GEOLOGICAL
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OF
CANADA

DEPARTMENT OF MINES
AND TECHNICAL SURVEYS

BULLETIN 80

CONTRIBUTIONS TO CANADIAN PALÆONTOLOGY

PART I — On the Ordovician Corals *Palaeophyllum rugosum* Billings and *Nyctopora billingsii* Nicholson

by **Dorothy Hill**

PART II — Notes on some Ordovician Corals

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PREFACE

The two papers comprising this bulletin complement each other. The first, by Dr. Dorothy Hill of the University of Queensland, Australia, who is a world authority on Palæozoic corals, redescribes the type specimens of two Ordovician corals in the collections of the Geological Survey of Canada. There has been considerable uncertainty in the interpretation of these two old species *Palaeophyllum rugosum* Billings and *Nyctopora billingsii* Nicholson. Together with the systematic discussion of some related forms this paper provides a much needed revision. The second paper describes some related forms in the Survey collections and assigns two of them to new species of the genus *Palaeophyllum* Billings.

J. M. HARRISON,
Director, Geological Survey of Canada

OTTAWA, December 7, 1960

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G. Winston Sinclair

ON THE ORDOVICIAN CORALS *PALAEOPHYLLUM RUGOSUM* BILLINGS AND *NYCTOPORA BILLINGSII* NICHOLSON

Dorothy Hill[1]

Abstract

The type specimen of *P. rugosum* and Nicholson's thin sections of *N. billingsii* are described and figured. *Palaeophyllum* is shown to be distinct from *Streptelasma* and the Streptelasmatina and similar to *Columnaria*, and is placed in the Columnariina. *Columniphyllum* Quenstedt 1879 is discussed, its type species selected and it becomes an objective synonym of *Columnaria* Goldfuss 1826. The family relationships of *Columnaria sulcata* are discussed and further study on European species is shown to be necessary before the nominal ordinal position of the Phillipsastraeidae can be safely established. *Nyctopora* is considered to belong to the family Syringophyllidae Pocta 1902.

Résumé

Cet ouvrage présente une description et une figuration de l'échantillon type de P. *rugosum* et des plaques minces de *N. billingsii* telles que préparées par Nicholson. Le *Palaeophyllum* est classé auprès des *Columnariina* bien qu'il semble différent des *Streptelasma* et des Streptelasmatina et semblable aux *Columnaria*. On y étudie le *Columniphyllum* Quenstedt 1879 et choisit ses espèces typiques; il est considére comme synonyme aux *Columnaria* Goldfuss 1826. L'affinité au sein des *Columnaria sulcata* porte à croire qu'il faudra étudier plus à fond l'espèce européenne avant de pouvoir déterminer avec certitude la place numérique ordinale des Phillipsastraeidae. On condidère les *Nyctopora* comme appartenant à la famille des Syringophyllidae Pocta 1902.

[1]University of Queensland, Australia.

Introduction

There has been considerable uncertainty in the interpretation of the two coral genera, *Palaeophyllum* Billings and *Nyctopora* Nicholson. This study is an attempt to clarify the situation and gives a redescription of the type material in the collections of the Geological Survey of Canada together with a discussion of the systematics of some related forms. The affinities of *Palaeophyllum* are shown to lie with *Columnaria* rather than with *Streptelasma* and the genus is accordingly placed in the Columnariina. *Nyctopora* is assigned to the family Syringophyllidae Pocta 1902. Grateful acknowledgment is made to Dr. H. Dighton Thomas for advice and bibliographic research in the British Museum (Natural History) in connection with Quenstedt's genus *Columniphyllum*.

Description of the Type Specimen of *Palaeophyllum rugosum* Billings 1858

The specimen selected by Lambe (1899, p. 217; 1901, p. 101) as lectotype is the syntype numbered 1379 in the collection of the Geological Survey of Canada. It was collected by J. Richardson in 1857 from Lake St. John, Little Discharge, and its horizon was given by Billings (1858) in his original description as Trenton. G. Winston Sinclair has informed me (*in litteris*) that the ". . . specimen is unique and will remain so, for its type locality is gone. I spent some weeks at Lake St. John last summer[1], hoping to check some of these old localities, but Limestone Island in the Little Decharge is completely submerged. However, I see no reason to doubt Billings' determination of the age as being Black River or lowermost Trenton (the precise drawing of this line is a problem all over eastern North America). He was a very careful worker, and knew that Richmond beds occurred on Snake Island in the Lake (now also submerged), and clearly stated that the Limestone Island beds were not Richmond, but the same as those seen at Pointe Bleue on the mainland. I have never seen it at Pointe Bleue, but it may yet turn up."

The type specimen is a block some 10 cm high by 8 cm by 6 cm, and has been in part silicified; the walls and peripheral parts of the septa have been replaced, but the axial ends of the septa and the tabulae have been affected in only a few corallites. The corallites of the phacelo-cerioid corallum have been etched out from much of the matrix, mainly by surface weathering but partly by laboratory intensification. Three thin transverse sections have been prepared from 5 mm of material cut from the base of the specimen, and two thin vertical sections from a small piece knocked off the back. The part of the surface figured diagrammatically by Lambe (1901, Pl. 6, fig. 3) is retained undamaged. New corallites arise frequently from the extreme margin of the calice, the offset being one-half mm at point of origin, increasing in diameter to about 4 mm in a height of 4 or 5 mm,

[1]1955.

after which the diameter increases more slowly; the parent corallite normally continues to grow parallel and sometimes in contact with the offset, so that increase appears lateral. The calices have long steeply sloping sides. Beekite rosettes prevent one from establishing whether the walls have external longitudinal ridging and grooving.

The thin sections show the corallum to be in part cerioid and in part phaceloid; in much of the corallum the corallites are in contact and polygonal through mutual pressure, but on the outside of the colony cylindrical corallites are commoner though close together. The adult diameter is 5 to 6 mm on the average, but in some corallites it is as much as 9 mm.

A narrow peripheral stereozone (0.2 mm) is formed by the thickening of the septa at their bases. There are forty septa in the average corallite; the twenty long and somewhat wavy major septa thin rather rapidly just inside the stereozone, then attenuate more slowly as they approach the axis, which they reach or almost reach; their axial edges are without the paliform lobes that distinguish the Ordovician species of *Streptelasma*, although one corallite showed two trabeculate patches opposite the axial end of one septum in transverse section. The twenty minor septa are short, extending barely inside the peripheral stereozone. The tabulae are in general complete, with an axial depression that may be 1.13 mm wide so that they are somewhat funnel-shaped; they may have slightly downturned peripheral edges also; an occasional tabula may be incomplete, contacting with its inner, lower edge the tabula next below at the margin of the axial depression. There are no dissepiments.

Status of the Genus *Palaeophyllum*

Billings (1858) regarded his new genus as differing from *Petraia* or *Streptelasma* only by forming large fasciculate or aggregate masses instead of being simple. Lang, Smith, and Thomas (1940), Bassler (1950) and Hill (1956), followed him in regarding it as a compound streptelasmid, but Lambe (1899, p. 217; 1901, p. 101) and Duncan (1956) considered it to be related not to *Streptelasma* but to *Columnaria alveolata* Goldfuss, and to *Favistella stellata* Hall.

Streptelasma is characterized by a wide septal peripheral stereozone, by a marked fossula and by its septa having irregular paliform lobes rising upwards and inwards from the axial edges of its major septa; and by tabular floors that rise from periphery to axis in a more or less steep dome. The thin sections show that paliform lobes of *Streptelasma*-type are absent in *P. rugosum* (the only species placed in *Palaeophyllum* by Billings in 1858), and that its tabulae may have a marked axial deepening; nor is there any marked fossula; further the peripheral stereozone is narrow in *Palaeophyllum*. I am therefore led to the conclusion that *Palaeophyllum* is not closely related to *Streptelasma*.

The type specimen of *Columnaria alveolata* Goldfuss 1826 has been described and illustrated from external appearance only, no thin sections have been made, so far as I know. Lang and Smith (1935) described it as a cerioid corallum with

corallites 4 to 5 mm in diameter, about twelve major septa which reach or nearly reach the axis, and minor septa which are sometimes a quarter, sometimes nearly half, as long as the major; the specimen appears to be silicified, and the internal structures are to a great extent destroyed, but it shows the long septa and has widely spaced tabulae.

Experience has shown how uncertain it is to interpret the internal structure of a rugose corallum without thin sections, and Lang and Smith (1935) were not necessarily correct in assigning to *C. alveolata* specimens from the Richmond of Madison, Indiana, and Marion County, Kentucky. Goldfuss' specimens came from Seneca Lake, New York, but Lang and Smith noted that they were from a pebble from glacial till and interpreted them as Ordovician. It would appear that the only way in which *C. alveolata* can be securely known is by making and illustrating thin sections from the type. Nevertheless, *P. rugosum*, having twenty major septa and twenty minor septa whereas only twelve of each have been noted in the type of *C. alveolata*, could scarcely be conspecific with *C. alveolata*, though it might be congeneric.

We need to know the generic characters of *Columnaria* Goldfuss 1826 with which Lambe placed our genus in synonymy. Though Edwards and Haime (1851) and others (e.g., Lambe) have interpreted *Columnaria* on *C. alveolata*, Lang and Smith have shown that McCoy had earlier (1849) chosen *Columnaria sulcata* Goldfuss 1826 as type species. Lang and Smith gave descriptions and illustrations of thin sections cut from Goldfuss' type specimen of *C. sulcata* and concluded that it was congeneric with *C. alveolata*; their illustrations did not reproduce very well. Some rather poor photographs I have of their sections show that this cerioid species, which has corallites 6 mm in average diameter, about eighteen attenuate major septa extending along two thirds of the radius and a similar number of very short minor septa, a narrow septal peripheral stereozone and complete rather distant tabulae, has intermittently a single vertical series of dissepiments; when the dissepiments are solitary, they are narrow and vertically elongate; when several are present one above the other, the elongate plates may have smaller, globose plates separating them vertically. The dissepiments tend to be convex inwards. One septum (at the angle of a corallite) was observed to be disrupted by a lonsdaleoid dissepiment.

The presence of intermittent and elongate dissepiments seems to me sufficient to distinguish this Middle Devonian German genus *Columnaria* from the Middle Ordovician American *Palaeophyllum*.

Another genus we need to consider is *Favistella* Dana 1846, which according to Stumm (1948) is congeneric with *Favistella* Hall 1847. According to Stumm (op. cit.), *Favistella* Dana has for type species *Columnaria alveolata* Goldfuss of van Cleve, the name *Columnaria alveolaris* van Cleve used by Dana being regarded as a demonstrable *lapsus calami*. Van Cleve apparently never described his specimen, merely named it in a list in 1849, three years after Dana's publication, giving its locality as "Yellow limestone, Dayton"; but its external appearance was figured by White (1882, pl. 44) under the name *Favistella stellata*. White's drawing shows

a cerioid corallum with twelve septa in each corallite, six reaching almost to the axis, and six alternate ones approximately half as far.

Bassler's (1950) and Duncan's (1956) figures of North American Ordovician cerioid corals show many species and several genera, which cannot be accurately distinguished from external appearance only. So far as I know, van Cleve's specimen has never had thin sections made from it, so that there is yet no certainty of its morphology, whatever the specific name given to it. I do not, therefore, think it safe to assume that *Palaeophyllum* is congeneric with van Cleve's specimen, the type for *Favistella* Dana, and would not retire *Palaeophyllum* into its synonymy.

Possibly *Palaeophyllum* is the same genus as *Favistella* Hall 1847. But if we accept Stumm's (1948) findings, this latter name is a junior homonym of *Favistella* Dana 1846 and hence is unavailable. The type species of *Favistella* Hall is *Favistella stellata* Hall 1847 from the Ordovician, Hudson River group of the State of New York and Madison, Indiana. So far as I know, no thin sections have been prepared from any of Hall's syntypes, and until they have, there will be uncertainty regarding its morphology and synonymy. Hall's diagrams show a cerioid corallum with corallites 2½ to 3½ mm in average diameter, with a narrow peripheral stereozone and eleven to thirteen rather unequal septa extending almost to the axis, and from this it would appear not to be conspecific with *Palaeophyllum rugosum*; but we need to know more about its septal structure and its tabulae.

From the above discussion I conclude that *Palaeophyllum* is not the same genus as *Columnaria* and although it may prove to be *Favistella* Dana when thin sections of the type specimen of F. *stellata* are examined, we are not at present justified in assuming this synonymy. *Favistella* Hall, being a junior homonym, may not be used. Pending investigation of van Cleve's specimen (or if this is lost, of a neotype from the yellow limestone of Dayton), we may continue to use *Palaeophyllum* as a valid genus, with the following diagnosis:

Phacelo-cerioid coralla, with peripheral, non-parricidal increase; corallites with narrow peripheral stereozone and without dissepiments; major septa long, thin towards axis, without paliform lobes; minor septa short; tabulae thin, distant, commonly complete and with marked axial depression, peripheral edges of some downturned.

Family and Subordinal Relations of *Palaeophyllum* and *Columnaria*

Columnaria is the name genus of a suborder of rugosa, the Columnariina Rominger 1876, which according to Hill (1956) contains the families Stauriidae, Spongophyllidae, Chonophyllidae, Ptenophyllidae, Stringophyllidae and Lonsdaleiidae. The subordinal characters are: Corallum compound or (less commonly) solitary; marginarium absent in oldest forms, but later develops as a septal stereozone which may be replaced by a lonsdaleoid dissepimentarium, or an

incomplete series of elongate dissepiments; septa thin in tabularium, somewhat withdrawn from axis, not lobed axially; tabulae complete and flat or with down-turned edges, or sagging medially; late forms develop an axial structure of septal lamellae and conical tabellae. Increase either axial or peripheral.

There seems to me to be no doubt that *Palaeophyllum* belongs to this suborder, and I place it in the Ordovician and Silurian family Stauriidae Edwards and Haime 1850 with which I regard the family Favistellidae Chapman 1893 as likely to prove synonymous when the genolectotype of *Favistella* Dana is examined in thin sections.

Whether Columnariina is the correct name to apply to this group of families depends on whether *Columnaria* itself has the characteristic group morphology. It must be admitted that *C. sulcata*, the type species, being described from one specimen only, is insufficiently known. A photographically illustrated study of the type specimen and others from its type locality, Paffrath near Bensberg, which Glinski (1955) evidently considers to be Givetian, is urgently needed. It is so often from the variations of structure within numerous coralla of a community that one is enabled to make safe conclusions of relationship. For the type species of genera which have become the name genera of families, superfamilies and suborders, broadly based variation studies are most necessary.

Glinski (1955) concluded, from a study of the cerioid rugosa of the Eifelian of the Eifel, that *Hexagonaria* is so closely related to *Columnaria sulcata* that the two genera must be placed in the same family. *Hexagonaria* is acceptable to all as a member of the family Phillipsastraeidae Roemer 1883, (= *Disphyllidae auctt.*), and if Glinski is right in his view of the close relationship between *Hexagonaria* and *Columnaria*, and our view is right that *Columnaria* is of the family Stauriidae, then the Phillipsastraeidae should be removed from the Streptelasmatina where they were placed by Lecompte (1952) and Hill (1956) and placed in the Columnariina. Soshkina (1951) has already regarded the phillipsastraeoid families as members of the Columnariina.

However, before Glinski's conclusions can be generally accepted, we need fully illustrated studies of *Columnaria sulcata* Goldfuss, *Cyathophyllum darwini* French 1885, *Campophyllum quadrigeminum* Schluter 1881, *Columniphyllum sulcatum* Quenstedt 1881 and *Hexagonaria hexagonum* Goldfuss 1826, amongst others, with attention both to type specimens and to additional rich material from the type localities.

From admittedly poor photographs of thin sections of the type of *C. sulcata* (reproduced herewith), it seems to me that *Columnaria* can be reasonably placed in the Stauriidae with *Stauria* and *Palaeophyllum*. Its dissepiments are like those of *Stauria*, so are its septa; its fossula is not noticeable, and its tabulae are rather distant and commonly complete.

For the present it seems preferable to leave *Columnaria* and the phillipsastraeoids in separate suborders. The latter are characterized by profuse small globose dissepiments, carinate septa, septa thickened more in midlength than elsewhere, and profuse incomplete tabulae; these features seem to ally them to the

Streptelasmatina rather than to *Stauria*, near which it seems to me *C. sulcata* should be placed.

Note on *Columniphyllum* Quenstedt 1879

In his Petrefactenkunde Deutschlands VI, (3), 1879, pp. 523-25, Quenstedt introduced *Columniphyllum* as a subgeneric name, naming two species, *Columniphyllum sulcatum* from the Devonian of Bensberg which he illustrated in 1881, pl. 162, fig. 23, and *Columniphyllum alveolatum* from the Trenton group, Tennessee, illustrated in 1881, pl. 162, fig. 24. It is clear from the context that he considered his specimens to be conspecific with *Columnaria sulcata* Goldfuss 1826 from the Devonian of Bensberg and *C. alveolata* Goldfuss 1826, from a loose boulder at Seneca Lake, New York State. It is not clear from his text whether he considered *Columniphyllum* a subgenus of *Columnaria* or of *Cyathophyllum*, or merely as a minor group of corals with similar external form.

Quenstedt gave no indication as to which of Goldfuss' species he considered the type of *Columniphyllum*, but *sulcatum* is mentioned and figured first and I here choose it as type species of *Columniphyllum* by this subsequent designation. This makes *Columniphyllum* an exact synonym of *Columnaria*, since *Columnaria sulcata* Goldfuss 1826 was chosen by subsequent designation of McCoy, 1849, p. 121 as type species of *Columnaria*. *C. alveolata* Goldfuss 1826 is unsuitable as a lectotype, being a specimen from glacial till. Except for references by Frech, 1885, p. 36, and 1886, p. 73 (187), *Columniphyllum* has been overlooked.

Description of Nicholson's Figured Thin Sections of *Nyctopora billingsii* Nicholson 1879

The two thin sections in the Geological Survey of Canada collection (GSC No. 6689) are those from which the diagrammatic figures of Nicholson, 1879, pl. IX, figs. 3a, b, were drawn. They are marked with a small red spot and the label with them states that they are the holotype slides, from the Trenton (Middle Ordovician) of Peterborough, Ontario. The specimen from which they were cut has not been located in the Survey collections, and may possibly be in the Nicholson Collection in the University of Aberdeen, Scotland.

The corallum is cerioid, the corallites being about 1.4 mm in average diameter and 4-to 6-sided; the smallest corallite observed was 4-sided, with a diameter of 0.88 mm. Increase is peripheral or intermural, the small corallites appearing at the angles of the larger ones. The common wall between corallites is but seldom smooth, when it is about 0.06 mm thick; in most transverse sections it appears weakly zigzag, with short thick projections at the changes of direction; in vertical sections these projections are seen to be very short septa; the number of septa is variable, up to nine rather longer ones alternating with a similar number of shorter, thinner ones; but there is no great regularity in number from corallite to

corallite, nor in alternation of long and short. The septa appear very much as do those of *Calapoecia huronensis* Billings, each consisting of a vertical (?compound) trabecula. At the angles between the walls of some corallites as many as three septal trabeculae may be counted in the thickness of the common wall between two corallites thus forming a narrow coenenchyme sporadically. The line of junction of the fibres of calcium carbonate in neighbouring septa is plainly visible in the walls. The axial edges of the septa appear to be smooth as in *Calapoecia* and not spinose as in *Favosites*. In a few places in transverse section mural pores are visible as channels of clear calcite between the dark fibres of the septal trabeculae, smaller than the channels in *Calapoecia*, being only 0.03 mm wide, but seemingly of the same kind. In vertical section the pores are seen in horizontal rows; commonly each is found at the junction of two septa and is about 0.04 mm wide; an occasional pore however cuts through a septal trabecula; the horizontal rows were seen in one part of the corallite 0.3 mm apart, with about 0.07 mm between the neighbouring pores of the one row. In many corallites a horizontal row of pores is seen to be developed on approximately the same level as a tabula. The tabulae are complete, rather distant (0.5 mm) but somewhat irregularly spaced, horizontal, or slightly arched or saucered.

Family Relationship of *Nyctopora* Nicholson 1879

N. billingsii is the type species of *Nyctopora* and in the absence of the type specimen (from which the two slides described here were presumably cut), the genus must be interpreted primarily upon these two slides figured by Nicholson. Its characters given above, especially the mural pores and the vertical type of septal trabeculae, show it to be very closely related to *Calapoecia*, differing only in the sparse and sporadic development of coenenchyme, which is profuse in some species of *Calapoecia*, and in having very short mural pores rather than the long horizontal canals of *Calapoecia*. I therefore (*as in* Hill and Stumm, 1956), place *Nyctopora* in the Syringophyllidae Pocta 1902, to which *Calapoecia* belongs. Bassler (1950) grouped *Nyctopora* in the rugosan family Favistellidae, regarding it as imperforate, but I think one must accept Nicholson's finding of pores in the walls of the type species, even if these are smaller than in the tabulatan family Favositidae. The imperforate species placed by Bassler in the genus should be removed; they may well be Favistellidae.

NOTES ON SOME ORDOVICIAN CORALS

G. Winston Sinclair

Abstract

Redescription of *Palaeophyllum* permits re-examination of material formerly assigned to it. Specimens from Manitoba and Lake Temiskaming are shown to be distinct and are here described as two new species. *Columnaria erratica* Billings included by Lambe in *P. rugosum* is shown to be structurally similar to *Eofletcheria* Bassler. The nature of the type material for the type species of *Eofletcheria, E. incerta* Billings, is recorded for the first time. A previous record of *E. incerta* is redescribed as a new species, tentatively assigned to the genus *Aulopora.*

Résumé

Cette nouvelle description du *Palaeophyllum* permet d'examiner à nouveau le matériel qui lui était auparavant assigné. Celle-ci montre la distinction qui existe entre des échantillons récoltés au Manitoba et au lac Témiscamingue et que l'on décrit dans le présent travail comme appartenant à deux espèces inédites. On démontre que les *Columnaria erratica* rattachés par Lambe au *P. rugosum* sont voisins, du point de vue conformation, aux *Eofletcheria* Bassler. C'est la première fois qu'on enregistre la nature du matériel caractéristique de l'espèce typique d'*Eofletcheria,* appelée *E. incerta* Billings. Une description antérieure des *E. incerta* est reprise à nouveau en tant qu'espèce nouvelle rattachée pour le moment au genre *Aulopora.*

Introduction

Palaeophyllum rugosum Billings has in the past been recorded from several localities in Canada, widely separated both geographically and geologically. Dr. Hill's redescription in this Bulletin of the type species establishes the genus on a firm footing, and makes possible a re-examination of other material that has been referred to it. Two species of *Palaeophyllum* from Manitoba and Lake Temiskaming prove to be distinct and are described as *P. argus* and *P. humei*.

Lambe (1901) included *Columnaria erratica* Billings in *P. rugosum*, but Billings' type of that species shows that it is structurally similar to *Eofletcheria* Bassler. This discovery led to consideration of *E. incerta* (Billings), the type species of that genus. It has been adequately described by Okulitch (1937), but the nature of the type material is now recorded for the first time. A specimen that had been described as *E. incerta* seems to be an auloporoid, and is described as *"Aulopora" wilsonae* n.sp.

This is not the place to pursue further the many other records of *Palaeophyllum*, but it should be noted that the specimen described by Troedsson (1928, p. 111) as *Columnaria* (*Palaeophyllum*) *stokesi* (Edwards and Haime) and said to come from the Ordovician Cape Calhoun beds of northeast Greenland has been redescribed by Poulsen (1941, p. 11) as *C.* (*P.*) *troedssoni*, and assigned to the Silurian (Llandoverian) Offley Island formation.

Palaeophyllum humei n. sp.

Plate III, figures 1 to 6

Columnaria alveolata discreta Foerste. Hume, 1925, p. 18.
Columnaria (Palaeophyllum) stokesi (Edwards and Haime). Hume, 1925, p. 18.

Types. Holotype, GSC 13627; paratypes, GSC 13628 to 13632.

Locality. North end of lot 4, concession I, Dymond township, Ontario, 2 miles west of New Liskeard.

Age. Ordovician, Trentonian stage, Liskeard formation.

Description. Corallum loosely cerioid or halysitoid. Holotype 145x115 mm in size, about 45 mm high. It is the largest specimen collected, but most specimens are preserved in a shaly limestone and break apart on weathering, and some fragments indicate a larger corallum.

Corallites tend to be cylindrical, only flattening on the sides when in contact with others; longitudinal rugae faint; fine transverse lirae present, and coarse irregular annuli. Calyx fairly deep, with steep sides. Diameter of corallite 4 to 6 mm.

Walls moderately thick; primary septa about eighteen, long, almost reaching the centre, thin except for a short distended region at the proximal end; secondary septa comparatively short (about 0.5 mm) but prominent. Tabulae thin, close (six in a length of 5 mm in a corallite 6 mm wide), complete, horizontal or with

a vague mesial depression, the depth of which varies considerably; bent down peripherally.

Increase lateral, frequent. Offsets usually (always?) remain in contact with the parent. No secondary connecting processes seen.

Remarks. Hume's specimen labelled *Columnaria alveolata discreta* is in the Survey collections and is assigned to *P. humei.* This species probably also includes Hume's *C. stokesi,* but that specimen has not been found. The cerioid nature of the corallum is not apparent when only fragmentary specimens are found.

P. humei differs from the other new species *P. argus* in having no connecting processes, a more cerioid habit, and shorter primary septa. It is more halysitoid than *P. rugosum,* has longer secondary septa and more angular corallites. It is more massive than *P. halysitoides* (Troedsson).

Palaeophyllum argus n. sp.

Plate IV, figures 1 to 4; Plate VII, figure 4

Diphyphyllum stokesi Edwards and Haime (sp.). Whiteaves, 1897, pp. 152-153, pl. 17, figs. 5, 5a-b.

Columnaria rugosa Billings (sp.). Lambe, 1901, pp. 101-102, in part (*not* figured specimens).

Types. Holotype, GSC 6878, T. C. Weston, collector, 1884; paratype, GSC 6877, Donald Gunn, collector.

Locality. Lower Fort Garry, Manitoba. The holotype is labelled thus, the paratype as "Stone fort, 20 miles from Winnipeg", which is the same place.

Age. Ordovician, Dog Head member of the Red River formation (*see* Sinclair, 1959, p. 7).

Description. Corallum phaceloid, corallites occasionally in contact but usually separated, united at irregular intervals by short spiniform processes. Holotype about 11 cm high.

Corallites cylindrical, subcircular, 5 to 7 mm wide, rapidly attaining full size and growing free from the parent. Surface with fine growth lines, about ten in a length of one mm, and indefinite low annuli, 3 to 5 mm apart, and low longitudinal ridges, three in a width of one mm.

Walls fairly thick. About twenty major septa, long, reaching the centre of the corallite, thickened for about one mm of their length and then become very slender and straight. Tabulae usually complete, slightly concave, rising rather sharply peripherally, six in a length of 5 mm. Calyx not known.

Remarks. The paratype is the specimen figured by Whiteaves as *Diphyphyllum stokesi,* and the species has usually been cited as that of Edwards and Haime (1851, p. 440). However, it is clear from their original description (which is quoted by Whiteaves) and figure that their *Lithostrotion stokesi* had numerous strong lateral flanges uniting the corallites, a structure quite different from the

small spiniform processes in the present material. *L. stokesi* was said only to be from the 'Carboniferous' of Lake Winnipeg. So far as I can learn, Stokes collected only in the northwest corner of the lake, on his way from Norway House to the Saskatchewan River, and so his specimen should have come from beds of Stony Mountain or Gotlandian age (Sinclair, 1959, p. 6). Because of this uncertainty about the provenance of *L. stokesi* and the difference in form, I think it better to treat this older (Red River) species as a new one.

Whiteaves also considered that his specimens were conspecific with those described by Hall as *Sarcinula ? obsoleta* (1851?, p. 213). This may be so, and Hall's description is so indefinite that it is impossible to prove that it is not. However, the corallites in *S. obsoleta* seem to be much more widely separated than in *P. argus*. This is a trivial difference but, taken with the difference in age, suggests that two species may be distinguished. The age difference does not depend on any subjective opinion about the age of the Red River formation. The Red River, whatever its age may be, does underlie the Stony Mountain, which seems to be about the same age as the Wisconsin beds from which Hall's species was described.

The spiniform processes distinguish this species most readily from the eastern forms, and the sharp divergence and free growth of the new corallites are also unique.

Eofletcheria incerta (Billings)

Plate V, figures 1 to 3

Columnaria incerta (n.s.). Billings, 1859, p. 428, text-figs. 1, 2.
Fletcheria incerta Billings (sp.). Lambe, 1900, p. 48, pl. I, figs. 8, 8a, 9.
Fletcheria incerta (Billings). Okulitch, 1937, p. 314, pl. I, figs. 1 to 4.
Fletcheria incerta (Billings). Twenhofel, 1938, p. 40, pl. 6, figs. 5 to 7.
Eofletcheria incerta (Billings). Bassler, 1950, p. 266, pl. 19, figs. 16 to 18.
Not *Fletcheria incerta* (Billings). Wilson, 1948, p. 42, pl. 21, fig. 3.

Types. When he described this species Billings apparently had before him a number of specimens from the Chazy limestone of Mingan Islands, Montreal and Ottawa. Two figures were given, which might have been drawn from the same specimen. The originals of these figures cannot now be identified. Lambe gave three new figures, all from Mingan Island specimens, one (his figure 9) of which can be identified since the specimen has the area he drew outlined in ink, but the others cannot be matched with specimens. Okulitch figured a specimen and three thin sections, calling the specimen 'holotype'.

The Survey type collections do not now contain any specimens labelled as coming from the vicinity of Montreal or Ottawa. The catalogue of types shows eight specimens (1014, a-g) from the Mingan Islands. But the tray of specimens contains nine pieces. Eight of these, of which six bear contemporary labels giving the locality as "St. Charles Island, Mingan Islands, J. R [ichardson], 1860", agree in lithology and general appearance. The ninth specimen is not labelled, or

numbered, and is of a much blacker limestone than the rest. It has not been polished nor sectioned, and so it cannot be one of the specimens used to illustrate internal structure. Unfortunately, it is the specimen said by Okulitch to be the holotype. Ordinarily I would regard Okulitch's citation as settling a lectotype for the species, but in this case I think it would be better to be legalistic and point out that the specimen figured by Okulitch is not, in fact, the holotype (although it might have been one of the syntypes), and to treat the available material as syntypes from which a lectotype may be chosen. The alternative is to have a type specimen from an unknown locality.

The type material as I interpret it would then consist of nine specimens, which are:

1014c. Lectotype, here chosen. A large (110 mm high) silicified specimen showing the form of the corallum. It has not been cut.

1014a. Syntype. A small specimen which has been polished on two sides.

1014b. Syntype. A specimen which has been polished on three sides. Not labelled.

1014d. Syntype. A small corallum, 65 mm wide, which has not been cut.

1014e. Syntype. A small specimen which has been polished on three sides.

1014f. Syntype. A small specimen which has been polished on three sides.

1014g. Syntype, original of Lambe's figure 9. A small uncut corallum.

1014. Syntype. Part of a corallum from which two thin sections have now been made. This specimen is presumed to be 1014, and is now so numbered, since it agrees in appearance with the other Mingan material. Its original label and number are assumed to have been lost in the preparation of the thin sections.

Of these syntypes, all but 1014 and 1014b bear Billings' original labels. It seems probable that 1014a, e and f were originally pieces of one corallum.

14596. Hypotype, original of Okulitch's figure 1. Locality not known.

Description. Corallum bushy. Twenhofel reported a specimen 15 cm high and somewhat wider than high. Rather densely phaceloid. Corallites cylindrical, attaining a mature diameter, about one mm, very rapidly; usually fairly straight, but in places, especially just after leaving the parent, flexuous and errant; circular in section except in the rare places where crowding has produced a cerioid corallum and angulate corallites. Surface very poorly seen, but rather strong annuli (two or three in a length of one mm) and longitudinal striae are present. The striae have only been seen where the surface is somewhat worn, and probably represent structural elements of the thecal wall rather than a real surface ridging. No definite connecting processes between corallites have been seen.

Walls thick, of radial fibres which produce a septate appearance and may indeed be a septal stereozone. However, replacement has been so thorough that this is uncertain, and the appearance may be due to ingrowth of mineral material from the thecal wall. It may be noted that Lambe said there are minute spiniform septa, and Bassler spoke of the walls as having "rudimentary partitions (septa)". I have seen nothing to justify the retouching in Bassler's photograph of the

transverse section, nor any septa projecting beyond the stereozone, if the thick wall is one.

Tabulae rather infrequent, irregularly spaced, usually complete but not invariably so; usually horizontal or gently sagging, but occasionally slightly domed or (according to Okulitch's observations) infundibuliform. The tabulae do not merge directly into the thecal wall, but turn up and run along its inner side, sometimes in imperfect contact with it, before gradually losing their identity. This behaviour is most noticeable in tabulae that are thicker than normal, but seems to occur in thin ones as well. There is some suggestion that in merging it is the old wall that dies out, leaving the continuation of the tabula as the new thecal wall. This, in such a simple coral, could not be distinguished from parricidal budding. It should perhaps be mentioned that this pattern is seen very close to the proximal end of corallites, as well as distally.

Eofletcheria ? *erratica* (Billings)

Plate VI, figures 1 to 4

Columnaria erratica (Billings). Billings, 1858, pl. 166.
Columnaria rugosa Billings (sp.). Lambe, 1901, p. 101, in part (*not* figured specimens).

Lectotype. GSC 1380, J. Richardson collector, 1857. From his description it would seem that Billings had several specimens, but only one is now preserved in the type collections. It was labelled by him, and is here considered to be one of the original syntypes, and is chosen lectotype.

Locality. Pointe Bleue, Lake St. John, Quebec.

Age. Ordovician, late Wilderness stage, probably from the Simard formation. This assignment is presumptive, since the original locality is no longer available, but I think justified in that all the silicified slabs I have seen from Pointe Bleue seem to be from Simard beds.

Description. Corallum 70 by 75 mm, at present 35 mm high, but the base is not preserved. A silicified specimen with very little adherent matrix. Phaceloid, but the corallites so close that the appearance is subcerioid.

Corallites cylindrical or prismatic, tending to be circular in section, but where crowded becoming secondarily quadrate or irregular. Surface not well exposed, but there seem to have been coarse annuli; no longitudinal or fine transverse markings are seen. Corallites 5 to 6 mm in diameter, not tightly appressed, but with vacuities at the angles and sometimes between two closely contiguous sides. Even when close, each corallite is distinctly individual.

Wall thick, irregular, but some of this irregularity may be due to silicification. No septa (*see* Remarks). Tabulae strong, complete, irregularly spaced, horizontal or slightly concave, strongly bent up peripherally, to run along the wall to such an extent that one may be overlapped by the next distad. As seen in the calyces at the surface of the specimen, the tabulae are highly irregular in contour. Mode of increase unknown.

Remarks. This species is clearly not *Palaeophyllum rugosum*. At first glance it presents the appearance of a *Lyopora*, as that genus has been identified, but recent work (Hill, 1953, p. 158) shows that the structure of that genus is quite different. In its phaceloid growth, thick walls and form of tabulae it agrees with *Eofletcheria incerta*, and is tentatively referred to that genus, despite the different aspect given by the stoutness and closeness of the corallites.

The corallites have been described above as aseptate, but this was done with some hesitation. One corallite (fig. 4) in cross-section shows blunt rounded projections from a wall, but septal structures are so consistently absent in the rest of the specimen that this appearance is taken to be accidental. However, it is possible that this 'septate' patch is an unusually well preserved one, and that septa do exist. If this is so, then the generic assignment must be changed.

"Aulopora" wilsonae n. sp.

Plate VII, figures 1 to 3

Fletcheria incerta (Billings). Wilson, 1948, p. 42, pl. XXI, fig. 3.

Holotype. GSC 7399.

Locality. Paquette Rapids, Ottawa River.

Age. Ordovician, late Wilderness stage.

Description. Corallum of moderate size, 50 mm high, 45 mm wide, convex on one side, concave on the other.

Corallites small, about one mm wide, flexuous in one plane (as seen from above), fairly straight when seen from the side. Offsets frequent, lateral, sometimes in the nature of a bifurcation or roughly equal division. Surface unknown, but irregular annuli result from variation in the diameter of a corallite along its length. Lenticular in section. Internal features not known. No tabulae are seen, although some corallites are broken in such a way that traces of tabulae would be expected were they present and common. No septa seen, except that a very few corallites show a short stout 'tooth' projecting down from the upper wall.

Remarks. This is not a satisfactory species. The only specimen is coarsely silicified and gives no evidence on some crucial points of structure. In places there is an appearance recalling the imbricate peripheral zone of *Paleoalveolites*, but nothing corresponding to the cerioid medulla of that genus, and no septa are evident except that mentioned above. It does not resemble *Eofletcheria* except in size.

I think it can best be interpreted as repent, having grown prone upon some object now gone, in a mass from two to four corallites thick. All the calyces seen are on the convex side of the specimen, and that seems to be the side toward which budding took place. It would seem to be in essence an auloporoid, but generic assignment must await better material. *Aulopora* has been described from the Ordovician, *A. trentonesis* Winchell and Schuchert and *A. ellisensis* Twenhofel, and an undescribed species occurs in the Hull beds near Ottawa, but this form in its dense growth is clearly distinct from any of those.

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PLATES I-VII

PLATE I

Figures 1-6. *Palaeophyllum rugosum* Billings. Lectotype, GSC No. 1379, [Black River or lowermost] Trenton, Lake St. John, Little Discharge, Canada. Coll. J. Richardson, 1857. 1, external view, x½; 2-6, oblique thin sections, x2.

Figures 7, 8. *Streptelasma* sp. Univ. Queensland F.2556. Ordovician, Richmondian, Green county, Ohio, U.S.A. To show paliform lobes of the Ordovician Streptelasmidae. 7, transverse section, x2; 8, vertical section, x2.

Figures 9-11. *Columnaria sulcata* Goldfuss. Type specimen (figured Goldfuss, 1826, pl. 24, figs. 9 a-c) in the Goldfuss Collection, Geol.-Palaeont. Instit. Mus. Univ. Bonn, Germany, from the [?Upper] Middle Devonian of Paffrath near Bensberg, about 10 miles east of Cologne, Germany. Transverse and vertical sections cut for Lang and Smith.

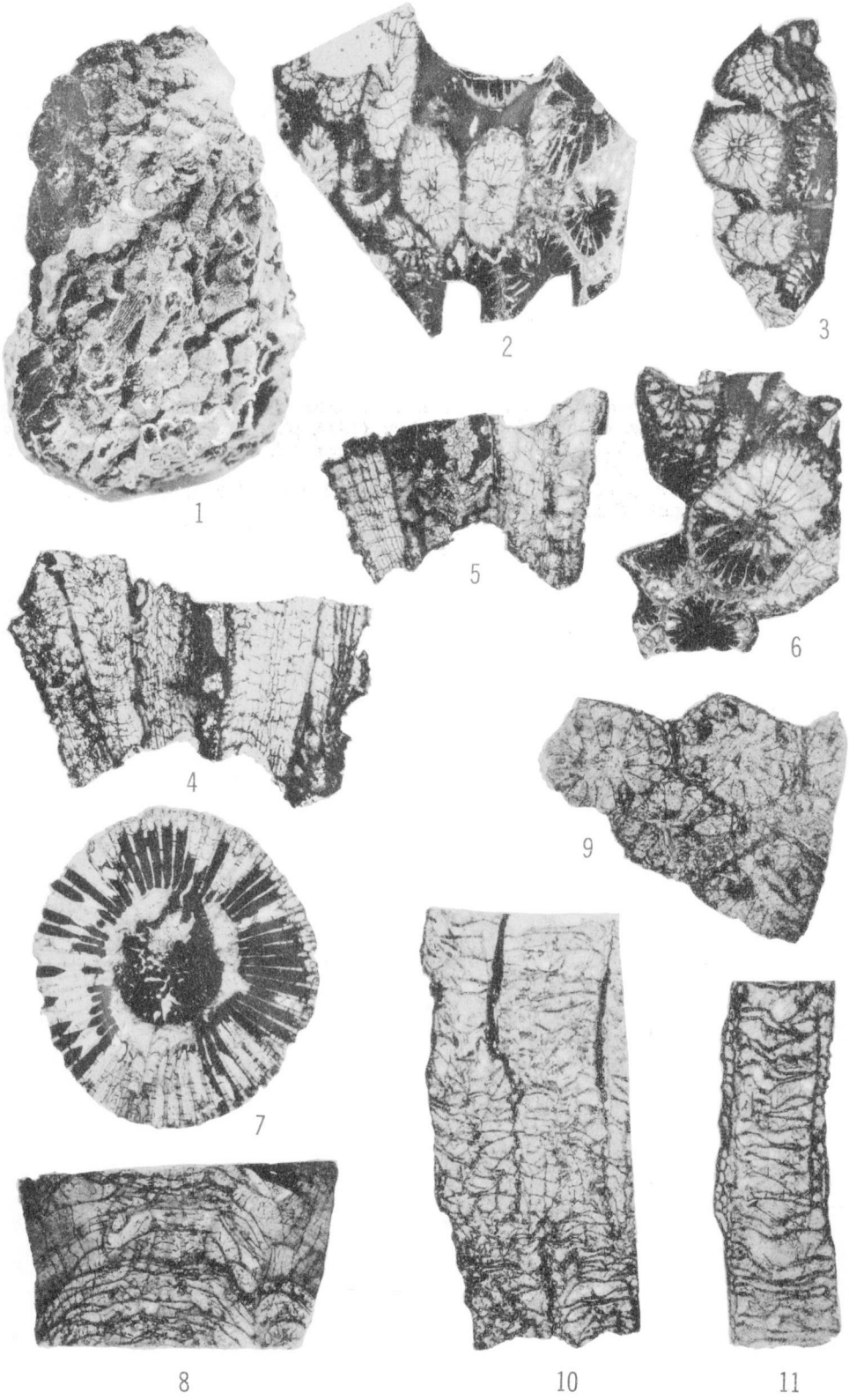


PLATE II

Figures 1-4. *Nyctopora billingsii* Nicholson. Thin sections 6689 (figs. 4a, b) and 6689a (figs. 4c, d) figured by Nicholson (1879, pl. IX, figs. 3a, b); Geol. Surv., Canada, Trenton of Peterborough, Ontario. 1-2, transverse section, x2 and x4; 3-4, vertical section, x2 and x13.5.

Figure 5. *Nyctopora billingsii* Nicholson. British Museum R31822. Nepean Point, Ottawa, Ontario, Canada. Middle Ordovician, x2.

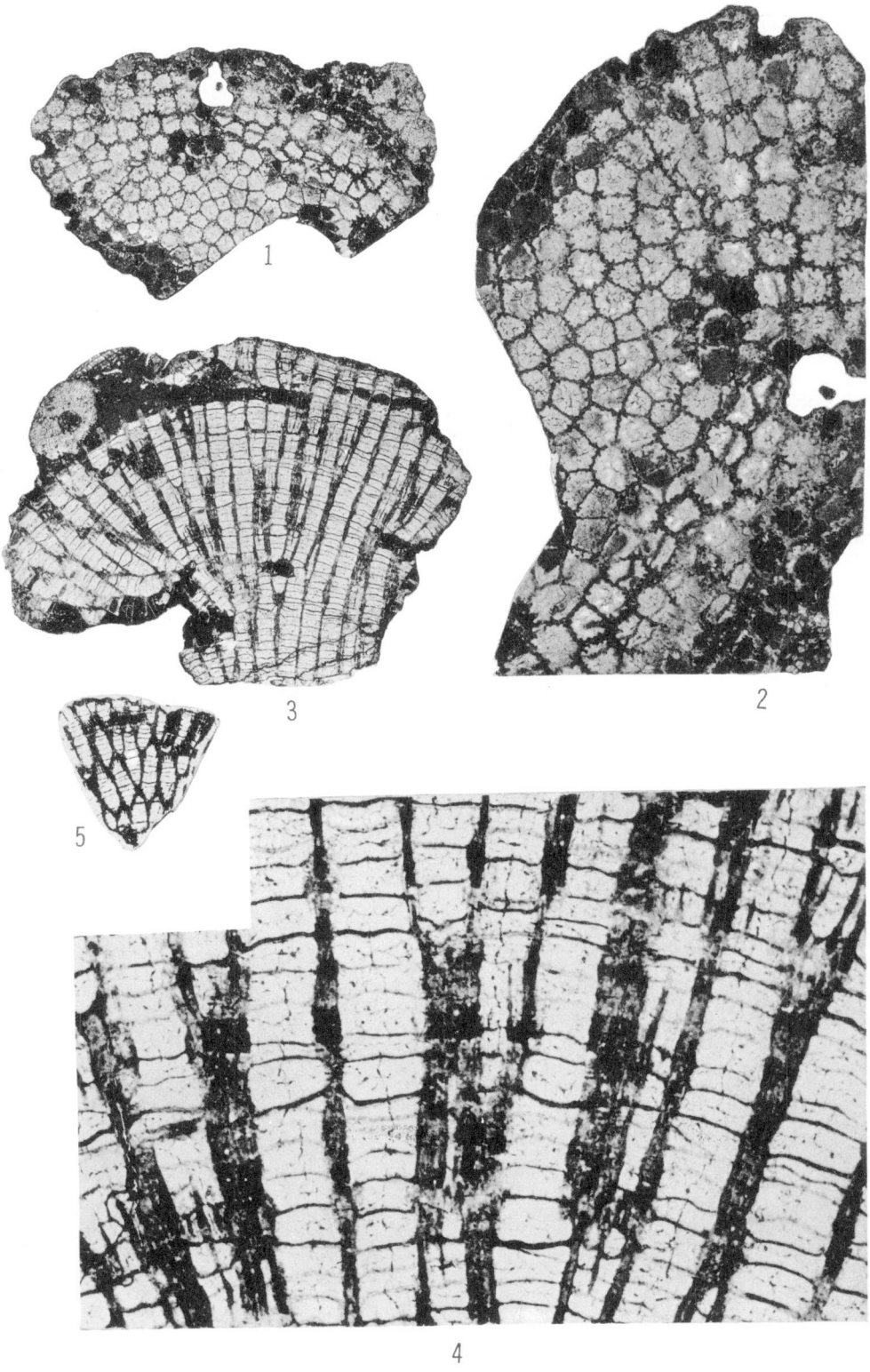
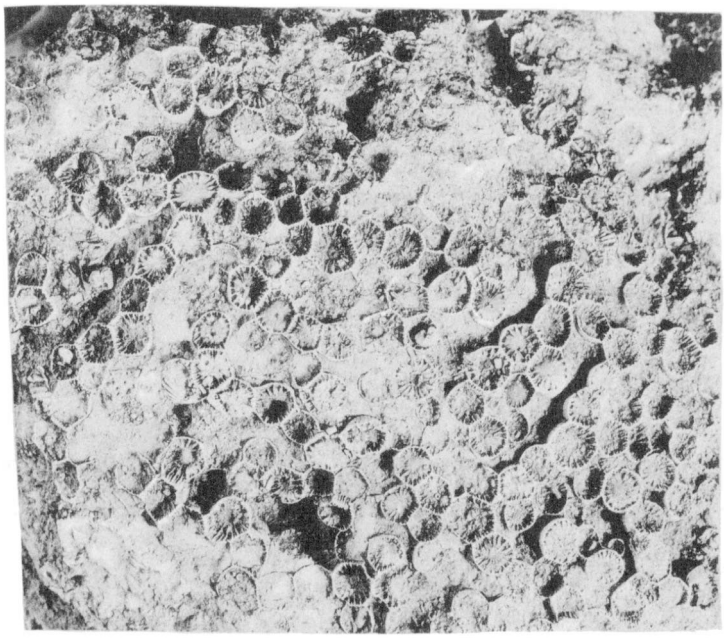


PLATE III

Figures 1-6. *Palaeophyllum humei* n. sp. Liskeard formation, Dymond township, Ontario. 1, part of the surface of the holotype, GSC 13627, x1. Near the centre of the figure and to the left the halysitoid habit is seen, whereas the corallites in the lower right are phaceloid or cerioid. 2-3, paratype, GSC 13631, x3; 4-5, paratype, GSC 13628, x1, to show the mode of increase. The small corallite with the prominent calyx at the lower end of figure 5 is the same as that seen budding off to the left in figure 6. 6, transverse section of holotype, x3.



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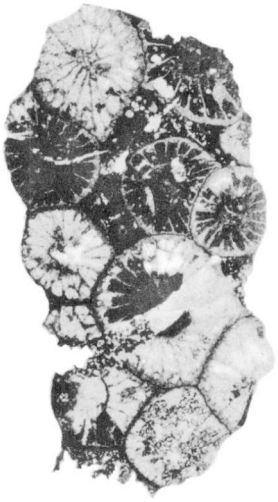

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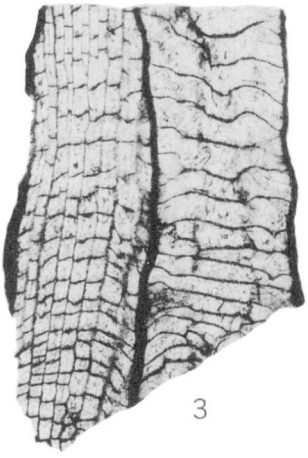

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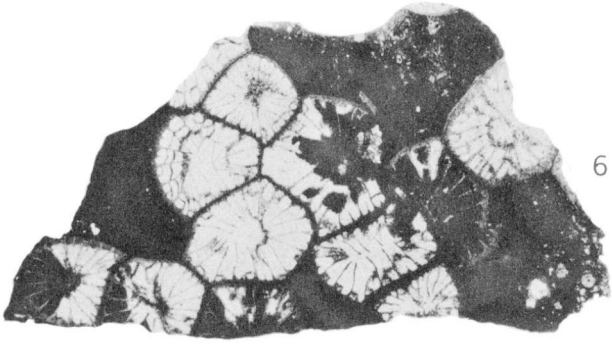

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PLATE IV

Figures 1-4. *Palaeophyllum argus* n. sp. Dog Head member of Red River formation, lower Fort Garry, Manitoba. Holotype, GSC 6878. Figures 1 and 4, side and top views, x1; 2, longitudinal section, x3; 3, part of surface x3. (*See also* Plate VII.)

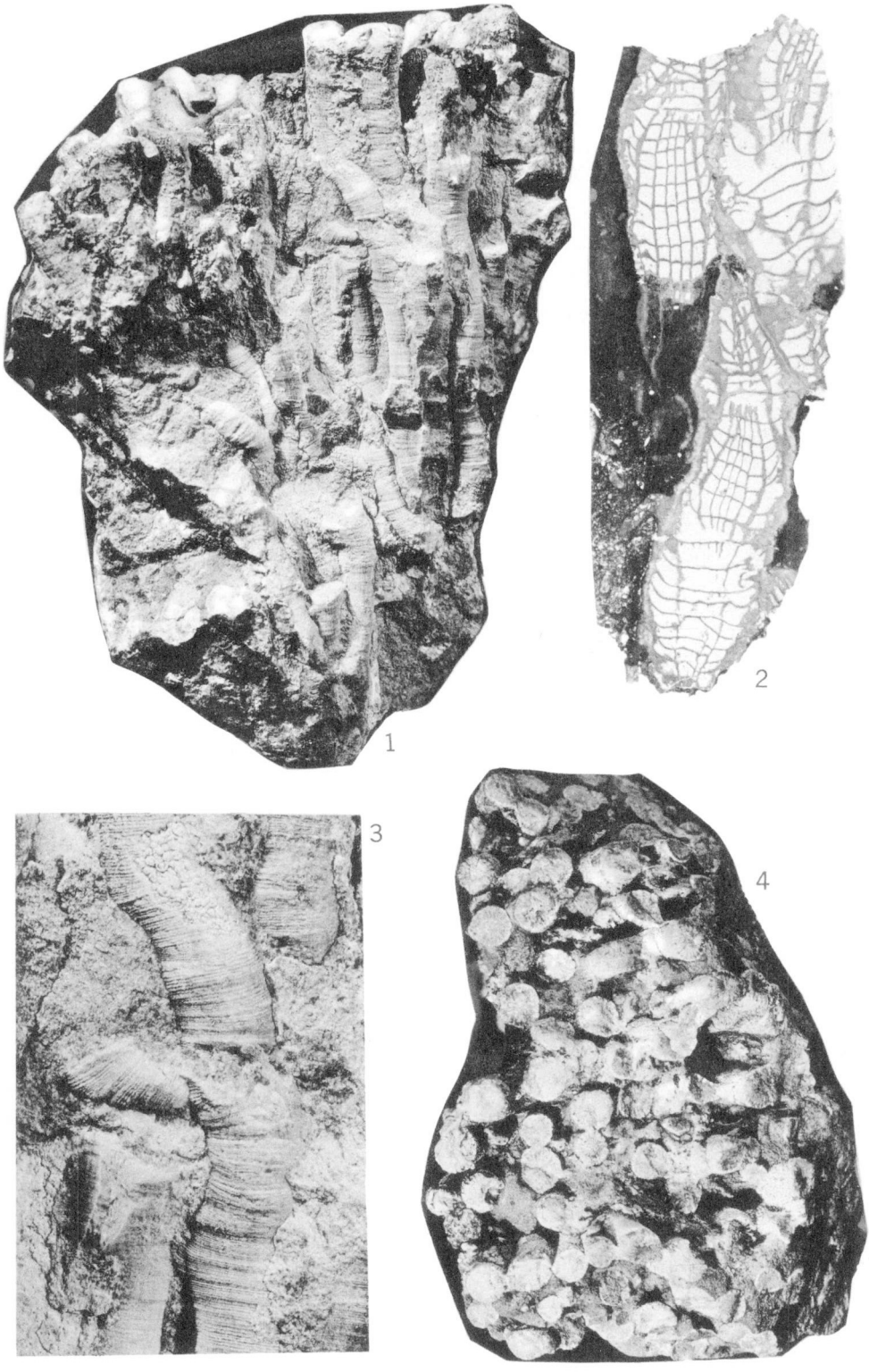
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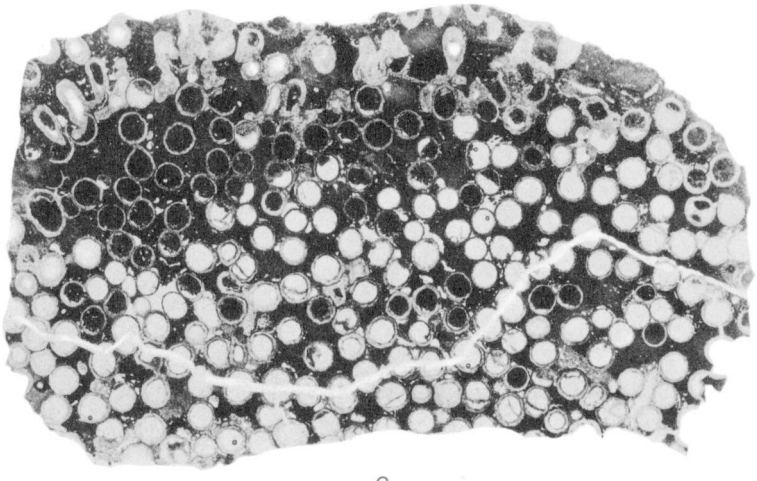
PLATE V

Figures 1-3. *Eofletcheria incerta* (Billings). Chazyan, Mingan Islands. 1, the lectotype, GSC 1014c, x1; 2-3, sections of the syntype, GSC 1014, x3.



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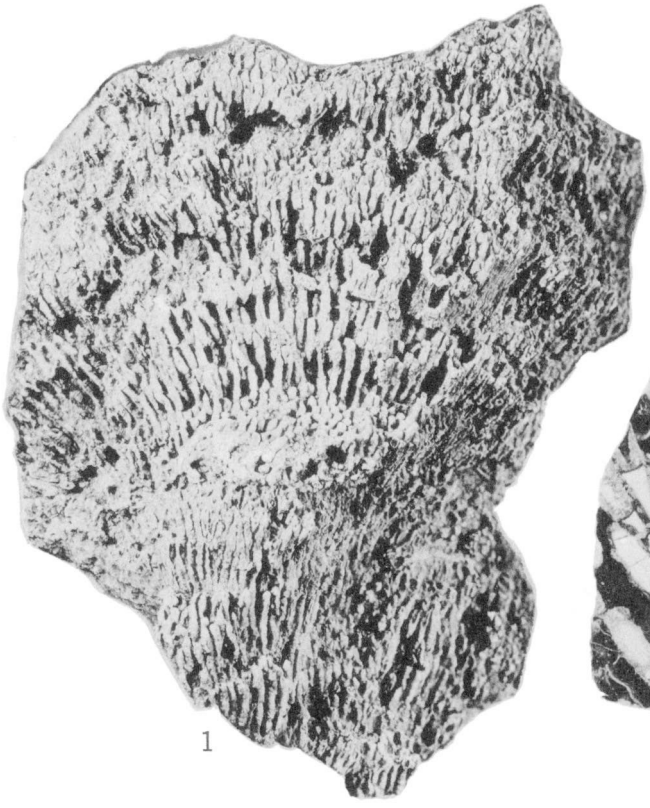

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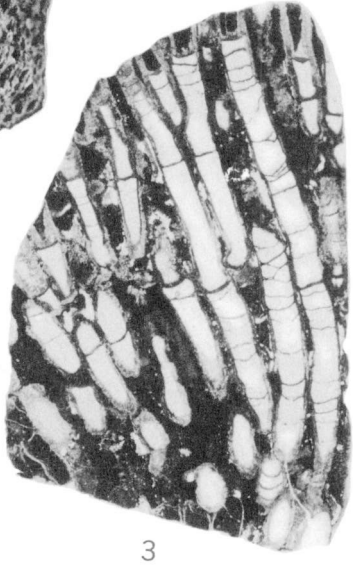

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Plate VI

Figures 1-4. *Eofletcheria* ? *erratica* (Billings). Simard formation, Pointe Bleue, Lake St. John, Quebec. Lectotype, GSC 1380. Thin sections x3 (figures 1 and 4) and side and top views of the corallum x1.

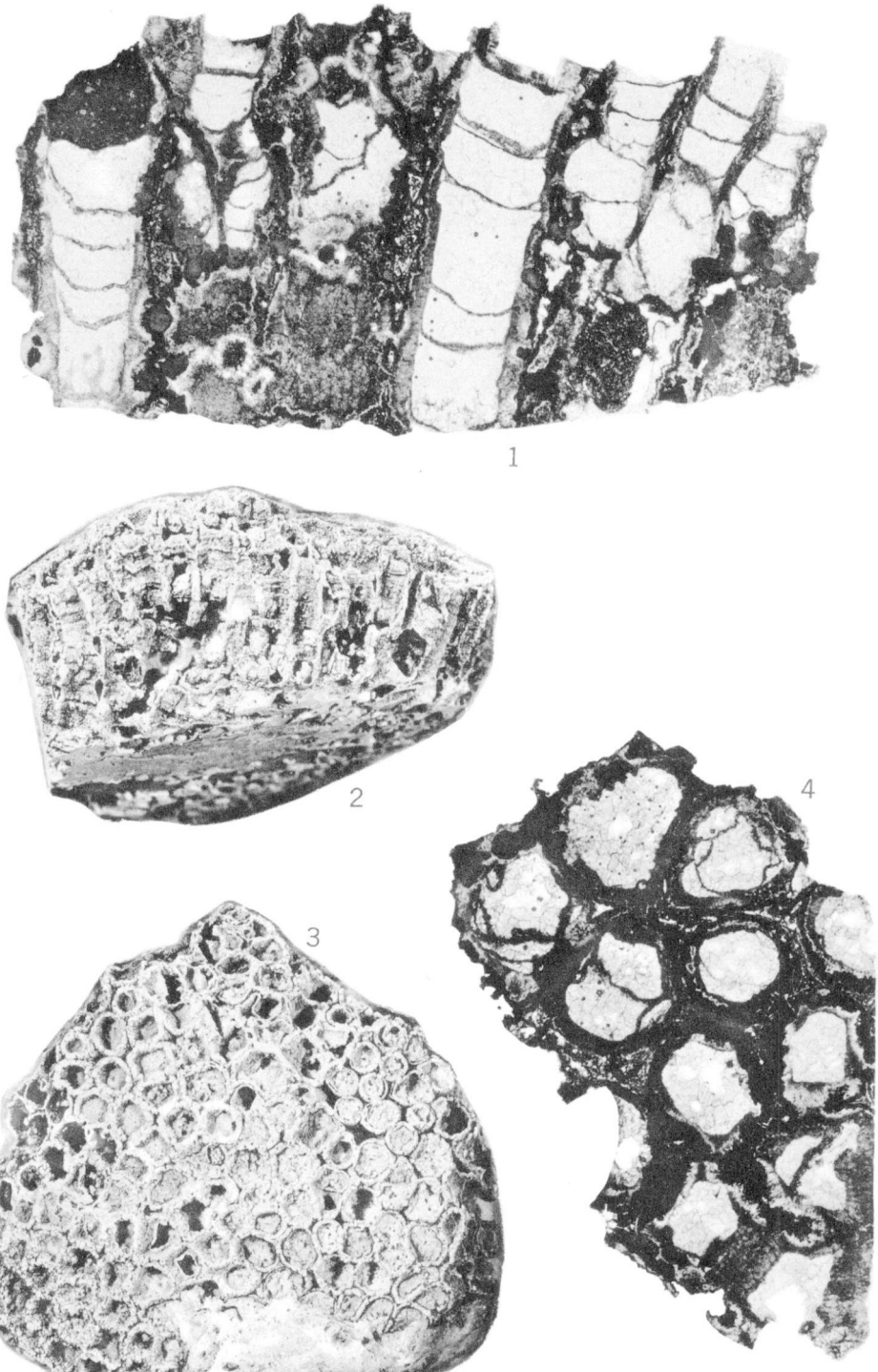
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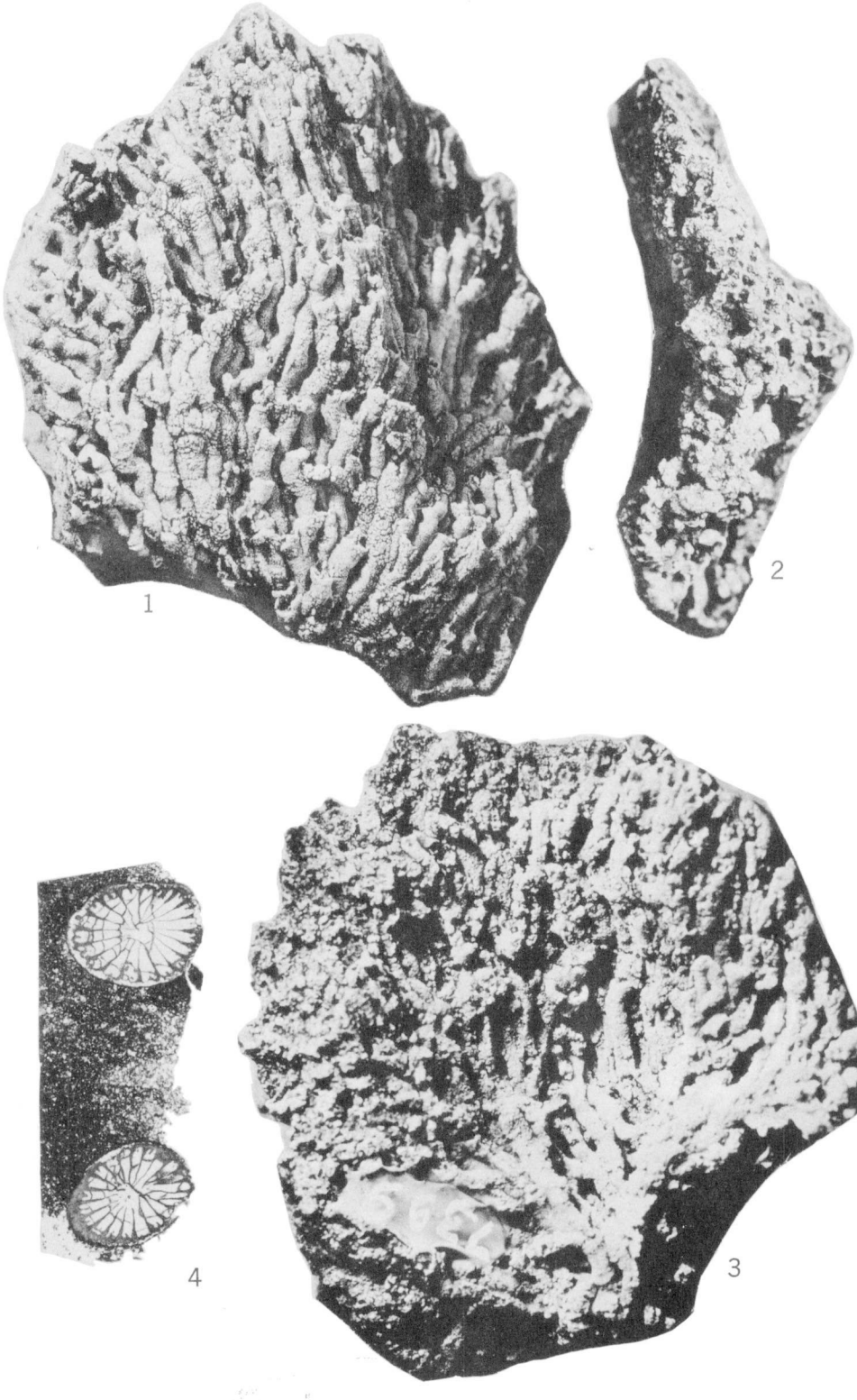
PLATE VII

Figures 1-3. *"Aulopora" wilsonae* n. sp. Upper Wilderness stage, Paquette Rapids, Ottawa River. Holotype, GSC 7399, x2. 1, the upper convex surface of the corallum; 2, end view of the corallum showing the lenticular corallites; 3, lower concave side of the corallum, which is assumed to have been repent on some foreign body.

Figure 4. *Palaeophyllum argus,* section of holotype, x3. (*See* Plate IV.)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