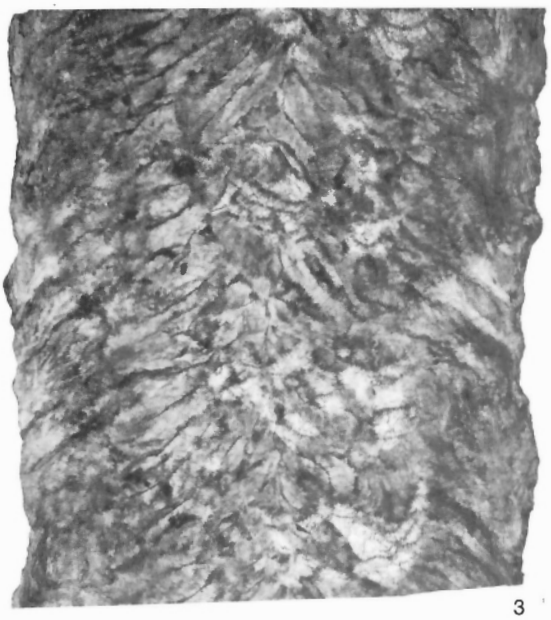

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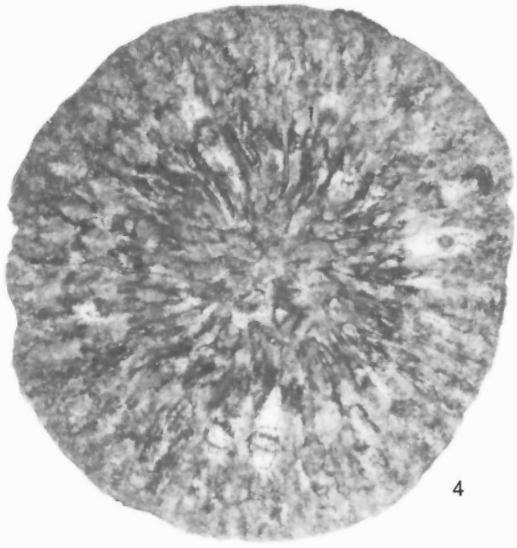

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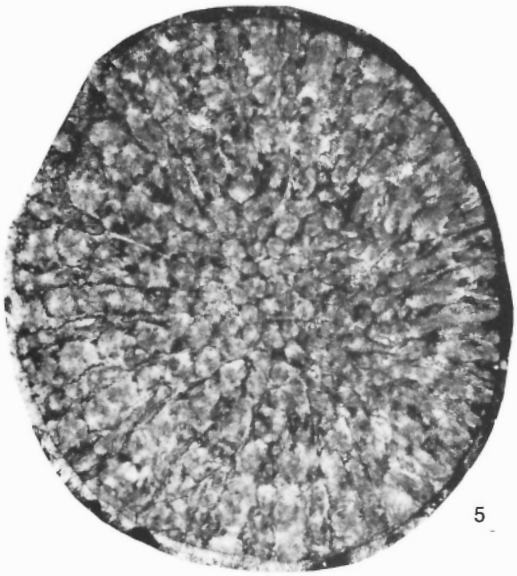

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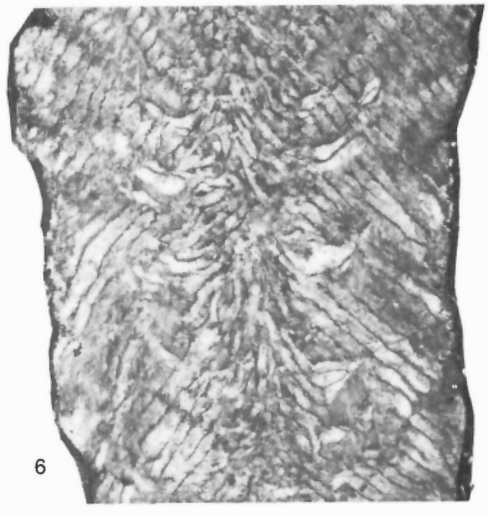

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PLATE 4

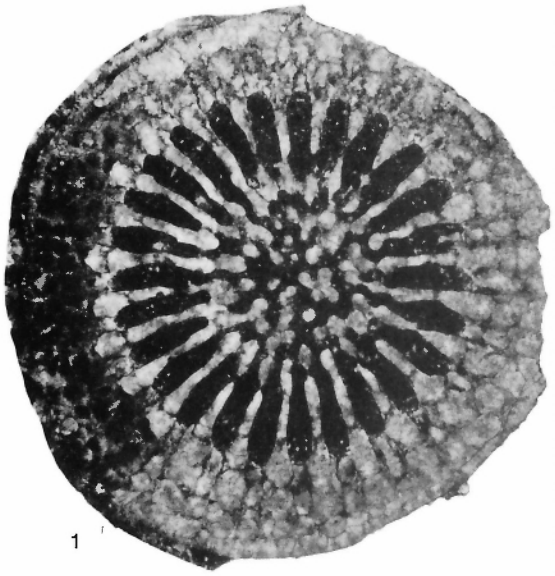
Stauromatidium marylandicum (Swartz, 1913)

All specimens are from the Keyser Limestone, late Pridolian or early Lochkovian (Helderbergian) age.

Figures 1-3. Transverse and longitudinal sections of USNM 314001; loc. 8 of Bowen (1967, p. 67), Pinto, Maryland; x5 (longitudinal section), x10 and x25 (transverse section).

Figures 4, 7. Transverse and longitudinal sections of USNM 314002; loc. 8 of Bowen (1967, p. 67), Pinto, Maryland; x10.

Figures 5, 6. Transverse and longitudinal sections of USNM 314003; loc. 12 of Bowen (1967, p. 68), Keyser, West Virginia; x5.



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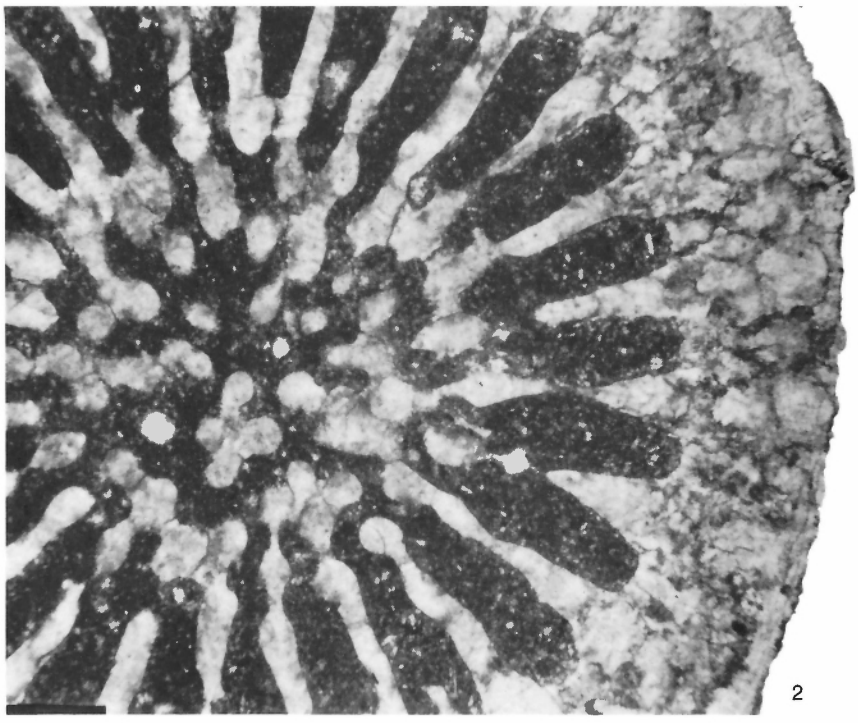

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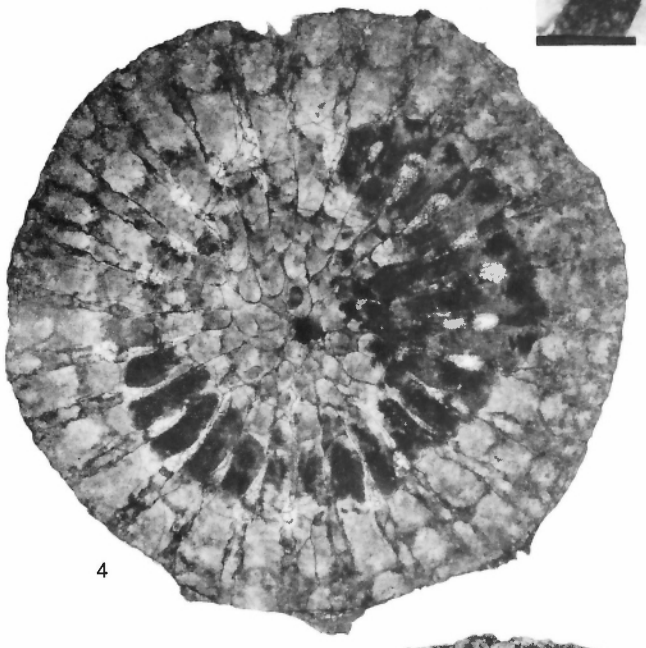

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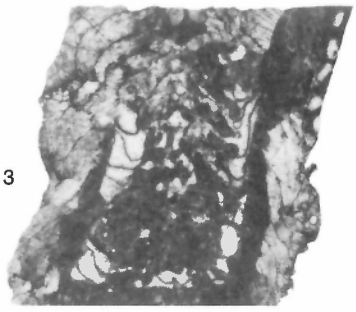

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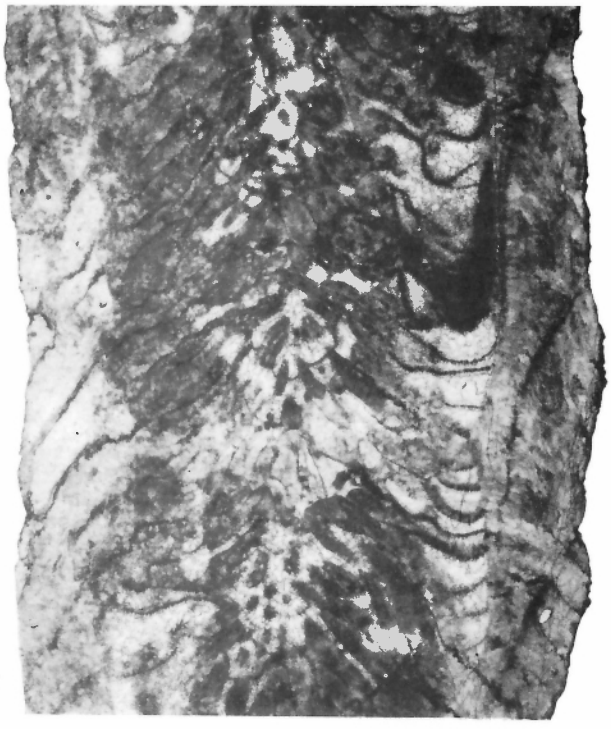

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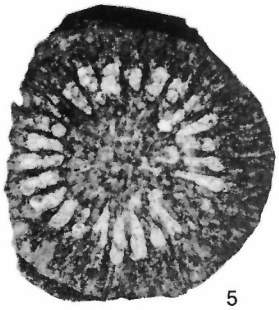

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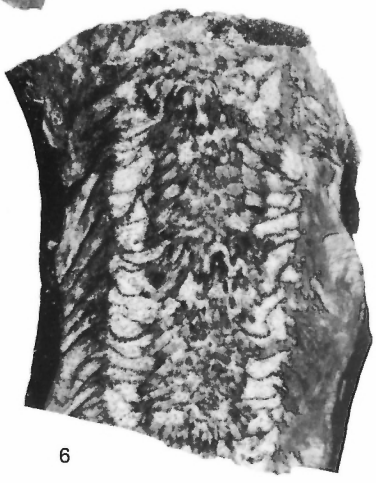

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PLATE 5

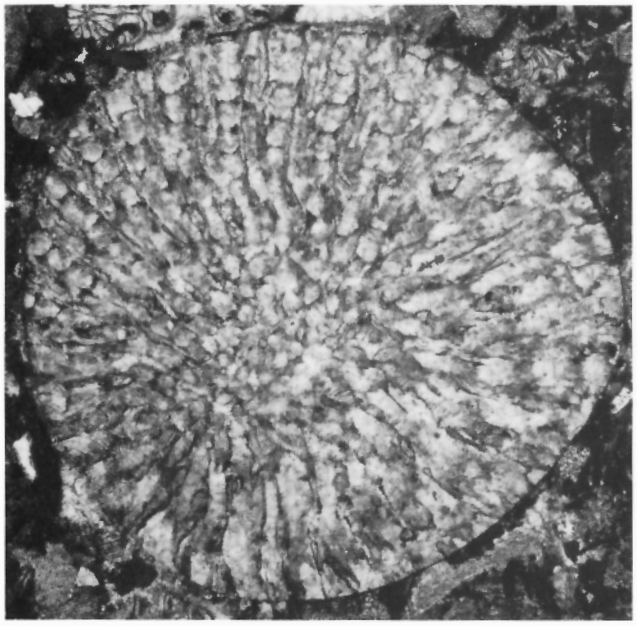
Stauromatidium marylandicum (Swartz, 1913)

All specimens are from limestones of Lochkovian (Helderbergian) age, Indian Pond, Piscataquis County, Maine.

Figures 1, 2, 5. Transverse and longitudinal sections of USNM 314006; USGS loc. 8992-SD; x5 (longitudinal section), x10 and x25 (transverse section).

Figures 3, 4. Transverse and longitudinal sections of USNM 314007; USGS loc. 7880-SD; x5 (longitudinal section), x10 (transverse section).

Figure 6. Longitudinal section of USNM 314008; USGS loc. 8992-SD; x10.



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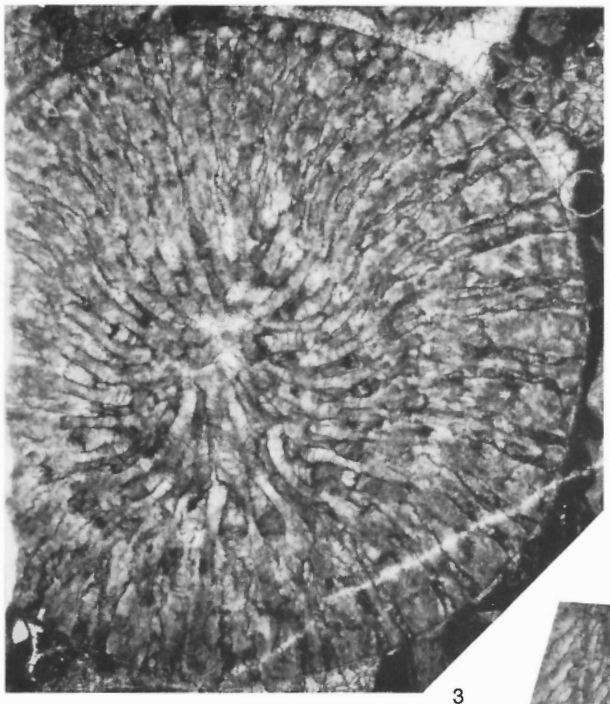

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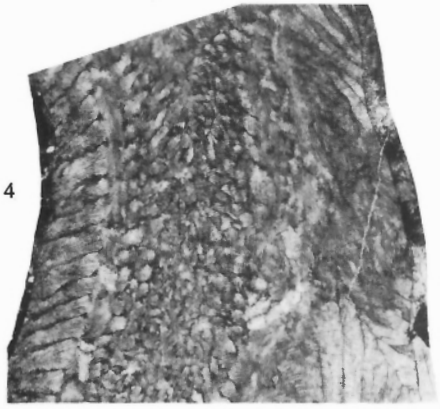

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PLATE 6

Stauromatidium sp. cf. **S. marylandicum** (Swartz, 1913)

Figures 1, 2. Longitudinal and transverse sections of USNM 314010; lower part of Windmill Limestone (as defined by Johnson, 1965, p. 369-372), Lochkovian age, Coal Canyon, northern Simpson Park Range, Nevada; x5.

Figure 3. Transverse section of USNM 317276 (figured as **Calostylis**? sp. by Merriam in Merriam and McKee, 1976, plate 7, figure 7); USGS collection M-1314, Lochkovian part of the Roberts Mountains Formation, Bootstrap Hill, southern Tuscarora Mountains, Nevada; x5.

Figures 4, 5. Longitudinal section of USNM 166481 (figured as **Kodonophyllum** sp. b by Merriam in Merriam and McKee, 1976, plate 5, figure 23); USGS collection M-1314, Lochkovian part of the Roberts Mountains Formation, Bootstrap Hill, southern Tuscarora Mountains, Nevada; x5 and x10.

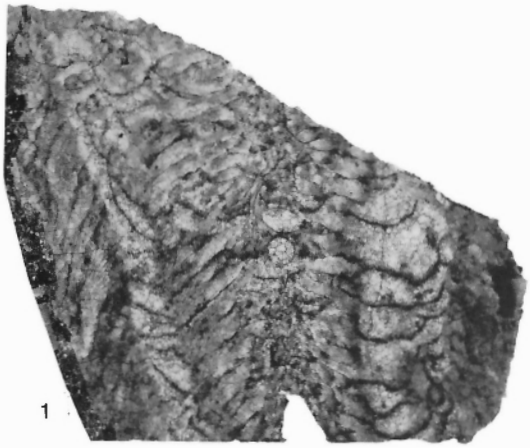
Figure 6. Transverse section of USNM 317277; USGS collection M-1314, Lochkovian part of the Roberts Mountains Formation, Bootstrap Hill, southern Tuscarora Mountains, Nevada; x5.

Figure 7. Transverse section of USNM 317278; USGS collection M-1314, Lochkovian part of the Roberts Mountains Formation, Bootstrap Hill, southern Tuscarora Mountains, Nevada; x5.

Figure 8. Longitudinal section of USNM 314009 (figured as **Kodonophyllum** sp. b by Merriam in Merriam and McKee, 1976, plate 5, figure 24); USGS collection M-1314, Lochkovian part of the Roberts Mountains Formation, Bootstrap Hill, southern Tuscarora Mountains, Nevada; x5.

Stauromatidium rhopalium (Oliver, 1960)

Figures 9, 10. Transverse and longitudinal sections of the holotype, USNM 137831 (figured Oliver, 1960, plate 4, figures 1, 2); USGS loc. 3499-SD, Beck Pond Limestone, Lochkovian (Helderbergian) age, 0.16 km south of Beck Pond, Somerset County, Maine; x10.



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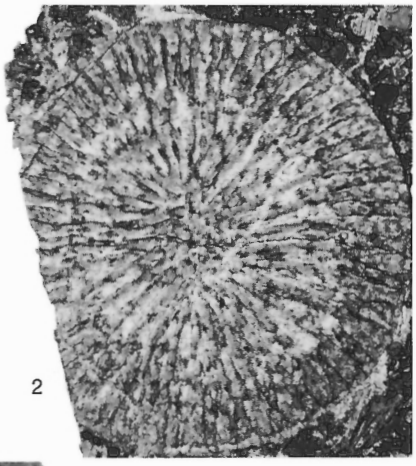

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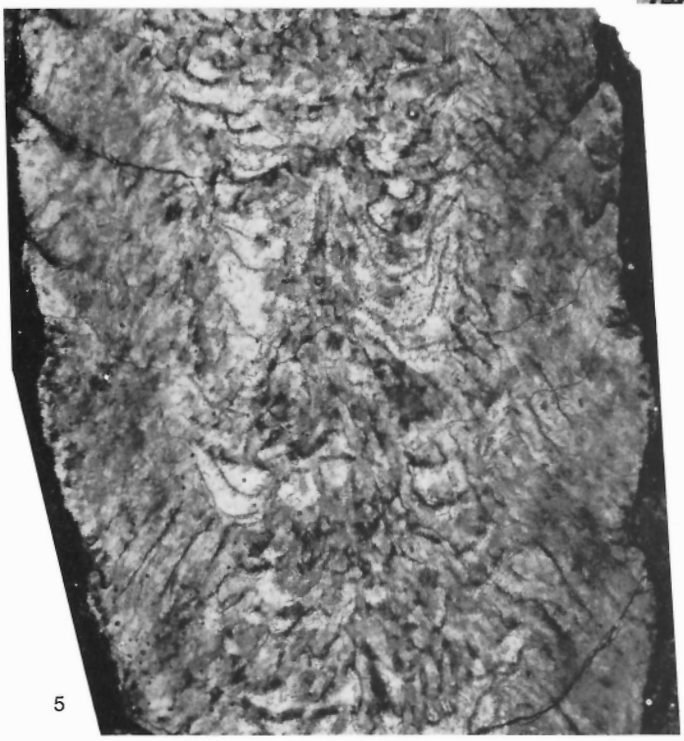

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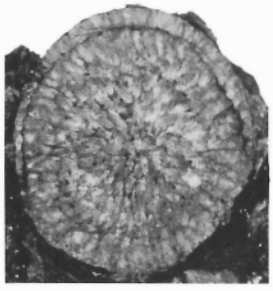

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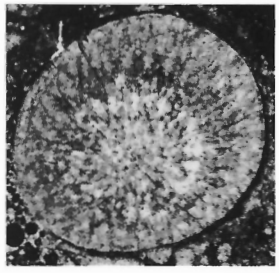

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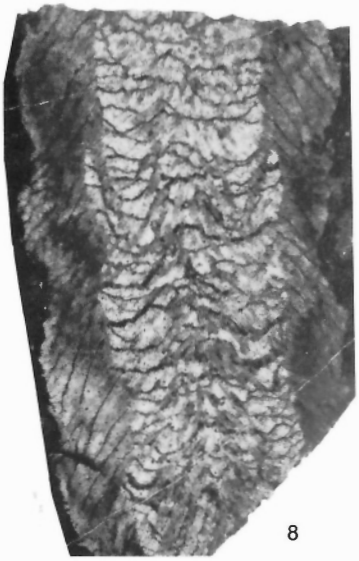

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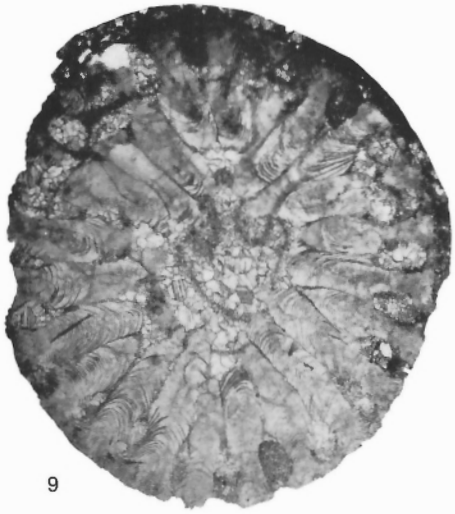

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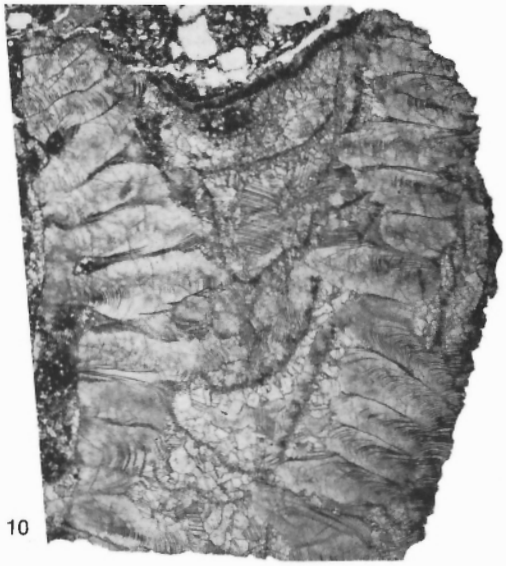

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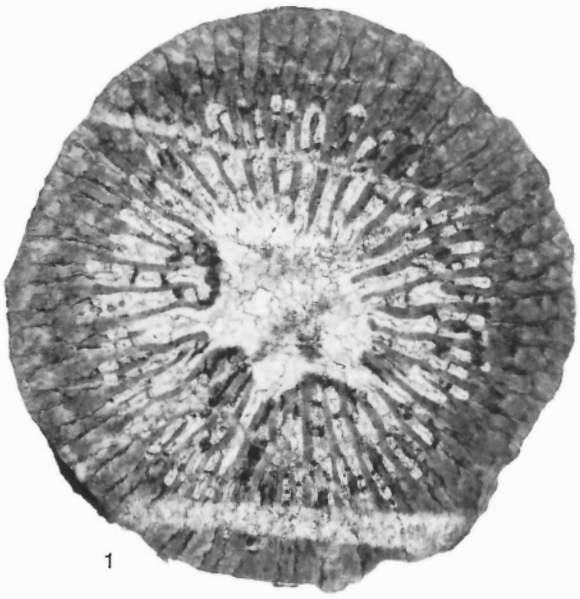
PLATE 7

Stauromatidium montjolicum sp. n.

Both specimens are from QMER loc. 62-L12, which is at the base of the type exposure of the Mont Joli Formation, Lochkovian (Helderbergian) age, sea-cliff about 155-160 m southwest of Mont-Joli Headland, northeast Percé Township, Gaspé, Québec.

Figures 1-3. Transverse and longitudinal sections of the holotype, GSC 65077; x5 and x25 (detail of longitudinal section).

Figures 4-6. Transverse and longitudinal sections of paratype GSC 65078; x5 and x25 (detail of longitudinal section).



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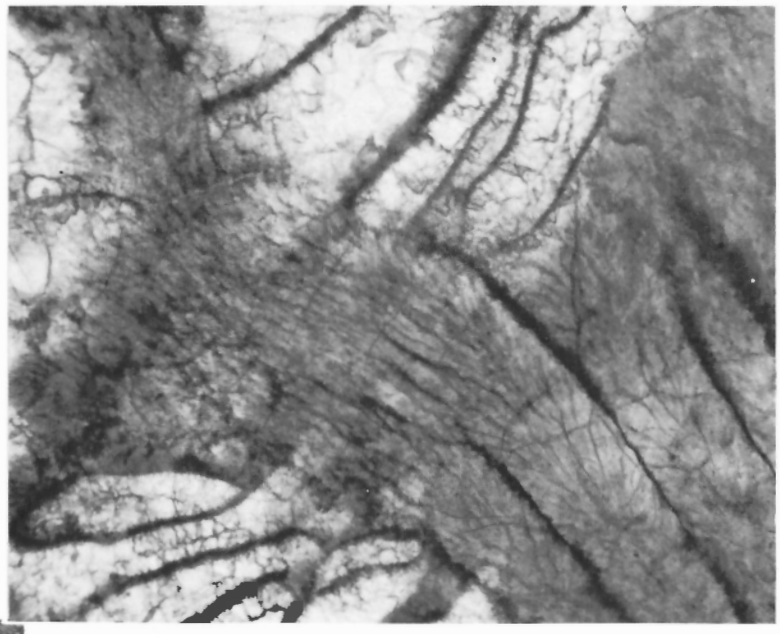

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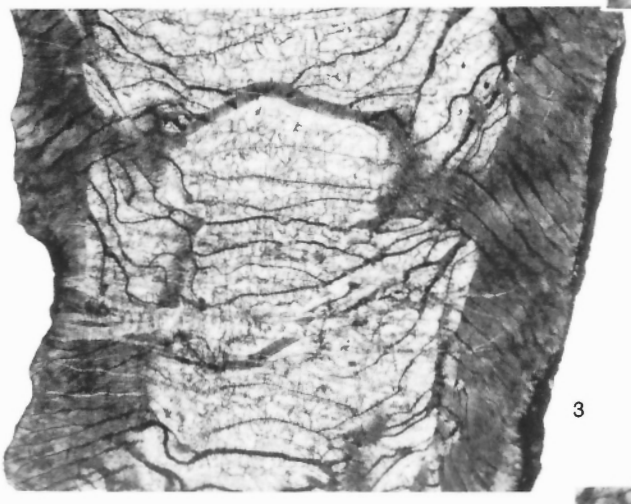

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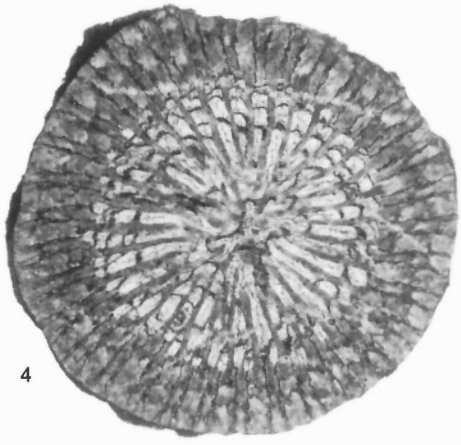

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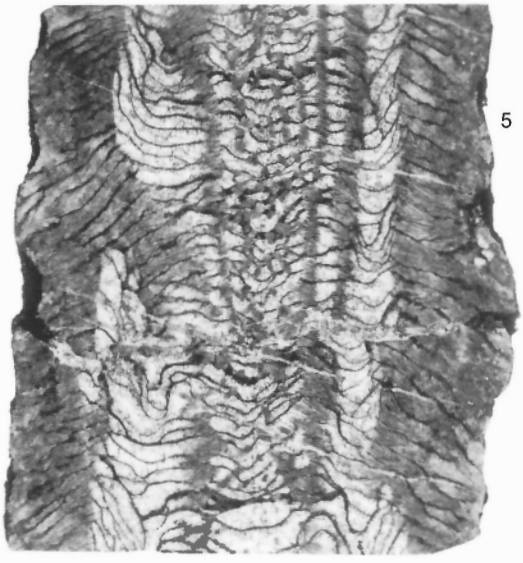

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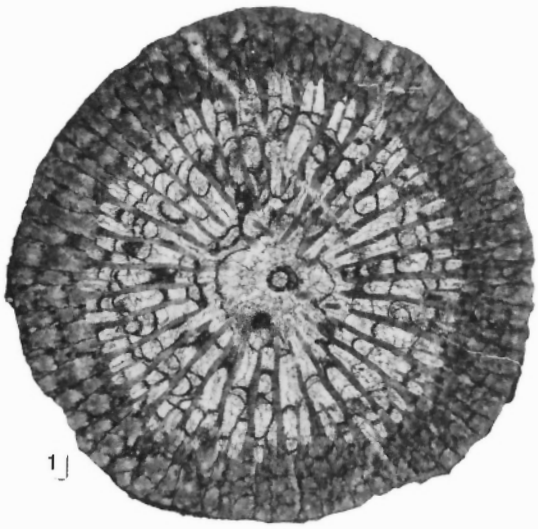
PLATE 8

Stauromatidium montjolicum sp. n.

Both specimens are from the Mont Joli Formation, Lochkovian (Helderbergian) age, northeast Percé Township, Gaspé, Québec.

Figures 1-4. Transverse and longitudinal sections of paratype GSC 65079; QMER loc. 62-L12, sea-cliff about 155-160 m southwest of Mont-Joli Headland; x5 and x25 (details of transverse section).

Figures 5, 6. Longitudinal and transverse sections of paratype GSC 65082; QMER loc. 62-L28, base of sea-cliff, 61 m ("200 feet") southeast of Grande Coupe Brook; x5.



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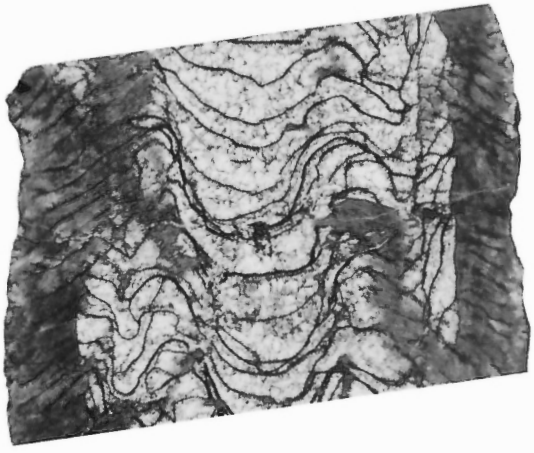

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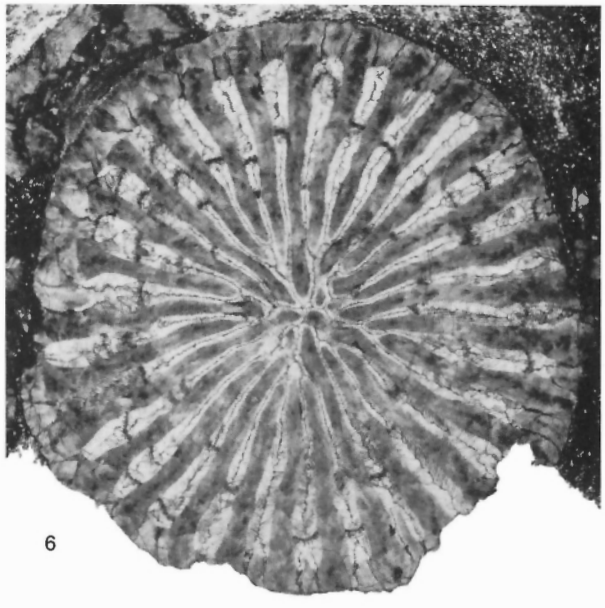

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PLATE 9

Stauromatidium montjolicum sp. n.

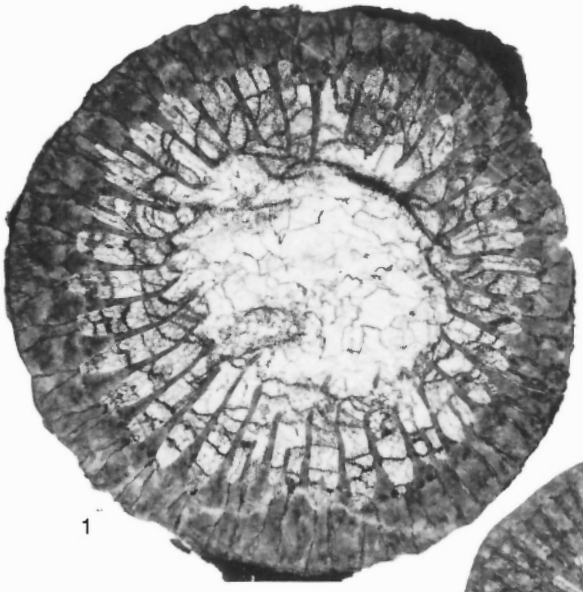
All specimens are from the Mont Joli Formation, Lochkovian (Helderbergian) age, northeast Percé Township, Gaspé, Québec.

Figures 1, 2. Transverse and longitudinal sections of paratype GSC 65080; QMER loc. 62-L12, base of type exposure of Mont Joli Formation, sea-cliff about 155-160 m southwest of Mont-Joli Headland; x5.

Figures 3, 6. Transverse and longitudinal sections of paratype GSC 65083; QMER loc. 62-L28, base of sea-cliff, 61 m ("200 feet") southeast of Grande Coupe Brook; x5.

Figures 4, 7. Transverse and longitudinal sections of paratype GSC 65085; QMER loc. S-62-F37a, Percé North Beach, below high-tide level, 61 m ("200 feet") southeast from northwest end of outcrops near Biard's Wharf; x5.

Figures 5, 8. Transverse and longitudinal sections of paratype GSC 65084; QMER loc. 62-L28, base of sea-cliff, 61 m ("200 feet") southeast of Grande Coupe Brook; x5.



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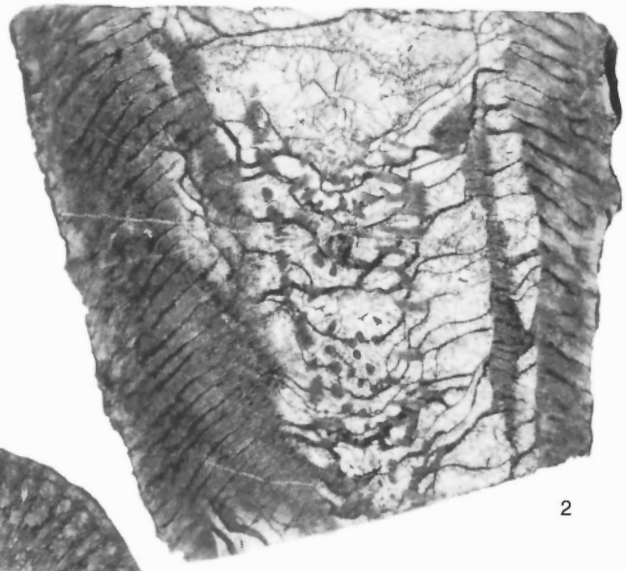

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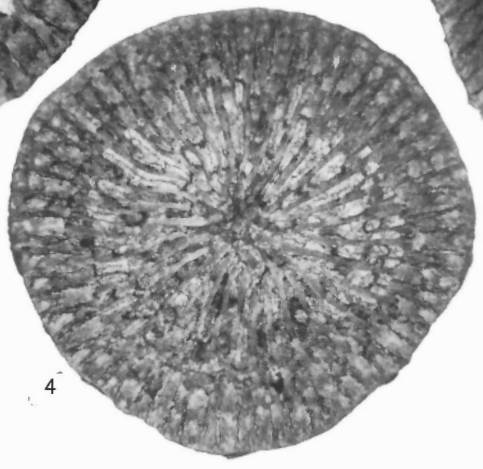

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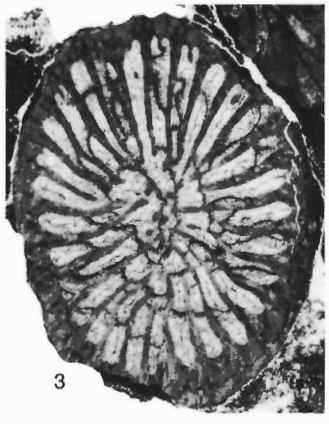

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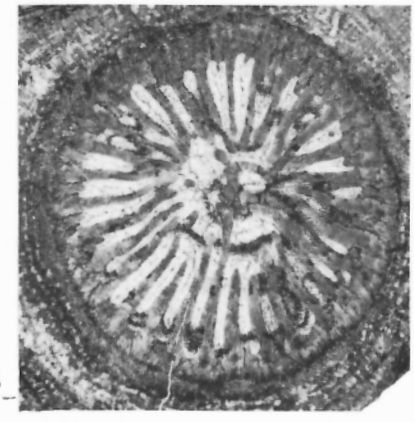

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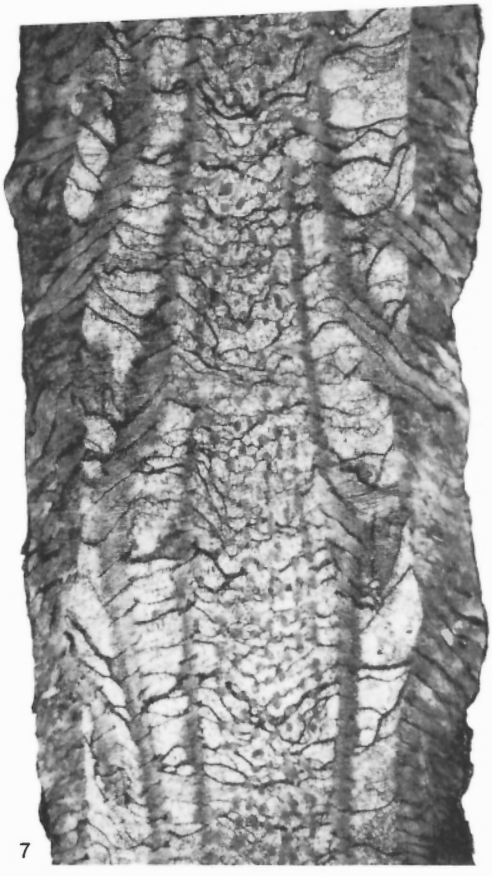

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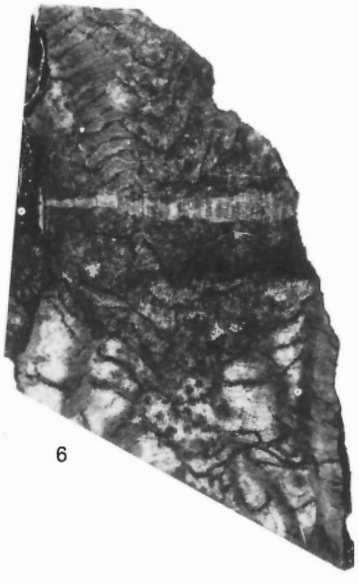

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PLATE 10

Stauromatidium sp. A

Figures 1, 2. Transverse and longitudinal sections of USNM 137834, paratype of **Tryplasma rhopalium** (figured Oliver, 1960, plate 4, figures 6, 7); USGS loc. 3499-SD, Beck Pond Limestone, Lochkovian (Helderbergian) age, 0.16 km south of Beck Pond, Somerset County, Maine; x5.

Figures 3. Transverse section of USNM 314013; USGS loc. 7880-SD, limestone of Lochkovian (Helderbergian) age, Indian Pond, Piscataquis County, Maine; x5.

Stauromatidium sentum sp. n.

Both specimens are from GSC loc. 69303, in the Pragian part of the Road River Formation, Royal Creek headwaters area (section 1 of authors), Yukon Territory.

Figures 4, 5. Transverse and longitudinal sections of the paratype, GSC 65076; x5.

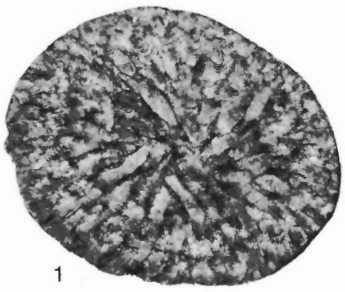
Figures 7, 8, 11, 12. Three transverse sections and a longitudinal section of the holotype, GSC 65075; x5.

Stauromatidium sp. B

Both specimens are from the Kushnova Horizon, Pragian, probably early Pragian age, Zinzilban Gorge, left side of Dzhindy-Darya River Valley, Uzbekistan S.S.R.

Figures 6, 9. Longitudinal and transverse sections of IGG AN Uz.SSR II-6/860z/364 (figured as **Farabophyllum farabicum** by Erina in Kim et al., 1978b, plate 32, figures 3a, b); x5.

Figures 10, 13. Transverse and longitudinal sections of IGG AN Uz.SSR II-6/860z/370; x5.



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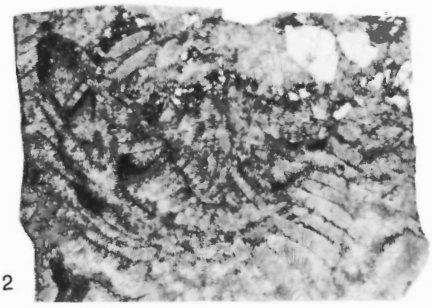

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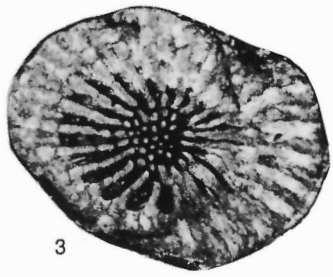

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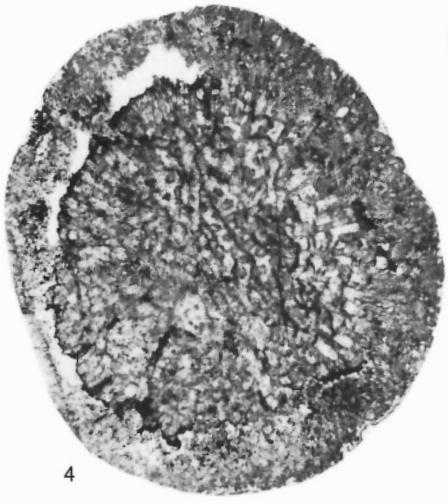

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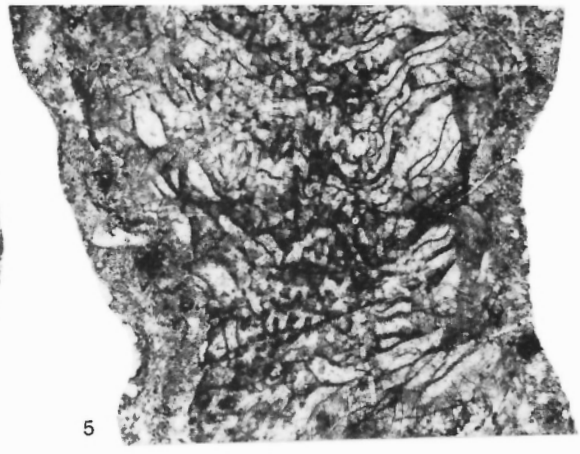

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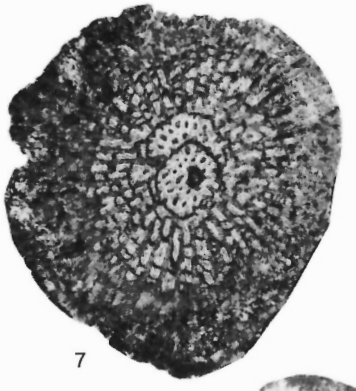

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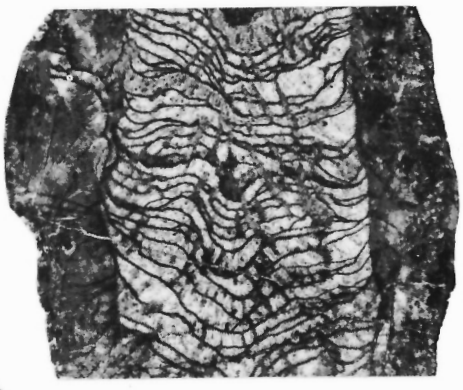

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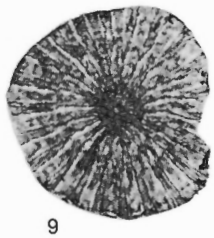

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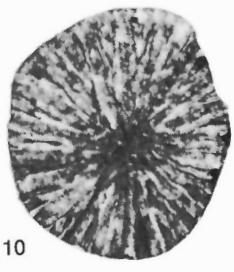

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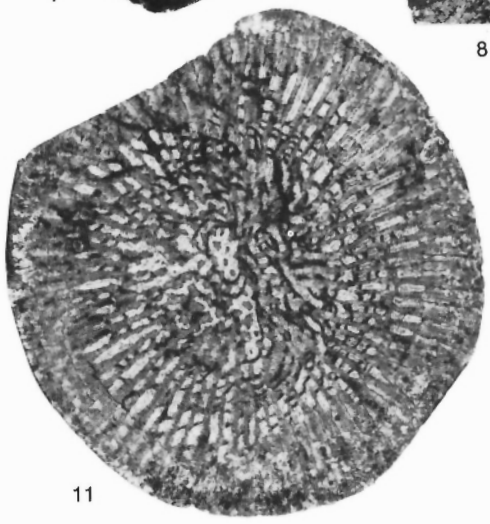

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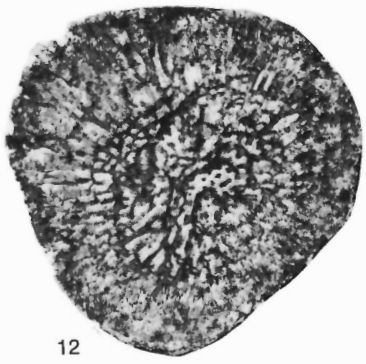

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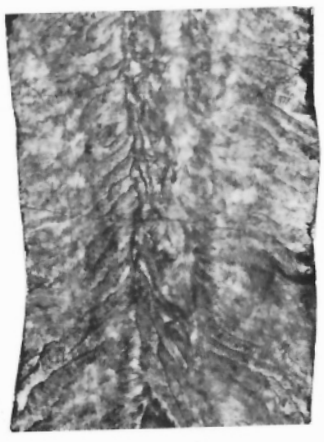

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PLATE 11

Stauromatidium trigemma (Davis, 1887)

All specimens are believed to be from the upper coral zone of the Jeffersonville Limestone, late Dalejan or early Eifelian (certainly early Southwoodian) age.

Figures 1, 2, 7. Longitudinal and transverse sections, and exterior view of the paralectotype, MCZ 7547 (original of Davis, 1887, plate 130, figure 1); Falls of the Ohio River, Louisville, Kentucky; x1 (exterior view) and x5 (sections).

Figures 3, 4, 8. Transverse sections (small colony?) and longitudinal section of UMMP 5274 (figured Stumm, 1965, plate 43, figures 9-11); Charlestown Landing, Clark County, Indiana; x5 (transverse sections in figure 3) and x10 (transverse section in figure 4 and longitudinal section).

Figures 5, 6. Longitudinal section and exterior view of the lectotype (chosen by Stumm, 1965, p. 47), MCZ 7548 (original of Davis, 1887, plate 130, figure 2 and Stumm, 1965, plate 43, figure 8); Falls of the Ohio River, Louisville, Kentucky; x1 (exterior view) and x5 (longitudinal section).

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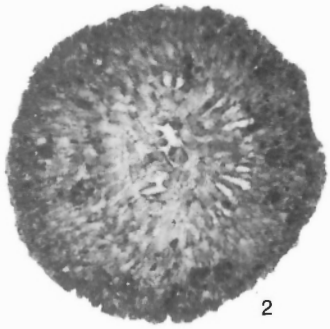

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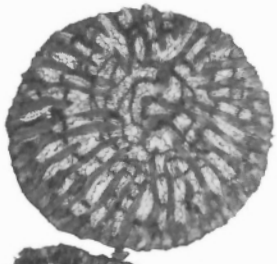

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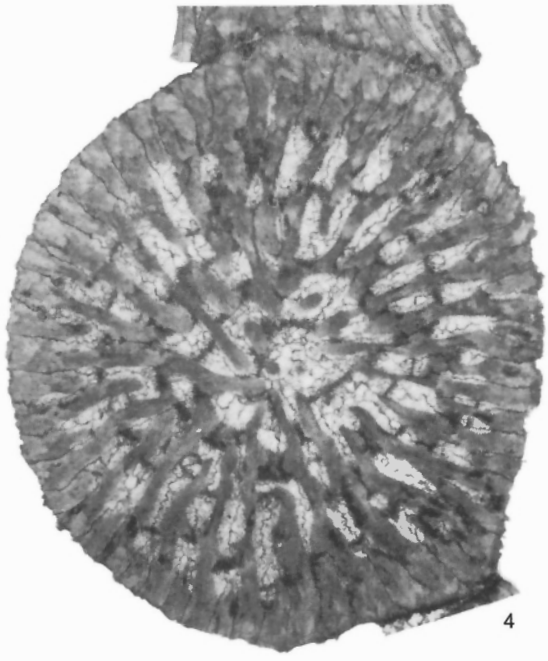

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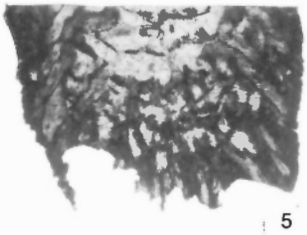

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PLATE 12

Stauromatidium trigemma (Davis, 1887)

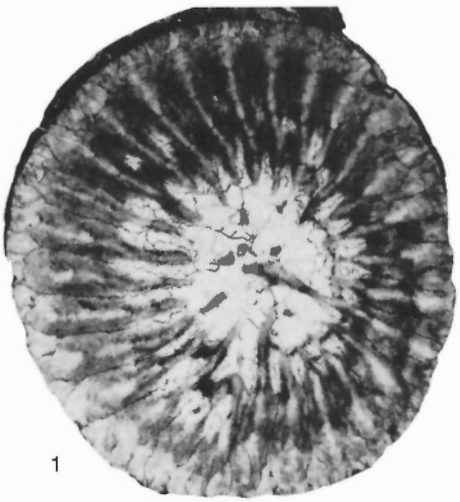
All specimens are from the coral zone (Zone C) of the Columbus Limestone, late Dalejan or early Eifelian (certainly early Southwoodian) age, in well cores from Avon Township, Lorain County, Ohio.

Figures 1-3, 5. Transverse and longitudinal sections of UMMP 64446; core W8 at a depth of 337.48 m (1106.5 ft); x5 (longitudinal section), x10 (transverse section), x25 (detail of transverse section) and x50 (detail of longitudinal section).

Figures 4, 6. Longitudinal and transverse sections of UMMP 64447; core W19 at a depth of 344.65 m (1130 ft); x5.

Figures 7, 8. Transverse and longitudinal sections of UMMP 64448; core W19 at a depth of 346.17 m (1135 ft); x5.

Figures 9, 10. Longitudinal and transverse sections of UMMP 64449; core W19 at a depth of 345.87 m (1134 ft); x5.



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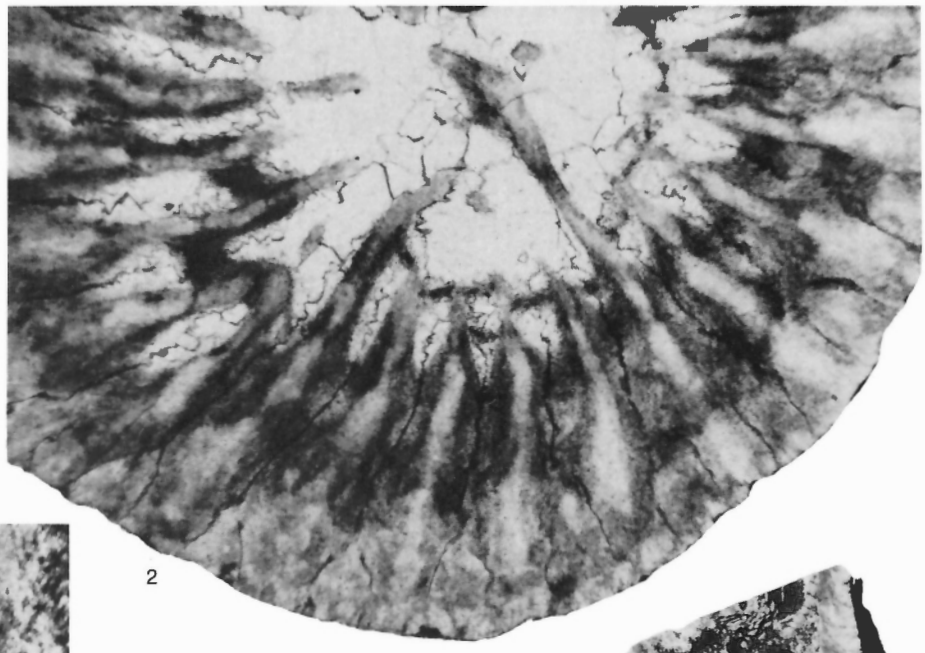

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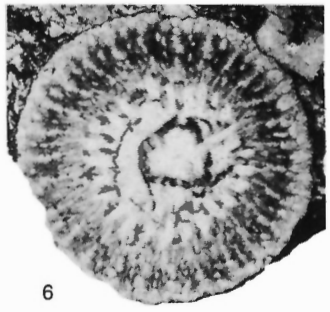

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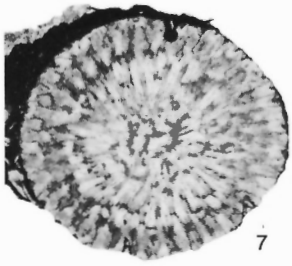

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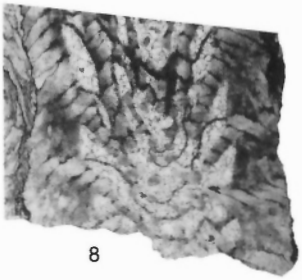

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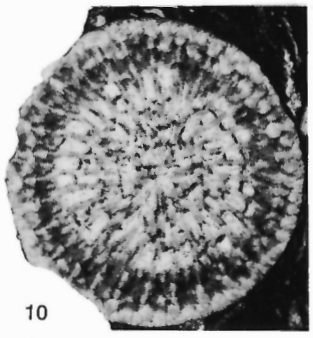

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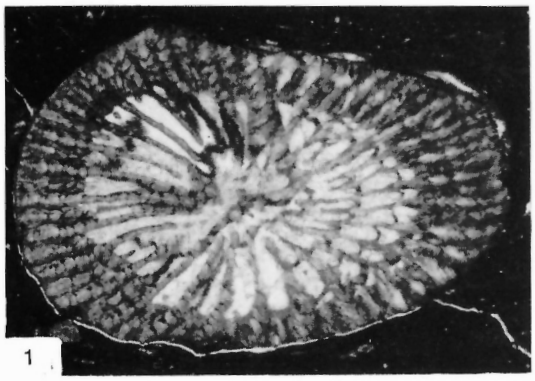
PLATE 13

Stauromatidium trigemma (Davis, 1887)

Figures 1-5. Transverse and longitudinal sections of USNM 314016; USGS loc. 5063-SD, Amherstburg Formation, late Dalejan or early Eifelian (certainly early Southwoodian) age, 2.56 km east of Gorrie, Ontario; x5 and x25 (detail of transverse section only).



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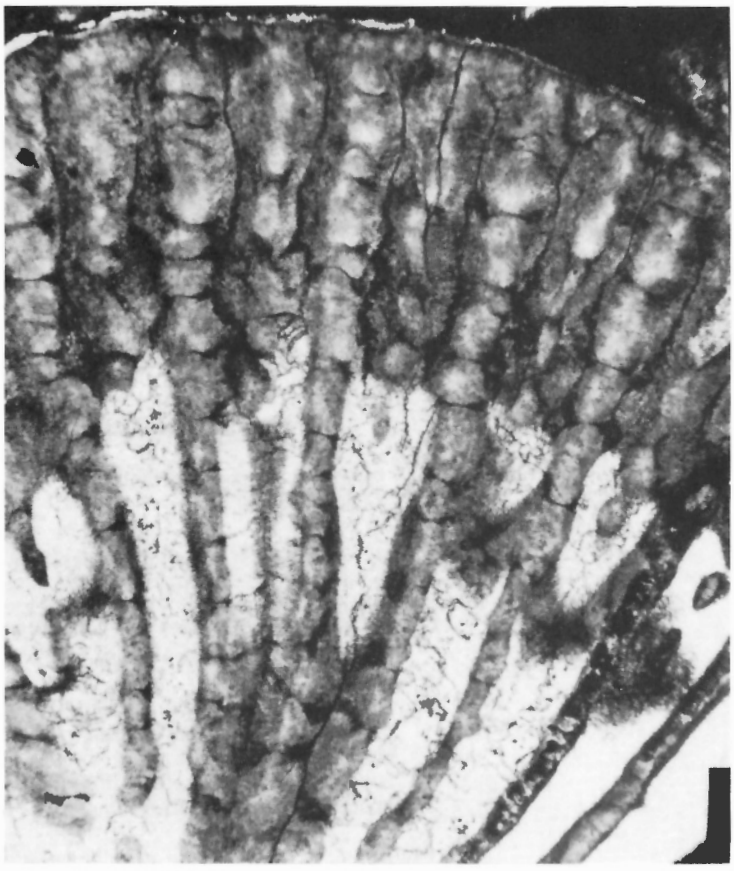

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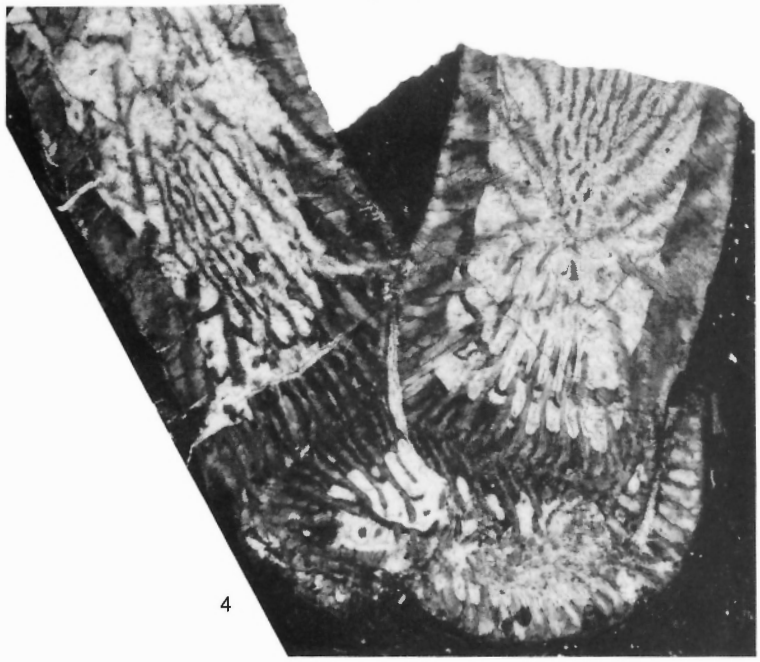

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PLATE 14

Stauromatidium trigemma (Davis, 1887)

All specimens are late Dalejan or early Eifelian (certainly early Southwoodian) age.

Figures 1, 4, 5. Transverse and longitudinal sections, probably from same corallum, arranged on plate so that each longitudinal section is below the corresponding transverse section, USNM 314017; USGS loc. 5063-SD, Amherstburg Formation, 2.56 km east of Gorrie, Ontario; x5.

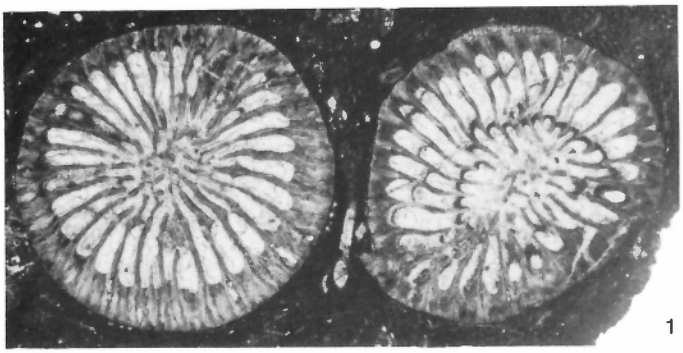
Figures 2, 3. Transverse and longitudinal sections of UMMP 36117, paratype of **Synaptophyllum grabaui** (figured Fagerstrom, 1961, plate 3, figures 11, 12); loc. 12 of Fagerstrom, 1961, Amherstburg Formation, Formosa reef facies, Brant Township, Bruce County, Ontario; x5.

Figures 6, 7. Transverse and longitudinal sections of UMMP 36116, paratype of **Synaptophyllum grabaui** (figured Fagerstrom, 1961, plate 3, figures 13, 14); loc. 12 of Fagerstrom, 1961, Amherstburg Formation, Formosa reef facies, Brant Township, Bruce County, Ontario; x5.

Figures 8, 9, 12. Two transverse sections taken from just above (figure 12) and below (figure 8) the longitudinal section, USNM 314018; USGS loc. 5063-SD, Amherstburg Formation, 2.56 km east of Gorrie, Ontario; x5.

Synaptophyllum grabaui Fagerstrom, 1961

Figures 10, 11. Longitudinal and transverse sections of the previously unillustrated holotype, UMMP 13083, shown for comparison with the paratypes in figures 2, 3, 6, 7; Amherstburg Formation, Detroit River, Michigan-Ontario boundary; x5.



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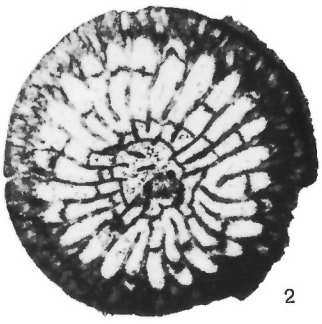

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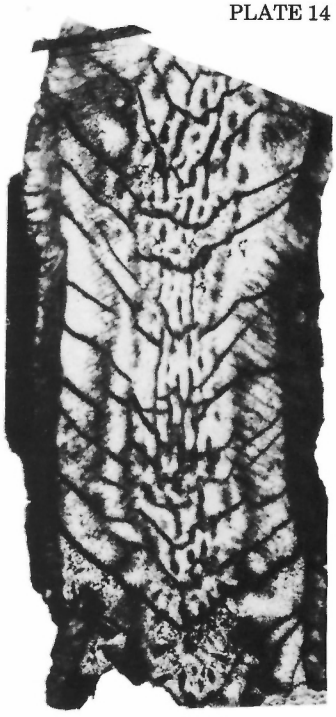

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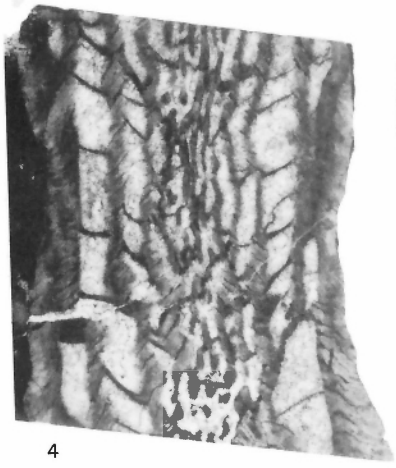

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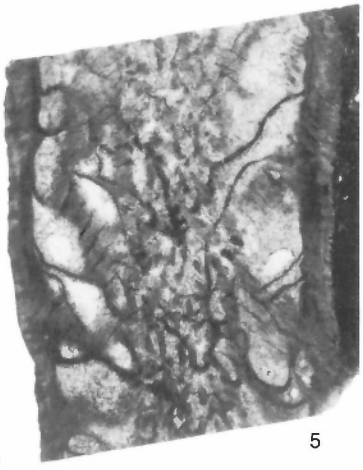

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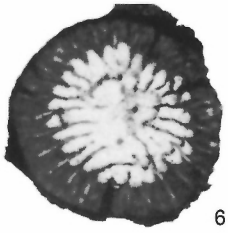

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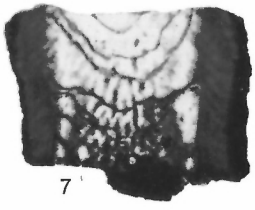

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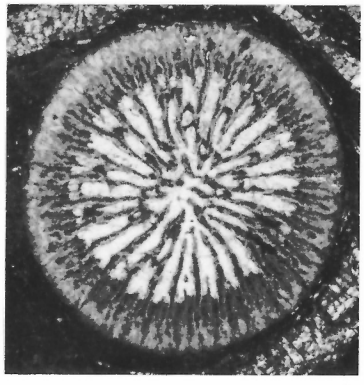

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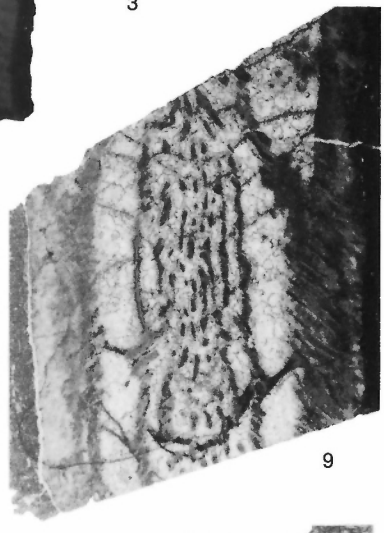

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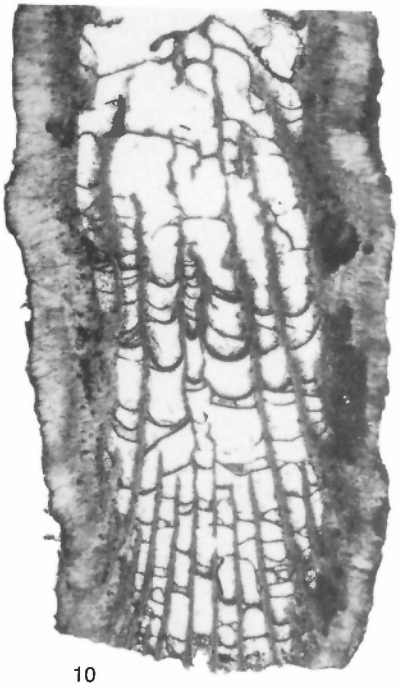

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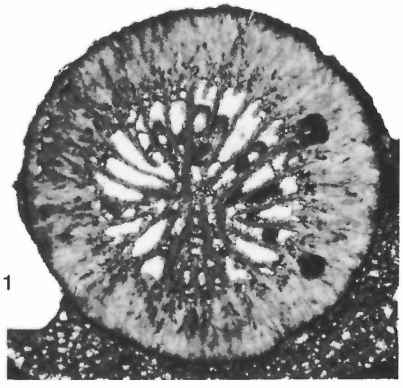

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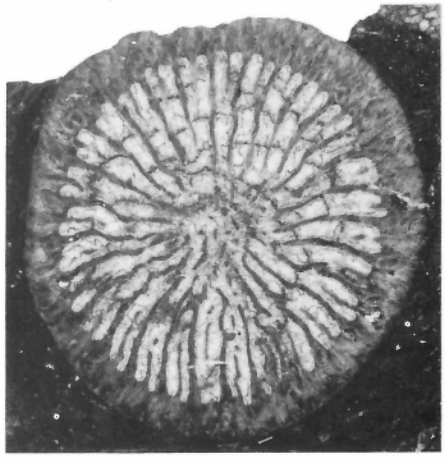


12

PLATE 15

Farabophyllum farabicum Lavrusevich, 1971

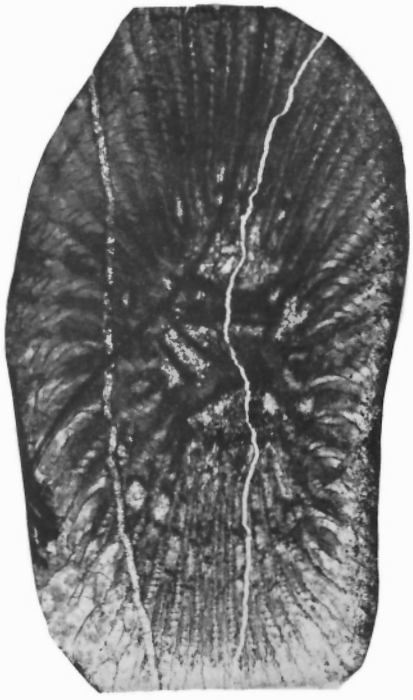
Both specimens are from the Shut Horizon, **Farabophyllum** (?) **intermedium** Zone (Pragian), Zeravshan-Gissar region, Tadzhikistan S.S.R.

Figures 1, 3, 4, 6. Transverse, oblique and longitudinal sections of the holotype, UGSM Tadzh. SSR 2225/1 (figured Lavrusevich, 1971, plate 10, figures 2a, b, v); Obi-Khunda Ridge, left side of the Farab River Valley; x5 and x10 (longitudinal section in figure 6 only).

Figures 2, 5. Longitudinal and transverse sections of paratype, UGSM Tadzh. SSR C556a (figured Lavrusevich, 1971, plate 10, figures 3a, b, v); Devo-Sary Ravine, 3 km above mouth; x5.

1

2



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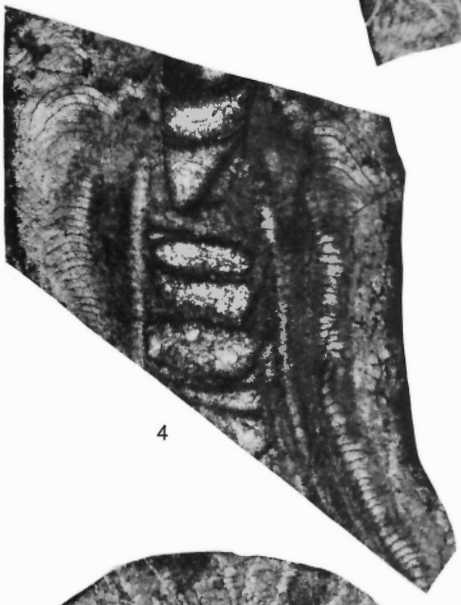

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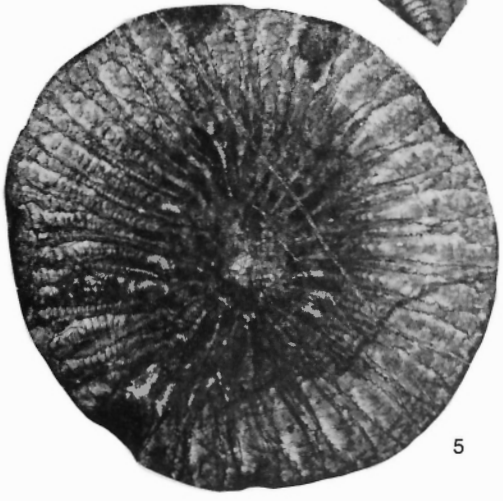

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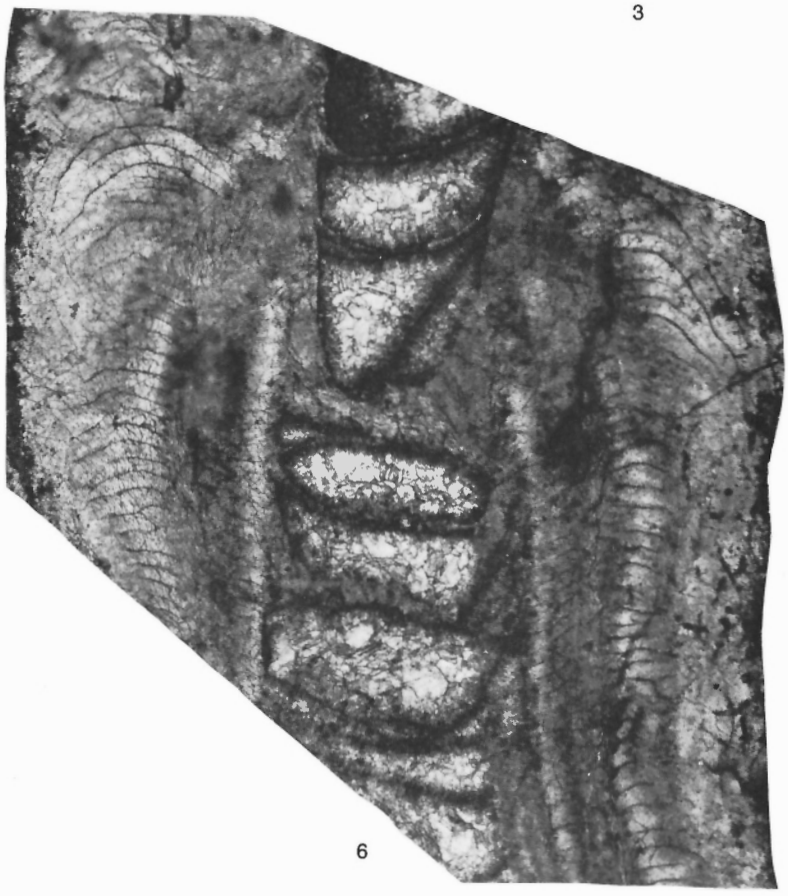

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