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A DESCRIPTION AND STRATIGRAPHIC
CORRELATION OF THE FENESTEL-
LIDAE FROM THE DEVONIAN
OF MICHIGAN

BY

CHARLES F. DEISS



UNIVERSITY OF MICHIGAN PRESS
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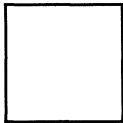
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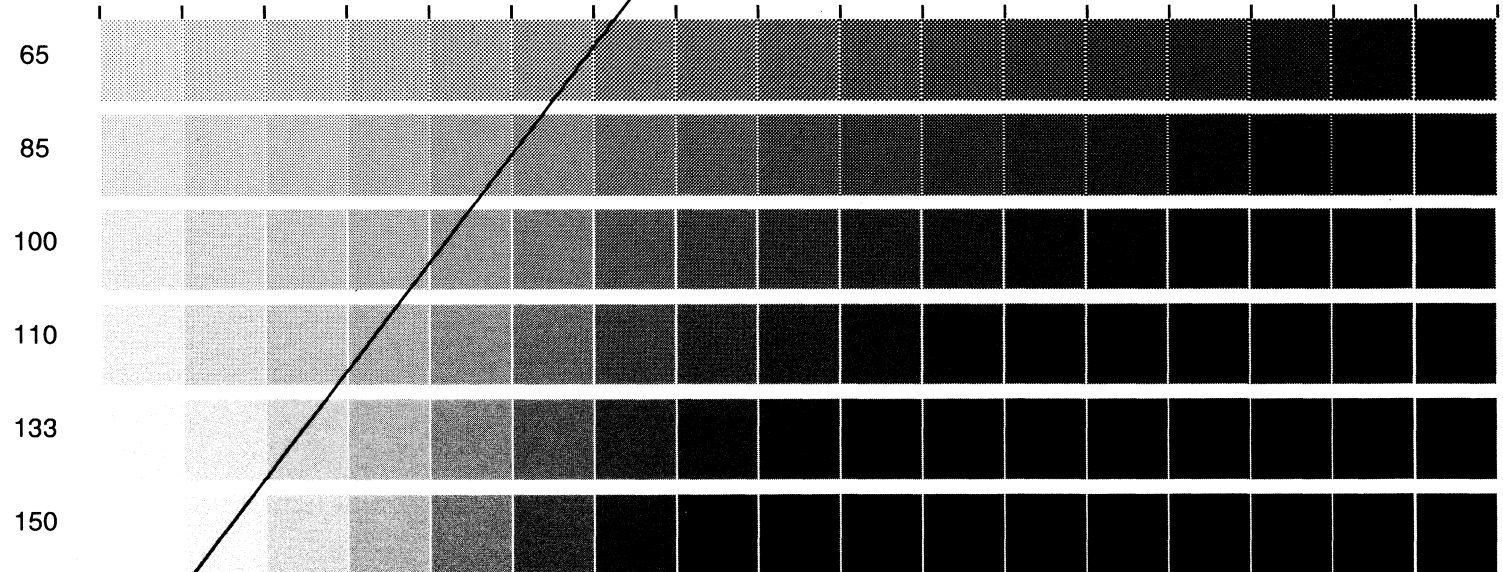
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CONTRIBUTIONS FROM THE MUSEUM OF PALEONTOLOGY

(Continuation of Contributions from the Museum of Geology)

UNIVERSITY OF MICHIGAN

Editor: EUGENE S. McCARTNEY

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(Continued on inside of back cover)

A DESCRIPTION AND STRATIGRAPHIC CORRELATION OF THE FENESTEL- LIDAE FROM THE DEVONIAN OF MICHIGAN *

By CHARLES F. DEISS

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INTRODUCTION

The family Fenestellidae occurs with especial luxuriance and in large numbers in the Devonian rocks of Michigan. Although it is represented in such abundance, but two species have been described from the state, *Fenestella eximia* Winchell and *F. filitexta* Winchell. Dr. R. S. Bassler¹ was kind enough to point out this fact to the author, and since practically no work has ever been done upon specimens of this family from Michigan, the decision was made to undertake the task of identifying and describing the Fenestellidae in the hope that the results would clarify to some extent the Devonian Stratigraphy in the Southern Peninsula of Michigan.

The material examined was collected from the Devonian strata of the northern part of the Southern Peninsula of Michigan during the summer of 1926 by a party representing the Geological Survey of Michigan. The personnel of this party consisted of Dr. E. O. Ulrich, of the United States Geological Survey, Professor E. C. Case of the University of Michigan, Assistant Professor G. M. Ehlers, of the same university, Mr. S. W. Warthin, Jr., and Mr. C. F. Deiss.

It is the author's hope eventually to complete a description of the Bryozoa of the Devonian rocks of Michigan. This paper is a preliminary study in the work, and deals only with the different forms of the Fenestellidae.

The investigation of the forms described in the following pages was the basis for a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at the University of Michigan, 1928.

The problem was suggested to the author by Dr. R. S. Bassler in the winter of 1926. He said: "The situation in the Michigan Devonian Fenestellidae is as follows: many names have been applied to eastern Hamilton fenestellids without adequate descriptions of figures. I have considerable material from the eastern localities, but have never found time to work out the species to my satisfaction. Therefore for the Hamilton fenestellids we

¹ Personal communication.

have little material, although for the underlying formations we have much named material."

In a recent paper Pohl² has suggested that the Traverse group fills a hiatus between the Onondaga beneath and the basal Hamilton (Marcellus) above. The Geological Survey of Michigan has accepted Pohl's correlation. All the specimens described in this paper are from the Traverse group.

DESCRIPTIONS OF FAMILY AND GENERA

Family FENESTELLIDAE King

King, A Monograph of the Permian Fossils of England, pp. 28-49 (1850).

Original description. — "Zoaria forming reticulate expansions, celluliferous on one side only, composed of rigid branches united to each other by regular non-poriferous bars called dissepiments; or they may be sinuous and anastomose; or even remain free. Primitive portion of zoecia of oblong, quadrate or hexagonal outline. Superior hemiseptum usually present, the inferior one less frequently. Primitive aperture semi-elliptical, being truncated at the posterior side. Superficial apertures rounded, with peristome, and, in the perfect state, closed by centrally perforated opercula."

Genus Fenestella Lonsdale

Lonsdale, in Murchinson's Silurian System, Pt. II, p. 677 (1839).

Original description. — "Zoaria flabellate to infundibuliform, poriferous on the inside; branches nearly straight, and connected with each other at rhythmical intervals by non-poriferous dissepiments. Zoecia in two rows, separated by a more or less developed median keel. Type *Fenestella antiqua*, Miller. Range, Cincinnatian to Permian."

Genus Hemitrypa Phillips

Phillips, Figures and Descriptions of the Paleozoic Fossils of Cornwall, Devon, and West Somerset, p. 27 (1841).

Original description by Simpson. — "Zoaria funnel-shaped or undulating foliar expansions; branches rigid. Zoecia in two

² Pohl, Erwin, "The Middle Devonian Traverse Group of Rocks in Michigan." *Proc. U. S. Nat. Mus.*, Vol. 76. Art. 14, p. 33, 1929.

ranges, their apertures separated by a moderately developed keel. The latter is elevated at regular intervals into small pillars, which, when the superstructure they support is worn away, appear as spinelike prominences. The superstructure consists of straight or zigzag longitudinal bars, of which one is placed over each branch upon the row of pillars, and another, usually somewhat thinner, suspended midway between the branches. These bars are then connected by transverse processes, so as to leave regular, small, generally hexagonal openings, corresponding in number and position with the zoecial apertures beneath them."

Type, *Hemitrypa oculata* Phillips. Range, Clinton to St. Louis.

Genus *Isotrypa* Hall; (emended) Ulrich

Hall, New York State Geologist, Annual Report 4, p. 37 (1885).

Ulrich, Geol. Surv. Ill., Vol. 8, Text, p. 395 (1890).

Emended description. — "Zoaria infundibuliform; branches connected by dissepiments. Keel at first very thin, then abruptly expanded; at intervals corresponding to the true dissepiments the thickened summits are connected by strong processes, giving to the superstructure an appearance very much like that of the reverse face of the frond. Zoecia in two ranges."

Type, *Isotrypa conjunctiva* Hall. Range, Niagara to Hamilton.

Genus *Phyllopora* King

King, Annals and Magazine of Natural History, Sec. Ser., Vol. 3, p. 389 (1849).

Original description. — "A Fenestellidia consisting of infundibuliform, folded, perforated fronds or foliaceous expansions; cellules on the whole of the outer or under surface of the fronds, and planted more or less approximately to a position at right angles to the plane of the capillary tubular basal plate; cellule apertures with plain margins and parallel to the surface of the fronds."

Type, *Phyllopora ehrenbergi* King. Range, Devonian to Permian.

Genus *Polypora* McCoy

McCoy, A Synopsis of the Carboniferous Limestone Fossils of Ireland, p. 206 (1845).

Original description. — “Zoaria in most respects like *Fenestella*, but differing in having from two to six or even eight rows of cells, and in wanting the characteristic median keel. The latter is sometimes represented by a row of strong tubercles.”

“Such species approach *Fenestralia* Prout” (Ulrich).

Type, *Polypora dendroides* McCoy. Range, Niagara to Coal Measures.

Genus *Ptiloporina* Hall

Hall and Simpson, Geological Survey of the State of New York. Paleontology, Vol. 6, p. 172, pl. 43, figs. 7-9 (1887).

Original description. — “Bryozoum having the same manner of growth and general appearance as *Ptiloporella*, but differing from that genus in having three or more ranges of cell apertures, not separated by a carina. Branches of two sizes, the smaller or secondary branches proceeding laterally from the larger or primary ones, either from one or both sides.”

Type, *Ptiloporina sinistralis* Hall. Range, Upper Helderberg.

Genus *Semicosinium* Prout

Trans. St. Louis Acad. Sci., Vol. I, p. 443 (1859).

Original description. — “Zoaria funnel-shaped, poriferous on the outer side. Dissepiments wide, very short, the branches appearing on the non-poriferous side to anastomose. Here also, the fenestrules are subrhomboidal or rounded. Zoecia in two ranges. Median keel very high and more or less expanded at the summit.”

Type, *Semicosinium rhomboideum* Prout. Range, Niagara to Hamilton.

DESCRIPTIONS OF SPECIES

Genus *FENESTELLA* Lonsdale

For generic description see page 235.

Fenestella depressa Hall

Hall and Simpson, Geological Survey of the State of New York. Paleontology, Vol. 6, p. 111, pl. 45, figs. 16-17 (1887).

Original description. — "Bryozoum infundibuliform. Branches slender, width above a bifurcation, .30 mm., increasing to .45 mm., rounded, finely striated. Interstices narrower than the branches. Dissepiments very slender, width .18 mm., rounded, much depressed, nine in the space of 5 mm. Fenestrules oval or subquadrangular, length .40 mm., width about .20 mm.

"On the celluliferous face the dissepiments are rounded, much depressed. Fenestrules having the same appearance as on the opposite face. Cell apertures in two ranges, opening directly outward, twenty-six in the space of 5 mm., separated by less than the diameter of an aperture: margins elevated, strongly indenting the borders of the fenestrules. Surface between the ranges of apertures angular, nodose."

Onomatype No. 13251 U.M.

Horizon and locality. — Upper Helderberg group, Falls of the Ohio River.

Fenestella eximia Winchell **problematica**, var. nov.

(Plate I, Fig. 1)

Winchell, The Grand Traverse Region, Appendix, p. 92 (1886).

Original description. — "Rays angulated along the middle, bearing two rows of pores with salient margins, opening obliquely; twenty-three pores in the distance of ten fenestrules. Length of fenestrule .51 mm., breadth .37."

This description is inadequate and the type is unknown. For these reasons the following description is given of a form which approximates the description of *Fenestella eximia* more closely than any other form observed.

It is suggested that the species described by Winchell may possibly be the same as the one described here, but at this time it seems safer to give this form the tentative name *F. eximia problematica*, var. nov.

Description. — Obverse: branches slender; subangular,

smooth; straight to slightly sinuous. Apertures open laterally, separated by more than the diameter of an aperture; twenty-two in 5 mm. Dissepiments slender, subangular; slightly expanded at junction of, and depressed below plane of, branches; nine in 5 mm. Fenestrules oval to subquadrangular; average length 0.50 mm., width from 0.18 to 0.28 mm.

Reverse. — Not seen.

Holotype No. 10505 U.M.

Horizon and locality. — Zone 2 of Location 10.³

Fenestella idalia Hall

(Plate I, Figs. 4-6)

Hall and Simpson, Geological Survey of the State of New York. Paleontology, Vol. 6, p. 52, pl. 21, figs. 6-9 (1887).

Original description. — "Bryozoum infundibuliform, broadly spreading, nearly flat for a short distance above the base. Branches moderately slender, rounded, compactly arranged, granulose striations on each branch; sometimes so strongly granulose as to obscure the striae. Bifurcations frequent. Interstices usually about the width of the branches. Dissepiments very slender, sub-angular; from six to nine in the space of 5 mm.; very slightly expanding at their junction, and on the same plane with the branches. Fenestrules sub-quadrangular, occasionally oval.

"On the celluliferous face the branches are angular, or sub-carinated. Dissepiments angular and much depressed. The fenestrules appear narrower than on the opposite face. Cell apertures usually in two ranges, circular; opening somewhat laterally and separated by less than the diameter of an aperture: margins elevated, indenting the borders of the fenestrules. Width of branch above a bifurcation .20 mm., increasing to .50 mm.; diameter of dissepiments .16 mm.; length of fenestrules on different specimens varying from .40 mm. to .50 mm., width from .25 to .40 mm."

³ All locations are those of the party of the Geological Survey of Michigan of 1926. See page 273 for list and description of locations.

Horizon and locality. — Lower Helderberg group, near Clarksville, New York.

Plesiotype No. 10482 U.M.

Horizon and locality. — Zone 1 of Location 17.

Fenestella nodosa Prout

Trans. St. Louis Acad. Sci., Vol. 2, p. 410 (1866).

Original description. — "Bryozoum fan-shaped expansion, with small, round, longitudinal rays, [branches] regularly distributed, and without the appearance of dissepiments or nodes to the naked eye. Branches uniform, straight, round, bifurcating from one to one and a half lines apart, presenting under the microscope regular lines of nodes or tubercles, slightly longer than broad, about their own length apart and having no correspondence with the dissepiments, being to the number of 14-15 in each of the two lines in the length of the rays. Dissepiments depressed, short, round, thickened at junction with longitudinal rays. Fenestrules mostly quadrangular, but occasionally sub-oval from thickening of the dissepiments at their junction. Cells or chalices small, tapering upwards, placed in a line above the insertion of dissepiments and about midway between the obverse and reverse. In worn specimens the cells become distinct, showing three to each fenestrule, while the tubercles disappear entirely."

"Reverse striated where worn."

Onomatype No. 13252 U.M.

Horizon and locality. — Hamilton group of Illinois.

Fenestella vera Ulrich var. *acuta*, var. nov.

(Plate I, Figs. 2-3)

Geol. Surv. Ill., Vol. 8, p. 535 (1890), pl. 44, figs. 1-1a (1849).

Original description. — "Zoarium a somewhat undulating flabellate expansion; largest fragment seen over 6 cms. in length. Obverse with branches rather straight, slender, ridge-shaped, bifurcating at distant intervals, about .35 mm. in width and twenty-four in 1 cm. Dissepiments short, sub-carinate, varying in width from about two-thirds to almost the width of the branches.

Fenestrules elliptical or sub-quadrangular, about .50 mm. by .20 mm.; fourteen in 1 cm. Carina prominent, not sharp, bearing small nodes about twice their diameter apart, and six or seven in 2 mm. Zoëcia in two ranges. Apertures small, circular, opening obliquely into the fenestrules, generally four to each fenestrule, and twenty-three in 5 mm. On the reverse the branches are usually zigzag, on the same level and scarcely stronger than the dissepiments. The fenestrules have a somewhat hexagonal shape, less marked in the older portion of the zoarium, and form quite regular diagonal series. Surface of both branches and dissepiments very minutely granulose."

Horizon and locality. — Hamilton group, Buffalo, Iowa.

This form differs from the foregoing in three respects: (1) The carina on the obverse face is thick, sharp, and prominent with large nodes; (2) There are twenty-one apertures in 5 mm.; (3) The fenestrules are from 0.50 to 0.62 mm. in length, and average 0.30 mm. in width.

Holotype No. 10504 U.M.

Horizon and locality. — Shale zone of Location 14.

Fenestella compacta, sp. nov.

(Plate I, Figs. 7-8)

Zoarium unknown, fragments flattened.

Obverse. — Branches slender, angular, subparallel, bifurcations distant. Average width of branch 0.20 mm.; fourteen in 5 mm. Dissepiments short, angular, subequal to branches in thickness, depressed; eleven or twelve in 5 mm. Fenestrules very narrow, subquadrangular. Apertures open directly, separated by more than the diameter of an aperture; twenty-three to twenty-five in 5 mm. Peristome moderately developed and slightly indenting borders of fenestrules. Carina low, angular.

Reverse. — Not seen upon specimen. In thin section branches appear to be rounded, striated, and of about same width as those on opposite face. Dissepiments slender, broadly expanded at junction with branches. Fenestrules oval; average length 0.30 mm., width from 0.16 to 0.26 mm.

Holotype No. 10481 U.M.

Horizon and locality. — Shaly limestone of Location 35.

Fenestella paridistans, sp. nov.

(Plate II, Figs. 1-3)

Zoarium unknown, appears flabellate in large fragments.

Obverse. — Branches very slender, angular, practically parallel, bifurcations few, distant. Average width of branch 0.22 mm.; twelve to thirteen in 5 mm. Dissepiments extremely slender, subangular, depressed; ten in 5 mm. Fenestrules oval to subquadrangular; length and width about one to two, at places as one to three. Apertures open laterally; separated by more than diameter of an aperture; twenty in 5 mm. Peristomes distinct but weak, only slightly indenting borders of fenestrules. Carina low, subangular, in places sharp and thin; summit with a row of elongate, blunted nodes, unequally distant from each other.

Reverse. — Branches rounded, about equal in width to those of obverse face, coarsely granulose with low granular nodes irregularly distributed upon them. Dissepiments subequal, or stronger than branches; rounded, granulose, occasionally nodose and in places raised above plane of branches. Fenestrules oval to circular to subquadrangular; length 0.32 to 0.48 mm., width 0.18 to 0.26 mm.

Holotype No. 10480 U.M.

Horizon and locality. — Zone 1 of Location 9.

Fenestella variifenestrula, sp. nov.

(Plate II, Figs. 4-6)

Zoarium not seen, fragments flattened.

Obverse. — Branches slender, angular, subparallel, average width 0.23 mm.; thirteen in 5 mm.; bifurcations infrequent. Dissepiments thin; depressed below plane of branches; 0.20 mm. in diameter; eleven in 5 mm.; rounded to subangular. Fenestrules vary widely in shape, from thin oval to nearly square. Apertures open laterally; twenty-five in 5 mm., separated by more than

diameter of an aperture. Peristomes weakly developed. Carina angular, low, with a row of minute nodes.

Reverse. — Branches slender, rounded, coarsely granulose, with strong granular, conical nodes, irregularly disposed. Dissepiments rounded to subangular; in some places slightly depressed below, in others slightly raised above plane of branches; strong; granular, but rarely nodose. Fenestrules oval to circular to subquadrate; length from 0.26 to 0.40 mm., width from 0.10 to 0.26 mm.

Holotype No. 10479 U.M.

Horizon and locality. — Shaly limestone of Location 35.

Fenestella nodicula, sp. nov.

(Plate II, Figs. 7-8)

Zoarium unknown, fragments flattened.

Obverse. — Branches slender, angular, subparallel, straight; average width 0.28 mm.; eleven in 5 mm.; bifurcations distant. Dissepiments slender, angular; slightly depressed below plane of branches; average width 0.18 mm.; ten in 5 mm. Fenestrules flat oval to subquadrangular; sizes equal to those on reverse face. Apertures open laterally, separated by more than diameter of an aperture; three to a fenestrule, twenty in 5 mm. Peristome weakly developed. Carina low, strong, angular, with minute granular nodes in single row on summit.

Reverse. — Branches rounded, straight; from 0.18 to 0.28 mm. in thickness, striated and with large conical nodes irregularly disposed. Dissepiments slender, rounded, smooth; depressed below plane of branches; average diameter 0.18 mm. Fenestrules oval to subquadrangular; length from 0.40 to 0.42 mm., average width 0.20 mm.

Holotype No. 10478 U.M.

Horizon and locality. — Shaly limestone of Location 35.

Fenestella minutiserrata, sp. nov.

Zoarium infundibuliform.

Obverse. — Branches slender, straight, subparallel. Dissepiments extremely thin and but slightly expanded at junction with

branches; four to five in 5 mm.; slightly depressed below plane of branches. Fenestrules quadrangular, of same size as those on reverse face. Apertures open laterally and alternately, separated by more than diameter of an aperture; nineteen to twenty in 5 mm. Peristomes of alternate apertures give serrated appearance to branches. Carina very faint; minutely nodose.

Reverse. — Branches strong when compared with those on obverse face; rounded, coarsely striated, faintly carinated in places; bifurcation every second fenestrule. Dissepiments more slender than branches; not depressed below plane of branches and but slightly expanded at junction with them. Fenestrules quadrangular to elongate oval; length from 0.95 to 1.55 mm., width from 0.25 to 0.52 mm.

Holotype No. 10536 U.M.

Horizon and locality. — Gray limestone of Location 41.

Fenestella incerta, sp. nov.

(Plate II, Fig. 9; Plate III, Figs. 1-2)

Zoarium unknown, fragments flattened.

Obverse. — Branches strong, angular, straight; width from 0.25 to 0.30 mm., bifurcations distant. Dissepiments slender, rounded; much depressed below plane of branches; eight to nine in 5 mm. Fenestrules subquadrangular to oval. Apertures open laterally, separated by more than the diameter of an aperture; twenty in 5 mm., average three to a fenestrule. When apertures are disposed upon dissepiments they appear to open directly. Peristome strongly developed, indenting edges of fenestrules. Carina strong, low, rounded; bearing strong conical nodes upon summit.

Reverse. — Branches rounded to subangular; straight, subparallel; minutely granulose, with extremely large nodes irregularly disposed and with smaller, but prominent, nodes disposed at junction of branches and dissepiments. Dissepiments of same width as branches; rounded, granular, in places subangular; not depressed below plane of branches. Fenestrules quadrangular, rarely oval; length from 0.45 to 0.60 mm., width from 0.20 to 0.28 mm.

Holotype No. 10477 U.M. Paratype No. 10534 U.M.

Horizon and locality. — Zone 1 of Location 9.

Fenestella foraminosa, sp. nov.

(Plate III, Figs. 3-4)

Zoarium unknown, fragments flattened to flexuous.

Obverse. — Branches moderately slender, average about 0.25 mm. in width; angular, subparallel; bifurcations distant. Dissepiments slender, subangular, short, width 0.18 mm.; depressed below plane of branches; twelve in 5 mm. Fenestrules narrow oval to subquadrangular. Apertures open directly; twenty-five in 5 mm., occasionally twenty-seven in 5 mm., separated by more than the diameter of an aperture. Peristomes very strongly developed, indenting borders of fenestrules. Carina low, angular; minutely nodose on summit.

Reverse. — Branches more slender than on obverse face; smooth, rounded; with a large node near junction of dissepiments. Dissepiments rounded, occasionally faintly carinated, more slender than branches and expanded at junction with them; slightly depressed below plane of branches. Fenestrules oval to subquadrangular; length from 0.26 to 0.40 mm., width from 0.18 to 0.23 mm.

Holotype No. 10498 U.M. Paratypes Nos. 10519, 10520, 10521, 10522, U.M.

Horizon and locality. — Gray limestone of Location 36.

Fenestella megalopora, sp. nov.

(Plate III, Figs. 7-9)

Zoarium unknown, fragments flattened.

Obverse. — Branches slender, angular, subparallel; average width 0.30 mm.; nine in 5 mm. Dissepiments very slender, rounded, to subangular to flattened to concave; depressed below plane of branches; six to seven in 5 mm. Fenestrules oval to subquadrangular and of same size as on opposite face. Apertures large, opening laterally; eighteen to twenty in 5 mm., separated by less than half the diameter of an aperture; additional apertures

at bifurcations of branches. Peristomes weakly developed in proportion to size of apertures; thin, not prominent and but slightly indenting margins of fenestrules. Carina prominent, sharply angular; summit bears a row of high conical spines in some places and in others spines are flattened so that they appear as continuations of carina.

Reverse. — Branches sharply angular to rounded; more slender than those on opposite face; strongly carinated in mid-line and with an occasional prominent, granular node at junction with branches and dissepiments. Dissepiments rounded to subangular and usually carinated; carina of dissepiments uniting with that of branches; dissepiments not depressed below and usually raised above plane of branches. Fenestrules oval to subquadrangular; length from 0.60 to 0.75 mm., width from 0.26 to 0.40 mm.

Holotype No. 10497 U.M.

Horizon and locality. — Top zone of Location 28.

Fenestella incisa, sp. nov.

(Plate III, Figs. 5-6)

Zoarium unknown, fragments flattened, undulating.

Obverse. — Branches slender, angular, average width 0.34 mm.; eleven to twelve in 5 mm.; bifurcations distant. Dissepiments more slender than branches, average thickness 0.22 mm.; ten in 5 mm.; strongly expanded at junction with branches. Fenestrules oval; average length 0.30 mm., average width 0.18 mm. Apertures small, opening directly; twenty-two to twenty-four in 5 mm., separated by more than diameter of an aperture. Peristomes strongly developed, indenting borders of fenestrules. Carina prominent, angular, thin at summit, which bears a row of sharp spinules; four in 1 mm.

Reverse. — Branches rounded, slender, coarsely granulose, with low, granular nodes opposite dissepiments. Dissepiments about two thirds as wide as branches; rounded, granular, occasionally nodose; usually not depressed below plane of branches. Fenestrules oval; length from 0.26 to 0.38 mm., width average about 0.18 mm.

Holotype No. 10509 U.M.

Horizon and locality. — Top zone of Location 28.

The obverse face of this specimen was not seen macroscopically; the characters described above were taken from a thin section.

Fenestella longispinosa, sp. nov.

(Plate IV, Figs. 1 and 3)

Zoarium unknown, fragments flexuous.

Obverse. — Branches strong, angular, slightly sinuous to straight; average width 0.30 mm.; twelve in 5 mm. Dissepiments slender, from 0.10 to 0.20 mm. in width; subangular, depressed below plane of branches; ten in 5 mm. Fenestrules of same size and shape as on reverse face. Apertures open directly, separated by more than diameter of an aperture; two to a fenestrule; twenty-three to twenty-five in 5 mm. Peristomes strongly developed, indenting margins of fenestrules. Carina strong, angular, low, with sharp conical nodes disposed upon summit; seven nodes in 2 mm.

Reverse. — Branches rounded to subangular, coarsely granulate, straight; bifurcating every fourth fenestrule; low granular nodes disposed at junction of branches and dissepiments. Dissepiments comparatively slender, rounded to subangular; faintly depressed below plane of branches. Fenestrules oval; length from 0.26 to 0.36 mm., average width 0.22 mm.

Holotype No. 10476 U.M.

Horizon and locality. — Shaly limestone of Location 35.

Genus HEMITRYPA Phillips

For generic description see page 235.

Hemitrypa variosa, sp. nov.

(Plate IV, Figs. 2 and 5)

Zoarium unknown, fragments flexuous.

Obverse. — Branches not seen on specimen. In thin section they appear angular, slender; bifurcations average 2.1 mm.

distant; twelve to thirteen branches in 5 mm. Dissepiments more slender than branches; angular, carinated; nine to ten in 5 mm. Fenestrules elongate-oval. Apertures open laterally; twenty-five in 5 mm., separated by more than diameter of an aperture. Carina strong, thin, expanded at summit. Thin transverse processes extend laterally from summit of carina, uniting in mid-line and forming a pseudo-carina. Interstices between carina, pseudo-carina, and transverse processes hexagonal to circular to quadrate; average 0.12 mm. in diameter; twenty-four to twenty-six in 5 mm.

Reverse. — Branches slender, rounded, smooth; average width 0.20 mm. Dissepiments stronger than branches; average width 0.24 mm.; rounded, smooth; not depressed below plane of branches. Fenestrules circular to oval to subhexagonal; length from 0.22 to 0.34 mm., width from 0.16 to 0.22 mm.

Holotype No. 10475 U.M.

Horizon and locality. — Blue shale zone of Location 46.

Genus ISOTRYPA Hall

For generic description see page 236.

Isotrypa tropozomena, sp. nov.

(Plate IV, Figs. 4 and 6)

Zoarium unknown, fragments flattened.

Obverse. — Branches strong, zigzag, angular; average width 0.40 mm.; eight in 5 mm. Dissepiments stronger than branches; sharply carinated; average width 0.50 mm. Fenestrules broadly oval to circular. Apertures open directly, separated by the diameter of an aperture; twenty to twenty-three in 5 mm.; disposed in oval rows surrounding fenestrules. Carina strong, thin with expanded summit. Transverse processes extend laterally, connecting carina of adjacent branches; usually occur above a dissepiment and equal in number to dissepiments; six in 5 mm. Carina and transverse bars of equal size; smooth, rounded, and of same size and appearance as branches and dissepiments of reverse face.

Reverse. — Branches smooth, subangular, with a low broad node at junction of dissepiments. Dissepiments and branches subequal in size. Dissepiments rounded, smooth; not depressed below plane of branches. Fenestrules circular; length from 0.55 to 0.70 mm.

Holotype No. 10474 U.M.

Horizon and locality. — Middle shale zone of Location 14.

***Isotrypa megista*, sp. nov.**

(Plate V, Figs. 1-3)

Zoarium unknown, fragments flattened and flexuous.

Obverse. — Branches slender, zigzag, bifurcations distant; average 0.26 mm. in thickness; nine in 5 mm. Dissepiments angular, more slender than branches; six to seven in 5 mm. Fenestrules broadly oval; length from 0.56 to 0.70 mm., width from 0.33 to 0.37 mm. Apertures open directly, separated by more than the diameter of an aperture; twenty in 5 mm. Carina thin, expanded at summit, which is angular. Transverse bars connect the carina of adjacent branches. Transverse bars comparatively slender; slightly depressed below plane of carinae; eight to ten in 5 mm. Low node present at junction of carina with transverse bar. Interstices between transverse bars and carinae circular to subquadrangular; average length 0.38 mm.

Reverse. — Branches angular, slender, with mid-row of granular nodes; usually zigzag, occasionally straight; from one fifth to one third wider than carina on obverse branches; average 0.30 mm. in width. Dissepiments more slender to faintly broader than branches; angular to rounded; depressed below plane of branches; usually minutely nodose. Fenestrules broadly oval, occasionally subrhomboidal or hexagonal; average length 0.50 mm., width from 0.30 to 0.40 mm.

Holotype No. 10473 U.M. Paratype No. 10528 U.M.

Horizon and locality. — Middle shale zone of Location 14.

Isotrypa angulata, sp. nov.

(Plate V, Figs. 4-6)

Zoarium unknown, fragments flattened.

This species differs from *I. megista* in (1) the carina and transverse bars, which are more sharply angular; (2) the absence of a node at the intersection of the transverse bars and carinae; and (3) the absence of nodes on the reverse branches, which are minutely granulose.

Holotype No. 10472 U.M.

Horizon and locality. — Blue shale zone of Location 47.**Isotrypa anomala**, sp. nov.

(Plate V, Figs. 7-8)

Zoarium unknown, fragments flattened, flexuous.

Obverse. — Branches slender, average width 0.20 mm.; eight to nine in 5 mm. Dissepiments vary from 0.20 to 0.48 mm. in width; five to six, usually six, in 5 mm.; seen only in thin sections, where they appear broadly rounded, depressed below plane of branches. Fenestrules elliptical; length from 0.36 to 0.42 mm., width from 0.18 to 0.28 mm. Apertures open directly, separated by more than diameter of an aperture; twenty-three to twenty-five in 5 mm. Carina slender, thin with expanded summit, which is slightly angular. Carinae of adjacent branches connected by transverse bars of same size as carina and not depressed below planes of carinae. Six to seven bars in 5 mm. Interstices between transverse bars and carinae subquadrangular to oval; length from 0.40 to 0.55 mm., width from one third to four fifths of length.

Reverse. — Branches rounded, smooth, straight to sinuous; bifurcations distant. Dissepiments vary in width from slightly less to slightly more than that of branches; rounded to faintly carinated, usually depressed below plane of branches. Fenestrules elongate-oval; length from 0.40 to 0.62 mm., width from 0.26 to 0.30 mm.

Holotype No. 10471 U.M. Paratypes Nos. 10526, 10547 U.M.

Horizon and locality. — Zone 1 of Location 9.

Isotrypa anomala var. *sinuosa*, var. nov.

(Plate V, Fig. 9; Plate VI, Figs. 1-2)

Zoarium unknown, fragments flattened, flexuous.

Obverse. — Branches slender, from 0.30 to 0.34 mm. in width; slightly sinuous. Dissepiments slender, rounded; six to seven in 5 mm. Fenestrules narrow, elliptical. Apertures open directly, separated by more than diameter of an aperture; twenty-three in 5 mm. Branches, dissepiments, fenestrules, and apertures observed only in thin sections. Carina thin, summit expanded and sharply angular. Transverse bars of same thickness as the branches, sharply angular, angular part connecting with sharp summit of carina; eight bars in 5 mm. Interstices between carinae and transverse bars suboval to quadrate; length from 0.42 to 0.56 mm., width from 0.26 to 0.42 mm.

Reverse. — Branches slender, rounded, with minute granular nodes; straight to zigzag. Dissepiments stronger than branches; broadly expanded at junction with them, rounded; with minute granular nodes of same appearance as those on branches. Fenestrules elliptical; length from 0.44 to 0.54 mm., width from 0.24 to 0.32 mm.

Holotype No. 10470 U.M. Paratypes Nos. 10545, 10546 U.M.

Horizon and locality. — Zone 1 of Location 49.

Isotrypa rara, sp. nov.

(Plate VI, Figs. 3-4)

This species differs from *Isotrypa anomala* in that (1) there are twenty instead of twenty-three to twenty-five apertures in 5 mm.; and (2) the obverse carina and transverse bars and the reverse branches are more irregularly disposed and more granular.

Holotype No. 10469 U.M.

Horizon and locality. — Zone 8 of Location 40.

Isotrypa ovata, sp. nov.

(Plate VI, Figs. 5-7)

Zoarium unknown, fragments flattened, flexuous.

Obverse. — Branches slender, width average 0.24 mm., sinuous to straight. Dissepiments slender, much depressed below plane of branches; seven in 5 mm. Fenestrules elliptical; length 0.52 mm., width 0.26 mm. Apertures open directly, separated by more than the diameter of an aperture; twenty in 5 mm. Carina thin, broadly expanded at summit, which is broadly flattened, smooth, faintly striated where worn. Transverse bars more slender than carinae, usually rounded, faintly carinated and raised above the plane of the carinae in places; eight bars in 5 mm. Interstices between carinae and transverse bars subquadrangular to circular; length from 0.40 to 0.76 mm., width from 0.28 to 0.40 mm.

Reverse. — Branches zigzag to sinuous, rarely straight, rounded, slender; width from 0.24 to 0.33 mm., with very low granular nodes. Dissepiments stronger than branches; width from 0.28 to 0.46 mm., rounded, not depressed below plane of branches, with granular, low nodes. Nodes on dissepiments and branches are disposed in oval rows surrounding fenestrules. Fenestrules from 0.32 to 0.46 mm. in length, average width 0.32 mm.

Holotype No. 10468 U.M.

Horizon and locality. — Zone 1 of Location 17.**Isotrypa hexagona**, sp. nov.

(Plate VII, Figs. 1-2)

Zoarium unknown, fragments flattened.

Obverse. — Branches average 0.32 mm. in width, slightly sinuous. Dissepiments stronger than branches; average 0.42 mm. in width, rounded; five in 5 mm. Fenestrules elliptical; average length 0.50 mm., average width 0.22 mm. Apertures open directly, separated by more than diameter of an aperture; twenty in 5 mm. Carina thin, expanded at summit, which is thin and extremely sharp; zigzag, never straight. Transverse bars as sharply angular

as carina. The angular summits of both bars and carinae unite to form hexagonal interstices between them, with length from 0.40 to 0.60 mm. Eight bars in 5 mm.

Reverse. — Branches strong, flattened to subangular; zigzag to sinuous; with low sharp carina in mid-line. Dissepiments stronger than branches, smooth, rounded; depressed below plane of branches, to slightly carinated and not depressed below plane of branches. Fenestrules sharp-ended ovals; average length 0.50 mm., average width 0.25 mm.

Holotype No. 10467 U.M.

Horizon and locality. — Zone 1 of Location 17.

Isotrypa vibrata, sp. nov.

(Plate VII, Figs. 3-5)

Zoarium unknown, fragments flattened.

Obverse. — Branches average 0.30 mm. in width; zigzag. Dissepiments much stronger than branches; average width 0.40 mm.; five in 5 mm. Fenestrules elliptical to broadly oval; average length 0.60 mm., width 0.30 mm. Apertures open directly, separated by more than the diameter of an aperture; twenty-five in 5 mm. Carina thin, expanded at the summit, rounded, faintly granular. Transverse bars more slender than carina, in places slightly thicker than the carina and faintly angular; eight bars in 5 mm. Interstices between carinae and transverse bars elongate-oval to subquadrangular; length from 0.40 to 0.61 mm., average width 0.28 mm.

Reverse. — Branches very slender, minutely granulose; extremely zigzag; anastomosed. Dissepiments rarely present. Anastomosed portions of branches strong; width from 0.52 to 0.64 mm.; four, rarely five in 5 mm.; slightly raised above plane of other parts of branches. Fenestrules rhomboidal to oval; average length 0.65 mm., average width 0.45 mm.

Holotype No. 10466 U.M.

Horizon and locality. — Zone 1 of Location 17.

Isotrypa oxytropis, sp. nov.

(Plate VII, Figs. 6-7)

Zoarium unknown, fragments flattened, flexuous.

Obverse. — Branches 0.18 to 0.30 mm. in width; sinuous to zigzag. Dissepiments wider than branches; average 0.32 mm., six in 5 mm., very short, rounded, depressed. Fenestrules oval; average length 0.52 mm., average width 0.26 mm. Apertures open directly, separated by more than the diameter of an aperture; twenty to twenty-two in 5 mm. Carina thin, expanded at summit, which is sharply angular, with a conical node at junction of transverse bar and carina. Transverse bars of same width as carina, sharply angular, connected with angular summit of carina inclosing quadrangular to hexagonal interstices. Seven transverse bars in 5 mm. Interstices vary from 0.40 to 0.70 mm. in length and from 0.30 to 0.40 mm. in width.

Reverse. — Branches angular; usually zigzag; anastomosed. Dissepiments strong, angular, in some places depressed, in others raised above the plane of the branches. Large pores 0.20 mm. in diameter occupy dissepiments. Pore margins strong, elevated, giving appearance of node on dissepiment. Fenestrules oval; average length 0.50 mm., average width 0.28 mm.

Holotype No. 10465 U.M.

Horizon and locality. — Bell Shale of Location 31.**Isotrypa gigantea**, sp. nov.

(Plate VIII, Figs. 1-2)

Zoarium unknown, fragments flattened.

Obverse. — Branches slender, zigzag. Apertures open directly; separated by more than diameter of an aperture. Carina thin, expanded and rounded to gently angular at summit, sinuous to zigzag; in places carina of adjacent branches appear to anastomose, giving rise to very short, wide transverse bars; both transverse bars and branches granulate. Transverse bars and carina subequal in width when carinae are not anastomosed. Interstices between transverse bars and carinae hexagonal to subrhomboidal to oval; length from 0.70 to 0.80 mm., width from 0.32 to 0.50 mm.

Reverse. — Branches strong, rounded to angular, slightly granulose; zigzag; rarely sinuous. Dissepiments formed by anastomosed portions of branches; strong, short, rounded, slightly granulose; faintly raised above plane of branches. Fenestrules rhomboidal to suboval. Length from 0.50 to 0.55 mm., width and length subequal.

Holotype No. 10500 U.M.

Horizon and locality. — Zone 8 of Location 40.

***Isotrypa isopeda*, sp. nov.**

(Plate VIII, Figs. 3-5)

Zoarium unknown, fragments flattened.

Obverse. — Branches average 0.22 mm. in thickness; sinuous. Dissepiments stronger than branches, short, rounded; average 0.28 mm. in width; six in 5 mm. Apertures open directly, separated by more than diameter of an aperture; twenty-five to twenty-seven in 5 mm. Fenestrules 0.48 to 0.62 mm. in length, average width 0.26 mm.; elongate-oval in shape. Carina thin, expanded and sharply angular at summit; straight. Transverse bars of same width as carina, sharply angular, not depressed below plane of carinae; ten bars in 5 mm. Interstices subquadrangular to oval; average length 0.40 mm., average width 0.32 mm.

Reverse. — Branches irregularly zigzag to sinuous, slender; of equal width to branches of opposite face, sharply angular, anastomosed in places. Dissepiments normally slender, rounded, faintly depressed, occasionally slightly angular and not depressed below plane of branches. Anastomosed portions of branches rounded, broad; on same plane as branches. Fenestrules truncated oval to smooth oval; average length 0.60 mm., average width 0.30 mm.

Holotype No. 10464 U.M.

Horizon and locality. — Blue shale zone of Location 47.

Genus *PHYLLOPORA* King

For generic description see page 236.

Phyllopora aequirotundata, sp. nov.

(Plate VIII, Figs. 6-7)

Zoarium unknown, fragments flattened, flexuous.

Obverse. — Branches gently rounded, sinuous to zigzag; average 0.80 mm. in width. Dissepiments from 0.40 to 0.55 mm. in width; four in 5 mm., gently rounded, depressed below plane of branches. Fenestrules narrow oval; length from 0.60 to 0.75 mm., width from 0.22 to 0.40 mm. Zoëcia disposed in three to five ranges, on both branches and dissepiments; mid-line of dissepiments not celluliferous. Apertures small; twenty in 5 mm.; distant longitudinally by diameter of an aperture or more, transversely by less than the diameter of an aperture.

Reverse. — Branches more slender than on opposite face, rounded to faintly angular, smooth to minutely granulose; zigzag to sinuous. Dissepiments and branches subequal in width, rounded, not depressed below plane of branches. Fenestrules broadly oval; average length 0.94 mm., average width 0.72 mm.

This species differs from *Phyllopora superba* Ulrich⁴ in having smaller branches, dissepiments and fenestrules, and in the greater number of apertures in 5 mm.

Holotype No. 10499 U.M. Paratype No. 10543 U.M.

Horizon and locality. — Zone 1 of Location 17.

Genus POLYPORA McCoy

For generic description see page 237.

Polypora ambiplana, sp. nov.

(Plate IX, Figs. 1-2)

Zoarium unknown, fragments flattened.

Obverse. — Branches from 0.40 to 0.54 mm. in width, six in 5 mm.; straight to slightly sinuous; rounded. Dissepiments rounded, depressed below plane of branches; four to five in 5 mm. Fenestrules oval to subquadrangular; average 0.70 mm. by 0.50

⁴ Ulrich, E. O., "Paleozoic Bryozoa," Geol. Surv. Ill., Vol. 8, Text, Pt. 2, p. 613; pl. 44, figs. 6-6c, and pl. 55, figs. 9-9a (1890).

mm. Apertures in three to five ranges; twenty in 5 mm., separated by less than diameter of an aperture.

Reverse. — Branches rounded to faintly angular, with low nodes usually at junction of dissepiment and branch. Dissepiments vary in width from equal to twice as wide as branches. Fenestrules subquadrate to subhexagonal to oval; average length 0.78 mm., average width 0.50 mm.

Holotype No. 10463 U.M.

Horizon and locality. — Zone 1 of Location 49.

***Polypora finitima*, sp. nov.**

(Plate IX, Fig. 3)

Zoarium unknown, fragments flattened.

Obverse. — Branches strong, sinuous. Dissepiments of same width as branches; six in 5 mm. Fenestrules broadly oval to circular. Apertures disposed in three to four ranges, separated longitudinally by less than diameter of an aperture; twenty-two to twenty-four in 5 mm.

Reverse. — Branches angular; sinuous to zigzag, rarely straight; granulose, with low granular nodes usually at junction of branch and dissepiment. Dissepiments subangular to rounded; usually depressed below plane of branches; width from less than to twice that of branches. Fenestrules oval to circular to subhexagonal; length from 0.35 to 0.62 mm., width from 0.30 to 0.42 mm.

Holotype No. 10506 U.M. Paratype No. 10502 U.M.

Horizon and locality. — Bell Shale of Location 31.

***Polypora amorpha*, sp. nov.**

(Plate IX, Figs. 4-5)

Zoarium unknown, fragments flattened, flexuous, flabellate.

Obverse. — Branches angular; 0.30 to 0.50 mm. in width, low angular ridges between ranges of apertures, elongated nodes on summit of ridges, irregularly disposed. Dissepiments slender; average width 0.20 mm.; rounded to subangular, slightly depressed below plane of branches; six in 5 mm. Fenestrules elongate,

irregularly oval, narrower than those on reverse face. Apertures in two to four ranges; twenty in 5 mm., separated longitudinally by less than diameter of an aperture.

Reverse. — Branches rounded, in places subangular; straight to sinuous; width slightly less than on obverse face; bifurcations distant. Dissepiments comparatively slender; rounded to gently angular, smooth; not depressed below plane of branches. Fenestrules oval to subquadrangular to subhexagonal; length from 0.65 to 0.80 mm., width from 0.26 to 0.40 mm.

Holotype No. 10460 U.M.

Horizon and locality. — Zone 6 of Location 29.

Polypora magnifica, sp. nov.

(Plate IX, Fig. 6; Plate X, Fig. 1)

Zoarium unknown, fragments flattened.

Obverse. — Branches angular; width from 0.32 to 0.74 mm.; conical nodes irregularly distributed between ranges of apertures; branches straight to faintly sinuous. Dissepiments rounded, depressed below plane of branches; average 0.40 mm. in width; four, rarely five, in 5 mm. Fenestrules broadly oval to subquadrangular, slightly smaller than on opposite face. Apertures in three to six ranges; twenty in 5 mm., separated by less than diameter of an aperture. Margins of lateral ranges indenting borders of fenestrules.

Reverse. — Branches slender, width average 0.26 mm.; rounded to subangular, smooth, with low node near junction of dissepiment and branch. Nodes irregularly disposed. Dissepiments of same width as branches; rounded to subangular; usually not depressed below plane of branches, and occasionally slightly raised above it. Fenestrules quadrate to very broadly oval; length 0.80 to 1.10 mm., width 0.65 to 0.80 mm.

Holotype No. 10495 U.M. Paratype No. 10542 U.M.

Horizon and locality. — Zone 1 of Location 49.

***Polypora brevissima*, sp. nov.**

(Plate X, Figs. 2-3)

Zoarium unknown, fragments flattened.

Obverse. — Branches angular, slender, width from 0.30 to 0.50 mm.; with low nodes irregularly distributed between ranges of apertures. Dissepiments vary from 0.40 to 0.68 mm. in width; rounded to flattened, very short; slightly depressed below plane of branches; four to five in 5 mm. Fenestrules elongate-oval; length from 0.60 to 0.80 mm., width from 0.27 to 0.34 mm. Apertures in two to four ranges; nineteen to twenty-one in 5 mm., separated longitudinally by less than diameter of an aperture.

Reverse. — Branches slender; angular to broad, flattened, rounded at a bifurcation; faintly striated where worn. Dissepiments of same size as on obverse face; rounded, smooth; slightly depressed below plane of branches. Fenestrules elongate-oval, occasionally subquadrangular; length from 0.60 to 0.75 mm., width from 0.32 to 0.40 mm.

Holotype No. 10494 U.M.

Horizon and locality. — Zone 1 of Location 49.

***Polypora pyramidata*, sp. nov.**

(Plate X, Figs. 4-5)

Zoarium unknown, fragments flattened.

Obverse. — Branches slender, average 0.36 mm. in width; bifurcations frequent; straight. Dissepiments average 0.45 mm. in thickness; rounded, slightly depressed; four, occasionally five in 5 mm. Fenestrules oval; length 0.60 to 0.78 mm., width 0.30 to 0.48 mm. Apertures in two to five ranges; twenty in 5 mm., separated by less than diameter of an aperture. Very sharp, prominent, angular spinules irregularly distributed between ranges of apertures.

Reverse. — Branches 0.28 to 0.40 mm. in width; angular, straight to slightly sinuous; faintly striated where worn, smooth, minutely granulose. Dissepiments of same width as branches; smooth, subangular; not depressed below plane of branches.

Fenestrules oval, similar in appearance to those of obverse face; length from 0.64 to 0.92 mm., average width 0.42 mm.

Holotype No. 10493 U.M.

Horizon and locality. — Zone 1 of Location 49.

Polypora indentata, sp. nov.

(Plate X, Figs. 6-7)

Zoarium unknown, fragments flattened.

Obverse. — Branches slender, average width above bifurcation 0.22 mm.; ten in 5 mm.; angular ridge between ranges of apertures, straight to slightly flexuous. Dissepiments average 0.20 mm. in width, six in 5 mm.; slightly angular and depressed below plane of branches. Fenestrules irregularly oval; length from 0.55 to 0.65 mm., average width 0.26 mm. Apertures in two to four ranges; twenty in 5 mm., separated longitudinally by less than the diameter of an aperture. Margins of lateral ranges of apertures indenting borders of fenestrules.

Reverse. — Branches slender, rounded, sharply striated for short distances, with low, longitudinally elongated nodes at junction of dissepiments and branches; straight to sinuous. Dissepiments slightly more slender than branches; smooth, rounded, not depressed below plane of branches. Fenestrules subquadrangular to oval; length from 0.55 to 0.62 mm., width from 0.28 to 0.42 mm.

Holotype No. 10492 U.M.

Horizon and locality. — Zone 6 of Location 29.

Polypora uniplana, sp. nov.

(Plate X, Figs. 8-9)

Zoarium unknown, fragments flattened.

Obverse. — Branches slender, 0.22 mm. above a bifurcation; subangular. Dissepiments angular, slightly depressed; six in 5 mm.; more slender than branches. Fenestrules flat-oval to subquadrangular; average length 0.72 mm., average width 0.28 mm. Apertures in two to four ranges; sixteen to eighteen in 5 mm., separated by less than diameter of an aperture. Low blunted nodes irregularly disposed between ranges of apertures.

Reverse. — Branches slender, subangular, striated where worn. Straight to faintly sinuous, subparallel. Dissepiments slender, average 0.20 mm. in width; rounded, smooth; not depressed below plane of branches, very slightly expanded at the junction with branches. Fenestrules subquadrangular to occasionally oval; length from 0.65 to 0.75 mm., width from 0.30 to 0.42 mm.

Holotype No. 10491 U.M.

Horizon and locality. — Middle shale zone of Location 14.

***Polypora minuta*, sp. nov.**

(Plate XI, Figs. 1-3)

Zoarium unknown, fragments flattened, flexuous.

Obverse. — Branches rounded, slender, flattened, subparallel. Dissepiments more slender than branches, from 0.30 to 0.42 mm. in width; rounded; depressed below plane of branches, so that they appear as grooves between branches; five, rarely six, in 5 mm. Fenestrules elongate-oval to elliptical; length average 0.52 mm., width 0.24 mm. Apertures in two to four ranges, usually three; nineteen to twenty in 5 mm., separated by more than diameter of an aperture. Peristomes of lateral ranges of apertures indent borders of fenestrules.

Reverse. — Branches slender, angular; zigzag to sinuous, rarely straight. Dissepiments equal to branches in width, angular; not depressed below plane of branches. Both dissepiments and branches faintly granulose. Fenestrules oval to subquadrangular to subhexagonal; length from 0.50 to 0.62 mm., width from 0.28 to 0.50 mm.

Holotype No. 10490 U.M. Paratype No. 10538 U.M.

Horizon and locality. — Bell Shale of Location 31.

***Polypora allelomorpha*, sp. nov.**

(Plate XI, Figs. 4-5)

Zoarium unknown, fragments flattened, flexuous.

Obverse. — Branches rounded, slender, width 0.32 to 0.50 mm.; straight, subparallel. Dissepiments rounded, depressed below plane of branches, appear as grooves between branches; very

short; six in 5 mm. Fenestrules narrow-oval; width one fourth to one third of length. Apertures in two to four ranges, usually three; twenty-two to twenty-four in 5 mm., separated longitudinally by more than diameter of an aperture.

Reverse. — Branches slender, angular, smooth; zigzag to sinuous; minutely granulose. Dissepiments usually more slender than branches and expanded at junction with them; subangular to sharply rounded; depressed below plane of branches. Where branches anastomose, dissepiments thus formed appear raised above plane of branches. Fenestrules broadly oval to circular; length from 0.50 to 0.66 mm., width from 0.34 to 0.48 mm.

Holotype No. 10507 U.M.

Horizon and locality. — Bell Shale of Location 31.

***Polypora labellosa*, sp. nov.**

(Plate XI, Figs. 6-7)

Zoarium unknown, fragments flattened, flexuous.

Obverse. — Branches rounded, strong, straight, subparallel; bifurcations distant. Dissepiments rounded, equal in width to branches; depressed below plane of branches; six in 5 mm. Fenestrules very narrow-oval; width from one third to one half of length. Apertures in three to four ranges; eighteen to twenty in 5 mm., separated by more than diameter of an aperture; peristomes prominently developed.

Reverse. — Branches slender, sharply angular, with coarse, granular nodes at the summit, usually a larger node at the junction of a dissepiment; never straight, zigzag to sinuous; anastomosed. Dissepiments more slender than branches; angular, granular; depressed below plane of branches. Anastomosed portions of branches raised above plane of branches. Fenestrules predominantly hexagonal, in places quadrangular to suboval, length from 0.50 to 0.70 mm., width and length subequal.

Holotype No. 10462 U.M.

Horizon and locality. — Bell Shale of Location 31.

***Polypora tenuosa*, sp. nov.**

(Plate XI, Figs. 8-9)

Zoarium infundibuliform, fronds rapidly expanding from very short base.

Obverse. — Branches rounded, slender, from 0.30 to 0.44 mm. in width; straight, subparallel. Dissepiments more slender than branches, average 0.18 mm. in width; rounded to subangular; slightly depressed below plane of branches; eleven in 5 mm. Fenestrules flattened-oval; average length 0.32 mm., average width 0.12 mm. Apertures in two to three ranges; twenty-two to twenty-four in 5 mm., separated by more than diameter of an aperture. Peristomes weakly developed, faintly indenting borders of fenestrules.

Reverse. — Branches straight to sinuous, slender, rounded, smooth; thirteen to fourteen in 5 mm. Dissepiments equal in width to branches; rounded, smooth; not depressed below plane of branches. Fenestrules quadrangular to broadly oval to sub-hexagonal; length from 0.22 to 0.36 mm., width from 0.18 to 0.30 mm.

Holotype No. 10461 U.M.

Horizon and locality. — Zone 1 of Location 49.

***Polypora exemplaria*, sp. nov.**

(Plate XII, Figs. 1-3)

Zoarium infundibuliform, rapidly expanding.

Obverse. — Branches slender, width from 0.22 to 0.40 mm.; subangular, with low, rounded ridges between ranges of apertures; straight, subparallel. Bifurcation every fifth dissepiment in basal portion of frond, more distant in peripheral region of zoarium. Dissepiments rounded, short; average 0.30 mm. in width; seven to eight in 5 mm. Fenestrules oval; average length 0.40 mm., average width 0.20 mm. Apertures in two to three ranges; twenty to twenty-one in 5 mm., separated by more than diameter of an aperture. Peristomes absent.

Reverse. — Branches smooth, rounded, slender, straight to zigzag; eight in 5 mm. Dissepiments rounded, more slender than

branches to slightly thicker; in basal portion of frond depressed below plane of branches, in peripheral region on plane of branches; from 0.28 to 0.36 mm. in thickness. Fenestrules broadly oval to circular; length from 0.38 to 0.52 mm., width from 0.22 to 0.32 mm.

Holotype No. 10489 U.M.

Horizon and locality. — Zone 1 of Location 17.

***Polypora muricula*, sp. nov.**

(Plate XII, Figs. 4-6)

Zoarium infundibuliform, rapidly expanding.

Obverse. — Branches angular, strong; width from 0.50 to 0.65 mm.; straight, subparallel; bifurcations frequent in basal portion of frond. Dissepiments short, very strong, rounded, slightly depressed below plane of branches. Fenestrules narrowly oval; average length 0.70 mm., width from 0.20 to 0.30 mm. Apertures in two to three ranges; twenty-two to twenty-four in 5 mm., separated by more than diameter of an aperture. Ranges of apertures divided by low, rounded to slightly angular ridges. Apertures disposed on ends of dissepiments, but never completely covering them. Summits of ridges bear minute, low, granular nodes irregularly distributed.

Reverse. — Branches subangular to rounded; minutely granulose; sinuous to zigzag, rarely straight. Dissepiments of same thickness as branches; rounded, smooth to minutely granulose; slightly depressed below plane of branches; five in 5 mm. Fenestrules broadly oval to subquadrangular; length from 0.70 to 0.85 mm., width from 0.50 to 0.60 mm.

Holotype No. 10488 U.M.

Horizon and locality. — Zone 1 of Location 17.

***Polypora modesta*, sp. nov.**

(Plate XII, Figs. 7-8)

Zoarium unknown, fragments flattened, flexuous.

Obverse. — Branches slender; width from 0.30 to 0.44 mm.; angular, straight, subparallel, with low ridges separating ranges

of apertures. Dissepiments angular; slightly depressed below plane of branches; short; average width 0.32 mm.; ten in 5 mm. Fenestrules oval; width from one fourth to two thirds of length. Apertures in two to three ranges; twenty-one to twenty-three in 5 mm., separated by more than diameter of an aperture. Peristomes slightly developed only on anterior edge of apertures.

Reverse. — Branches in thin sections appear angular; sinuous to zigzag; average width 0.24 mm. Dissepiments from slightly less thick to slightly thicker than branches; angular; appear not depressed below plane of branches. Fenestrules circular to oval; length from 0.26 to 0.44 mm., width from 0.18 to 0.32 mm. All characters of reverse face taken from thin section. Reverse face not seen macroscopically.

Holotype No. 10496 U.M.

Horizon and locality. — Shaly limestone of Location 35.

Genus PTILOPORINA Hall

For generic description see page 237.

Ptiloporina jugosa, sp. nov.

(Plate XII, Fig. 9; Plate XIII, Fig. 2)

Zoarium unknown, fragments flattened.

Obverse. — Branches of two sizes; in thin section they appear angular, with sharp ridges between ranges of apertures; summits of ridges bear sharp, prominent spines. Dissepiments of about half the thickness of smaller branches; set oblique to branches in places where smaller branches unite with larger ones; six dissepiments in 5 mm. Fenestrules subrhomboidal to distorted oval; length from 0.46 to 0.72 mm., width from 0.26 to 0.40 mm. Apertures in two to three ranges; seventeen to nineteen in 5 mm., separated by less than diameter of an aperture.

Reverse. — Branches of two sizes; larger ones 0.64 mm. in width; smaller ones average 0.30 mm. Larger branches gently rounded to flattened; raised above plane of smaller ones; minutely granulose; slightly sinuous in places. Smaller branches rounded to subangular, faintly carinated in places; minutely granulose;

straight to sinuous; bifurcate from larger branches. Dissepiments of equal width to smaller branches; rounded, minutely granulose; usually oblique to branches; not depressed below plane of smaller branches. Fenestrules oval to subquadrangular; length from 0.50 to 0.62 mm., average width 0.32 mm.

Holotype No. 10487 U.M.

Horizon and locality. — Middle shale zone of Location 14.

Genus SEMICOSINIUM Prout

For generic description see page 237.

Semicosinium rhombicum Ulrich var. **obliquum**, var. nov.

(Plate XIII, Figs. 1, 3, 5)

Zoarium unknown, fragments flattened.

Obverse. — Branches slender, width from 0.20 to 0.30 mm.; sinuous to zigzag; sharply angular. Dissepiments much stronger than branches; width from 0.32 to 0.60 mm.; short, rounded to flattened; much depressed below plane of branches; five to six in 5 mm. Large accessory pore, 0.30 mm. in diameter, disposed on about fifty per cent of dissepiments. Fenestrules oval; length from 0.38 to 0.62 mm., width from 0.18 to 0.28 mm. Apertures open laterally; twenty-five in 5 mm., separated by less than diameter of an aperture. Carina thin, flexuous, sinuous, prominent; not expanded at summit.

Reverse. — Branches broadly angular; straight to faintly sinuous; minutely granulose. Dissepiments from slightly less than width of branches to equal to it; faintly angular; not depressed below plane of branches; minutely granulose. Fenestrules quadrangular to circular; length from 0.32 to 0.40 mm.

Holotype No. 10486 U.M.

Horizon and locality. — Zone 1 of Location 49.

Semicosinium thyene Hall var. **michiganense**, var. nov.

(Plate XIII, Figs. 4, 6)

Zoarium unknown, fragments flattened.

Obverse. — Branches slender, average 0.28 mm. in width; straight to slightly sinuous; sharply rounded to angular; ten in

5 mm. Dissepiments short, rounded to angular, much depressed; width from 0.30 to 0.48 mm.; seven in 5 mm. Fenestrules oval; width from 0.18 to 0.20 mm.; length equal to that of those on reverse face. Apertures open directly, separated by more than diameter of an aperture; from two to three to a fenestrule; twenty-three in 5 mm. Carina thin, flexuous, sinuous, very high, summit but slightly expanded.

Reverse. — Branches zigzag, slender, subangular, minutely granulose; anastomosed in places. Dissepiments subangular, with minute granular nodes; twice width of branches and elevated above plane of branches, in places continuing across them when dissepiments occur opposite each other. Fenestrules circular, oval to subrhomboidal; length from 0.36 to 0.50 mm., width from 0.26 to 0.38 mm.

Holotype No. 10485 U.M.

Horizon and locality. — Shale bed of Location 46.

Semicosinium approximatum, sp. nov.

(Plate XIV, Figs. 1-2)

Zoarium unknown, fragments flattened.

Obverse. — Branches slender, width from 0.22 to 0.36 mm.; flattened to angular, sinuous. Dissepiments very broad, average 0.56 mm.; rounded to flattened, depressed below plane of branches, appear as grooves between branches; five in 5 mm. Fenestrules oval, length 0.28 to 0.42 mm., average width 0.26 mm. Carina thin, sinuous; not expanded at summit; prominent. Apertures open directly; twenty-five in 5 mm., separated by more than diameter of an aperture. Large accessory pores on dissepiments absent in this form.

Reverse. — Branches in thin section appear angular; zigzag to sinuous, slender, anastomosed. Dissepiments, or anastomosed portions of branches, much stronger than normal branches; rounded to angular; not depressed below plane of normal branches. Fenestrules oval to circular to quadrangular; length from 0.30 to 0.38 mm., width and length subequal.

Holotype No. 10484 U.M. Paratypes Nos. 10550, 10551 U.M.

Horizon and locality. — Shaly limestone of Location 35.

Semicosinium flexuosum, sp. nov.

(Plate XIV, Figs. 3-4)

Zoarium unknown, fragments flattened.

Obverse. — Branches moderately strong, average width 0.40 mm.; angular, sinuous. Dissepiments from 0.40 to 0.60 mm. in width; rounded; depressed below plane of branches; five in 5 mm. Fenestrules oval; length from 0.44 to 0.70 mm., width from 0.24 to 0.32 mm. Apertures open directly; twenty in 5 mm., separated by more than diameter of an aperture. Carina thin, expanded and flattened at summit, prominent, flexuous, sinuous; in places summit appears rounded.

Reverse. — Branches slender, rounded, smooth, straight to sinuous. Dissepiments more slender than branches; broadly expanded at junction with, and not depressed below plane of, branches. Fenestrules oval to subquadrangular; length from 0.70 to 0.92 mm., width from 0.50 to 0.62 mm.

Holotype No. 10483 U.M. Paratype No. 10548 U.M.

Horizon and locality. — Zone 1 of Location 17.

CONCLUSIONS

The forms of fenestellid Bryozoa in the Devonian rocks of Michigan represent but a small number of the total fauna. Any group as small as the family Fenestellidae does not give sufficient evidence for stratigraphic correlation, but is useful as contributing evidence to that furnished by the complete fauna.

Such forms as *Fenestella vera* Ulrich var. *acuta*, *F. variifenestrula*, *F. incerta*, *F. foraminosa*, *Isotrypa tropozomena*, *I. megista*, *I. anomala*, *I. anomala* var. *sinuosa*, and *Polypora amorpha* occur in certain similar lithologic horizons on both sides of the state, but these horizons cannot be correlated as the same stratigraphic zone upon such meager evidence.

The species *Fenestella longispinosa*, *Polypora minuta*, *P. allelomorpha*, and *Semicosinium approximatum* occur in both the Bell Shale at Location 31, which lies at the base of the Lower Traverse group, and in the shaly limestone at Partridge Point, Location 35, which represents the highest beds of the Upper

Traverse group. This long vertical range may represent similar depositional conditions which were favorable to these species.

These forms may have lived in other places during the whole of the time in which the intermediate strata were being deposited. Then with a change in conditions which created favorable environment the species returned and thrived until conditions were again altered. If this hypothesis is correct, similar conditions must have prevailed at four intervals during Devonian time in Michigan, because the same species occur at two different intermediate horizons between the Bell Shale and the beds at Partridge Point.

It is thought that further study of the other groups of the fauna of these horizons may suggest a similar condition.

With the exception of three species of *Fenestella*, a new variety of *Fenestella vera* Ulrich, a new variety of *Semicosinium rhombicum* Ulrich, and a new variety of *Semicosinium thyene* Hall, all the forms described are new. This great difference in the fauna from that of any other known region suggests that during Devonian time Michigan was more or less an isolated basin. It appears that this difference between the faunas of Michigan and those of adjacent regions is due to geographic isolation and does not represent a difference in age.

Dr. Erwin Pohl⁵ has been studying some of the other groups of the Devonian fauna from Michigan and his conclusions correlate definitely with those of the author.

STRATIGRAPHIC SUMMARY

The following correlations are purely tentative and are suggested only as possibilities of what the situation may be in the Traverse Group. The evidence from the fenestellid Bryozoa is insufficient to do more than suggest possible correlations.

Western side

On the western side of the state the material examined represents three zones. The blue shale occurring in the middle portion of the Petoskey Portland Cement Co. quarry, Location 14, is the lowest. This bed is from forty to fifty-five feet below the second

⁵ Pohl, Erwin, *Proc. U. S. Nat. Mus.*, Vol. 76, Art. 14, p. 1, 1929.

of the three zones, which is the blue shale zone exposed as the lowest bed in the quarry of the Charlevoix Rock Products Co., Location 9, and in the quarry of the Antrim Lime Co., Location 17. The third and highest zone is a more or less crystalline limestone, yellow to gray in color, with shaly partings, occurring in the Charlevoix City quarry, Location 10, Zone 2. This zone is from thirty-seven to forty feet above the blue shale of Locations 9 and 17.

The blue shale of Zone 1, Locations 9 and 17, occurs about two feet below a two-foot bed of brown to yellow limestone with wavy, black carbonaceous streaks. This wavy layer occurs only as boulders in the drift high above the quarry at Location 14, but is limited to a narrow band, indicating that the rock is in place near the surface at this point. There is no exposure of the blue shale just below the wavy layer at this place. There is, however, a small flat developed at a slightly lower elevation than the band of boulders composed of the wavy limestone, and adjacent to it, which suggests that the rock exposed on the slope was soft and easily eroded. Since this flat occupies the theoretical position of the blue shale, it is probable that it was formed by the rapid erosion of an exposure of the shale.

The blue shale zone in the middle portion of the quarry walls at Location 14 is interbedded between coralline limestones. Because the lithologic character of this blue shale is the same as that of the blue shale just below the wavy layer and because *Fenestella incerta*, sp. nov., *F. vera* Ulrich var. *acuta*, var. nov., *Isotrypa megista*, sp. nov., and *I. anomala*, sp. nov., occur in all of these zones, it is believed that they represent the same depositional environment, although stratigraphically the blue shale zone of Location 14 is not equivalent to the blue shale of Locations 9 and 17.

Central area

There are but few horizons in the central part of the state which contain a fenestellid fauna. Zone 6 of Location 29 and Zone 3 of Location 28 were the only horizons which yielded Fenestellidae in this area and the faunas from these two zones are not the same.

Eastern side

On the eastern side of the state the lowest bed represented in the material studied is the Bell Shale, which occurs in pockets in the limestone of the quarry of the Michigan Limestone and Chemical Co. at Calcite, near Rogers City, Location 31, and as a five-foot bed at the base of the quarry at Rockport, Location 38. See chart, p. 269, for the faunal list of this shale.

The next higher zone, from which two species are identified, is not correlated on the basis of the Fenestellidae because both species have a long vertical range. The stratigraphic position of this zone is based upon the records of the Michigan Limestone and Chemical Co., which were made available by Mr. J. Valentine of that company. These records show this zone to be about fifty-seven feet above the Bell Shale. This zone is exposed at Location 32.

The faunas of the blue shale zones of Locations 40, 41, 46, 47 and 49 each show a considerable number of the same species. It is suggested that the similarity of the faunas from these horizons does not indicate that they are to be correlated as the same geologic formation, but rather that these species are long-lived forms which have a vertical range from the Long Lake Series to the Dock Street Shale. The blue shale of Locations 46 and 47 was described by Grabau⁶ as the Dock Street Shale, which he placed at the base of the Upper Traverse or Thunder Bay Series. This horizon lies well above the one at Location 40, which is thought to be a member of the Long Lake Series of Grabau,⁷ which he called the upper member of the Lower Traverse Group.

The highest beds exposed are those at Partridge Point, Location 35. These lie at the top of the Thunder Bay Series of Grabau.⁸ Although this horizon and the one represented by Zone 8 of Location 40 have four species in common, they are not to be considered as the same horizon, but rather as another example of a recurrence

⁶ Grabau, A. W., "Stratigraphy of the Traverse Group of Michigan," *Report of the State Board of Geological Survey of Michigan for the Year 1901*, pp. 163-210.

⁷ *Ibid.*

⁸ *Ibid.*

of similar conditions which permitted these species to return to this area from a parent sea where they lived during the time the intermediate beds were being deposited.

LIST OF LOCATIONS

LOCATIONS

9. Quarry of the Charlevoix Rock Products Co. NW. $\frac{1}{4}$ Sec. 28, T. 34 N., R. 8 W.
10. Charlevoix City quarry, now used as a dump ground. Immediately south of the center of E.-W. road, on the N. line of Sec. 33, T. 34 N., R. 8 W.
14. Quarry of the Petoskey Portland Cement Co.
17. Antrim Lime Co. quarry. SE. $\frac{1}{4}$ Sec. 1, T. 34 N., R. 6 W.
28. Exposure below dam on Black River one-quarter mile north of Tower, Michigan
29. Abandoned quarry on shore of Black Lake, near the State Park
31. Quarry of the Michigan Limestone and Chemical Co. at Calcite, near Rogers City, Michigan
32. Point on highway M-10, SW. corner of Sec. 35, Rogers Township
35. Exposure at Partridge Point
36. Abandoned quarry about one-quarter mile south of the center of Sec. 29, Alpena Township
38. Quarry at Rockport, Michigan
40. Quarry of the Michigan Alkali Co., at Alpena
41. Spillway below Power House, at the Three (Four) Mile Dam on the Thunder Bay River
46. Shale bank on the south side of the Thunder Bay River one-half mile east of the Three (Four) Mile Dam
47. Shale bank on the south side of the Thunder Bay River at the Seven Mile Dam
49. Abandoned quarry of a cement company near El Cajon Beach

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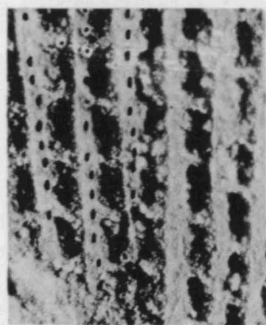
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EXPLANATION OF PLATE I

All specimens magnified 12 diameters

	PAGE
FIG. 1. <i>Fenestella eximia</i> Winchell <i>problematica</i> , var. nov.....	238
Obverse face of frond showing low, rounded carina and deeply depressed dissepiments.	
Holotype No. 10505 U.M.	
Zone 2, Location 10.	
FIG. 2. <i>Fenestella vera</i> Ulrich var. <i>acuta</i> , var. nov.....	240
Obverse face of frond showing strongly developed peristomes, and apertures opening laterally.	
Holotype No. 10504 U.M.	
Shale zone, Location 14.	
FIG. 3. <i>Fenestella vera</i> Ulrich var. <i>acuta</i> , var. nov.....	240
Reverse face of frond showing granular node at junction of branch and dissepiment.	
Holotype No. 10504 U.M.	
Shale zone, Location 14.	
FIG. 4. <i>Fenestella idalia</i> Hall.....	239
Obverse face of frond showing rounded branches, with apertures opening laterally.	
Plesiotype No. 10482 U.M.	
Zone 1, Location 17.	
FIG. 5. <i>Fenestella idalia</i> Hall.....	239
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Plesiotype No. 10482 U.M.	
Zone 1, Location 17.	
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Plesiotype No. 10482 U.M.	
Zone 1, Location 17.	
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Holotype No. 10481 U.M.	
Shaly limestone, Location 35.	
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Section cut slightly oblique to plane of frond, showing variation in size and shape of fenestrules. Section largely crystallized.	
Holotype No. 10481 U.M.	
Shaly limestone, Location 35.	

PLATE I



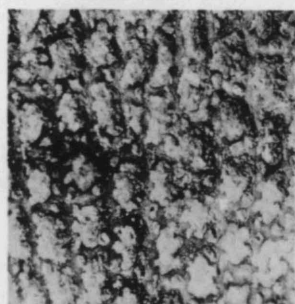
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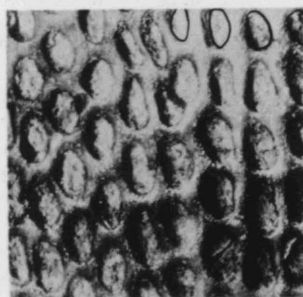
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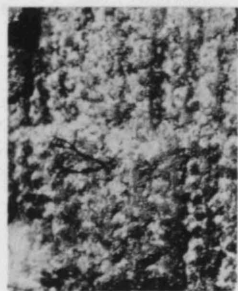
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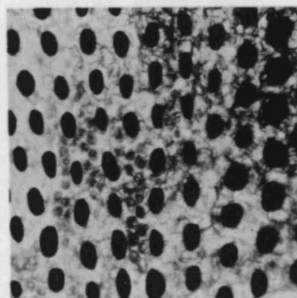
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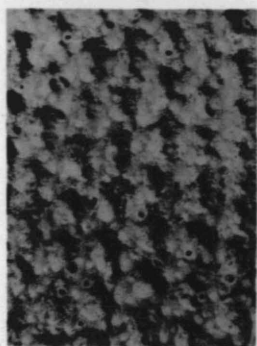
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EXPLANATION OF PLATE II

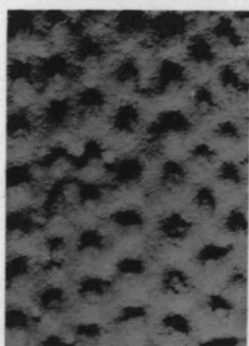
All specimens magnified 12 diameters

	PAGE
<p>FIG. 1. <i>Fenestella paridistans</i>, sp. nov.</p> <p style="padding-left: 2em;">Obverse face of frond showing low, angular carina with blunt nodes disposed upon its summit.</p> <p style="padding-left: 2em;">Holotype No. 10480 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 9.</p>	242
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<p>FIG. 3. <i>Fenestella paridistans</i>, sp. nov.</p> <p style="padding-left: 2em;">Section cut slightly oblique to plane of frond, showing arrangement of zocœcia in branches and structure of nodes upon obverse carina.</p> <p style="padding-left: 2em;">Holotype No. 10480 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 9.</p>	242
<p>FIG. 4. <i>Fenestella variifenstrula</i>, sp. nov.</p> <p style="padding-left: 2em;">Obverse face of frond, showing rugose appearance of angular branches. Apertures concealed by a thick secondary deposit.</p> <p style="padding-left: 2em;">Holotype No. 10479 U.M.</p> <p style="padding-left: 2em;">Shaly limestone, Location 35.</p>	242
<p>FIG. 5. <i>Fenestella variifenstrula</i>, sp. nov.</p> <p style="padding-left: 2em;">Reverse face of frond, showing branches and dissepiments on same plane, and low, broad, granular nodes disposed at junction of branches and dissepiments.</p> <p style="padding-left: 2em;">Holotype No. 10479 U.M.</p> <p style="padding-left: 2em;">Shaly limestone, Location 35.</p>	242
<p>FIG. 6. <i>Fenestella variifenstrula</i>, sp. nov.</p> <p style="padding-left: 2em;">Section cut slightly oblique to plane of frond, showing wide variation in size of fenestrules.</p> <p style="padding-left: 2em;">Holotype No. 10479 U.M.</p> <p style="padding-left: 2em;">Shaly limestone, Location 35.</p>	242
<p>FIG. 7. <i>Fenestella nodicula</i>, sp. nov.</p> <p style="padding-left: 2em;">Obverse face of frond, showing angular branches and slender, much depressed dissepiments.</p> <p style="padding-left: 2em;">Holotype No. 10478 U.M.</p> <p style="padding-left: 2em;">Shaly limestone, Location 35.</p>	243
<p>FIG. 8. <i>Fenestella nodicula</i>, sp. nov.</p> <p style="padding-left: 2em;">Section cut slightly oblique to plane of frond, showing structure of minute nodes disposed upon reverse branches and wide variation in size and shape of fenestrules.</p> <p style="padding-left: 2em;">Holotype No. 10478 U.M.</p> <p style="padding-left: 2em;">Shaly limestone, Location 35.</p>	243
<p>FIG. 9. <i>Fenestella incerta</i>, sp. nov.</p> <p style="padding-left: 2em;">Section cut slightly oblique to plane of frond, showing slender carinae on branches and angular, depressed dissepiments with an aperture occasionally disposed upon them.</p> <p style="padding-left: 2em;">Holotype No. 10477 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 9.</p>	244

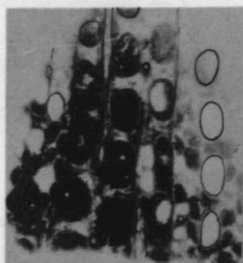
PLATE II



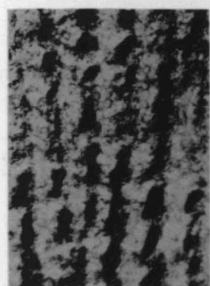
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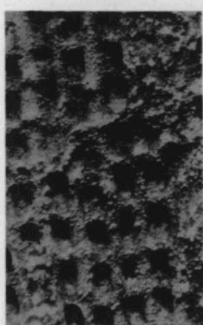
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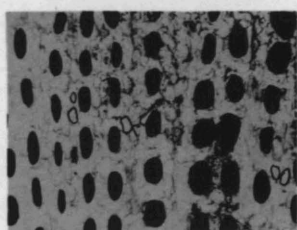
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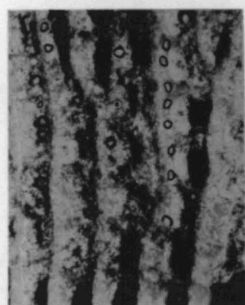
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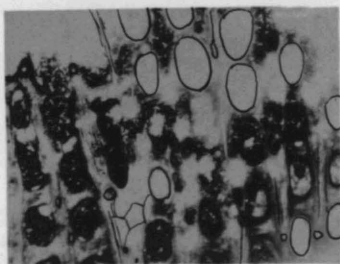
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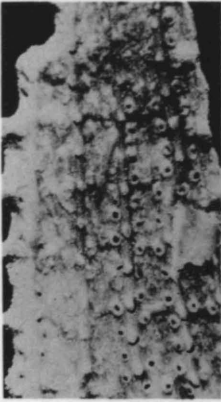
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EXPLANATION OF PLATE III

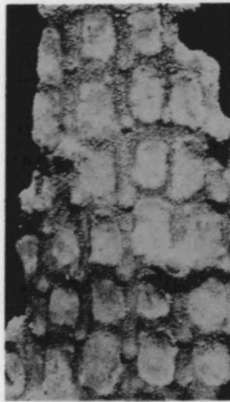
All specimens magnified 12 diameters

	PAGE
<p>FIG. 1. <i>Fenestella incerta</i>, sp. nov.....</p> <p style="padding-left: 2em;">Obverse face of frond, showing slender, rounded carinae with blunt nodes regularly disposed upon them.</p> <p style="padding-left: 2em;">Holotype No. 10477 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 9.</p>	244
<p>FIG. 2. <i>Fenestella incerta</i>, sp. nov.....</p> <p style="padding-left: 2em;">Reverse face of frond, showing strong nodes disposed at junction of branches and dissepiments.</p> <p style="padding-left: 2em;">Holotype No. 10477 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 9.</p>	244
<p>FIG. 3. <i>Fenestella foraminosa</i>, sp. nov.....</p> <p style="padding-left: 2em;">Obverse face of frond, showing apertures opening directly. Specimen partly covered with a secondary deposit.</p> <p style="padding-left: 2em;">Holotype No. 10498 U.M.</p> <p style="padding-left: 2em;">Location 36.</p>	245
<p>FIG. 4. <i>Fenestella foraminosa</i>, sp. nov.....</p> <p style="padding-left: 2em;">Section cut slightly oblique to plane of frond. Central portion shows position of apertures with relation to zoecia.</p> <p style="padding-left: 2em;">Holotype No. 10498 U.M.</p> <p style="padding-left: 2em;">Location 36.</p>	245
<p>FIG. 5. <i>Fenestella incisa</i>, sp. nov.....</p> <p style="padding-left: 2em;">Obverse face of frond, showing prominent carinae with blunt nodes disposed upon summits.</p> <p style="padding-left: 2em;">Holotype No. 10509 U.M.</p> <p style="padding-left: 2em;">Top zone, Location 28.</p>	246
<p>FIG. 6. <i>Fenestella incisa</i>, sp. nov.....</p> <p style="padding-left: 2em;">Reverse face of frond, showing minutely granulose branches and dissepiments.</p> <p style="padding-left: 2em;">Holotype No. 10509 U.M.</p> <p style="padding-left: 2em;">Top zone, Location 28.</p>	246
<p>FIG. 7. <i>Fenestella megalopora</i>, sp. nov.....</p> <p style="padding-left: 2em;">Obverse face of frond, showing apertures opening laterally, closely disposed, and with their peristomes indenting borders of fenestrules.</p> <p style="padding-left: 2em;">Holotype No. 10497 U.M.</p> <p style="padding-left: 2em;">Top zone, Location 28.</p>	245
<p>FIG. 8. <i>Fenestella megalopora</i>, sp. nov.....</p> <p style="padding-left: 2em;">Reverse face of frond, showing faint carina upon branch, with an occasional granular node.</p> <p style="padding-left: 2em;">Holotype No. 10497 U.M.</p> <p style="padding-left: 2em;">Top zone, Location 28.</p>	245
<p>FIG. 9. <i>Fenestella megalopora</i>, sp. nov.....</p> <p style="padding-left: 2em;">Section cut slightly oblique to plane of frond, showing arrangement of apertures at bifurcation of a branch, and structure of carinae and elongated nodes on reverse branches.</p> <p style="padding-left: 2em;">Holotype No. 10497 U.M.</p> <p style="padding-left: 2em;">Top zone, Location 28.</p>	245

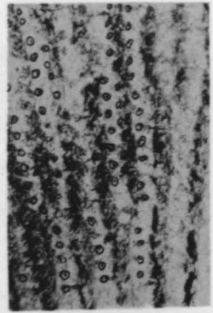
PLATE III



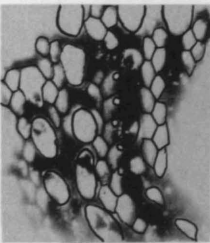
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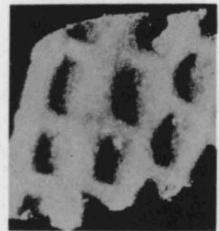
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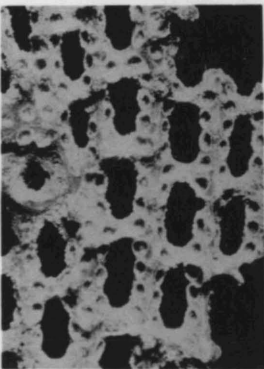
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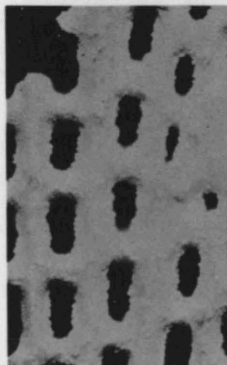
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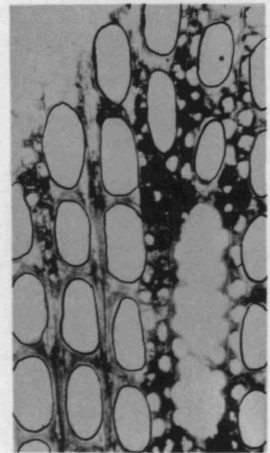
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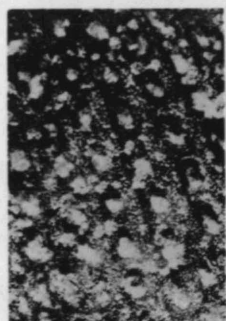
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EXPLANATION OF PLATE IV

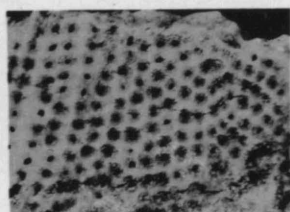
All specimens magnified 12 diameters

	PAGE
<p>FIG. 1. <i>Fenestella longispinosa</i>, sp. nov.....</p> <p style="padding-left: 2em;">Reverse face of frond, showing dissepiments depressed below plane of branches. Specimen badly worn. Holotype No. 10476 U.M. Shaly limestone, Location 35.</p>	247
<p>FIG. 2. <i>Hemitrypa variosa</i>, sp. nov.....</p> <p style="padding-left: 2em;">Obverse face of frond, showing superstructure. Holotype No. 10475 U.M. Location 46.</p>	247
<p>FIG. 3. <i>Fenestella longispinosa</i>, sp. nov.....</p> <p style="padding-left: 2em;">Section cut slightly oblique to plane of frond. Left side of figure shows apertures opening directly and minute nodes regularly disposed upon obverse branches. Right side of figure shows structure of reverse branches with occasional node disposed at junction of branches and dissepiments. Holotype No. 10476 U.M. Shaly limestone, Location 35.</p>	247
<p>FIG. 4. <i>Isotrypa tropozomena</i>, sp. nov.....</p> <p style="padding-left: 2em;">Reverse face of frond, showing strong, angular dissepiments continuing across branches. Holotype No. 10474 U.M. Middle shale zone, Location 14.</p>	248
<p>FIG. 5. <i>Hemitrypa variosa</i>, sp. nov.....</p> <p style="padding-left: 2em;">Section cut oblique to plane of frond, showing structure of branches with carinae supporting superstructure. Holotype No. 10475 U.M. Location 46.</p>	247
<p>FIG. 6. <i>Isotrypa tropozomena</i>, sp. nov.....</p> <p style="padding-left: 2em;">Section cut oblique to plane of frond, showing arrangement of apertures and carina on both branches and dissepiments. Holotype No. 10474 U.M. Middle shale zone, Location 14.</p>	248

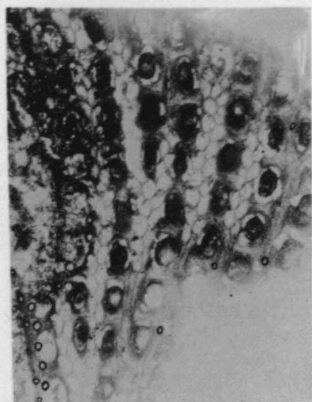
PLATE IV



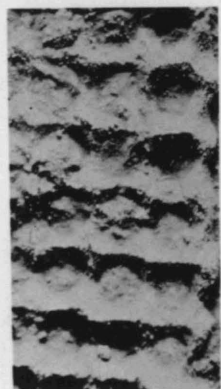
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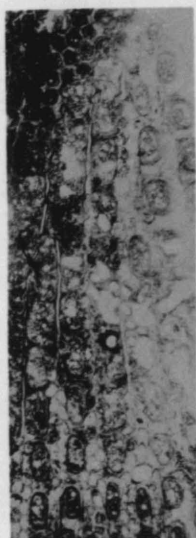
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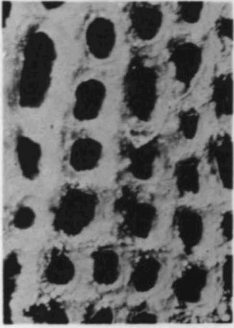
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EXPLANATION OF PLATE V

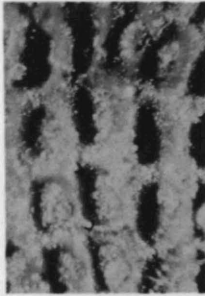
All specimens magnified 12 diameters

	PAGE
FIG. 1. <i>Isotrypa megista</i> , sp. nov.....	249
Obverse face of frond, showing angular, granulose superstructure.	
Holotype No. 10473 U.M.	
Middle shale zone, Location 14.	
FIG. 2. <i>Isotrypa megista</i> , sp. nov.....	249
Reverse face of frond, showing irregular branches with low nodes disposed upon them.	
Holotype No. 10473 U.M.	
Middle shale zone, Location 14.	
FIG. 3. <i>Isotrypa megista</i> , sp. nov.....	249
Section cut nearly parallel to plane of frond, showing arrangement of zoecia in zigzag branches, and wide variation in width of dissepiments.	
Holotype No. 10473 U.M.	
Middle shale zone, Location 14.	
FIG. 4. <i>Isotrypa angulata</i> , sp. nov.....	250
Obverse face of frond, showing superstructure.	
Holotype No. 10472 U.M.	
Location 47.	
FIG. 5. <i>Isotrypa angulata</i> , sp. nov.....	250
Reverse face of frond, showing branches more sinuous and fenestrules more elongate-oval than those of superstructure.	
Holotype No. 10472 U.M.	
Location 47.	
FIG. 6. <i>Isotrypa angulata</i> , sp. nov.....	250
Section cut slightly oblique to plane of frond, showing extremely slender carinae supporting superstructure.	
Holotype No. 10472 U.M.	
Location 47.	
FIG. 7. <i>Isotrypa anomala</i> , sp. nov.....	250
Obverse face of frond, showing faintly carinated superstructure.	
Holotype No. 10471 U.M.	
Zone 1, Location 9.	
FIG. 8. <i>Isotrypa anomala</i> , sp. nov.....	250
Reverse face of frond, showing irregularity in size of branches and dissepiments occasionally depressed below plane of branches.	
Holotype No. 10471 U.M.	
Zone 1, Location 9.	
FIG. 9. <i>Isotrypa anomala</i> var. <i>sinuosa</i> , var. nov.....	251
Reverse face of frond, showing coarsely granulose branches and dissepiments.	
Holotype No. 10470 U.M.	
Zone 1, Location 49.	

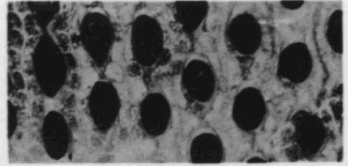
PLATE V



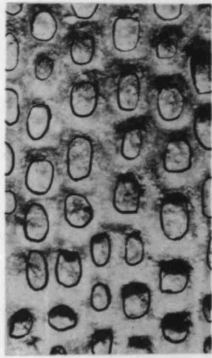
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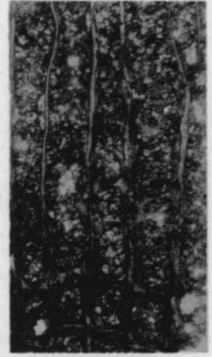
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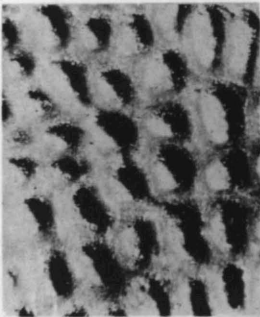
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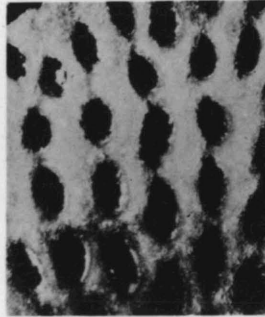
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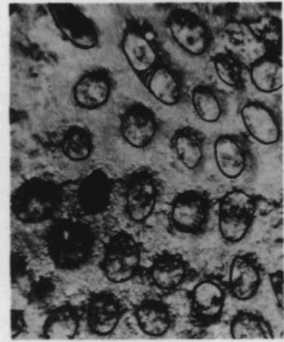
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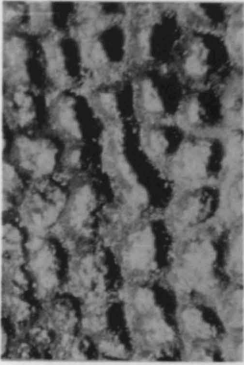
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EXPLANATION OF PLATE VI

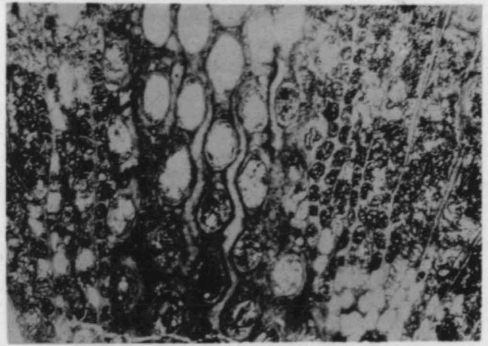
All specimens magnified 12 diameters

	PAGE
<p>FIG. 1. <i>Isotrypa anomala</i> var. <i>sinuosa</i>, var. nov.....</p> <p style="padding-left: 2em;">Obverse face of frond, showing sharply carinated superstructure.</p> <p style="padding-left: 2em;">Holotype No. 10470 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 49.</p>	251
<p>FIG. 2. <i>Isotrypa anomala</i> var. <i>sinuosa</i>, var. nov.....</p> <p style="padding-left: 2em;">Section cut oblique to plane of frond, showing sinuous to zigzag reverse branches, arrangement of zoecia in branches, and thin carinae supporting superstructure.</p> <p style="padding-left: 2em;">Holotype No. 10470 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 49.</p>	251
<p>FIG. 3. <i>Isotrypa rara</i>, sp. nov.....</p> <p style="padding-left: 2em;">Obverse face of frond, showing faint striae in places on superstructure.</p> <p style="padding-left: 2em;">Holotype No. 10469 U.M.</p> <p style="padding-left: 2em;">Zone 8, Location 40.</p>	251
<p>FIG. 4. <i>Isotrypa rara</i>, sp. nov.....</p> <p style="padding-left: 2em;">Section cut oblique to plane of frond, showing reverse branches and extremely thin carinae supporting superstructure.</p> <p style="padding-left: 2em;">Holotype No. 10469 U.M.</p> <p style="padding-left: 2em;">Zone 8, Location 40.</p>	251
<p>FIG. 5. <i>Isotrypa ovata</i>, sp. nov.....</p> <p style="padding-left: 2em;">Obverse face of frond, showing superstructure.</p> <p style="padding-left: 2em;">Holotype No. 10468 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 17.</p>	252
<p>FIG. 6. <i>Isotrypa ovata</i>, sp. nov.....</p> <p style="padding-left: 2em;">Reverse face of frond, showing irregularly disposed, granular nodes and very strong dissepiments.</p> <p style="padding-left: 2em;">Holotype No. 10468 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 17.</p>	252
<p>FIG. 7. <i>Isotrypa ovata</i>, sp. nov.....</p> <p style="padding-left: 2em;">Section cut slightly oblique to plane of frond, showing arrangement and structure of nodes on reverse branches.</p> <p style="padding-left: 2em;">Holotype No. 10468 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 17.</p>	252

PLATE VI



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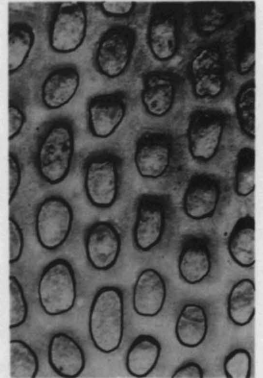
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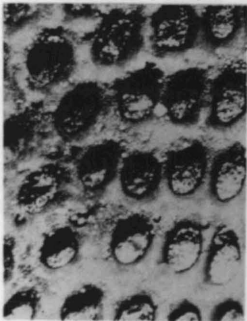
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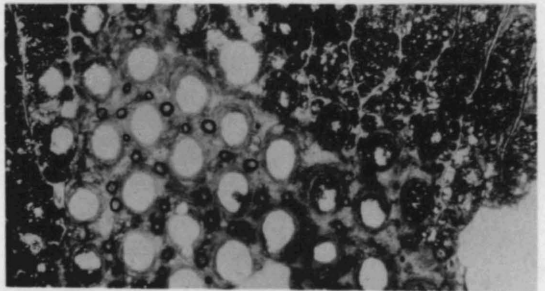
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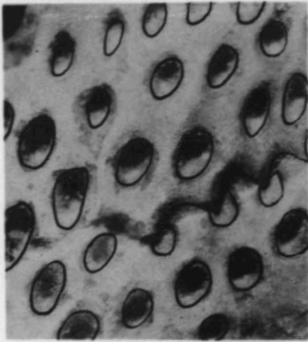
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EXPLANATION OF PLATE VII

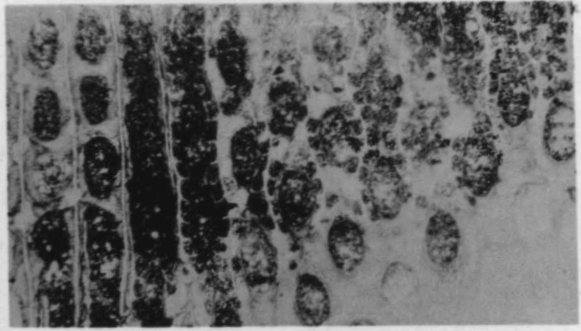
All specimens magnified 12 diameters

	PAGE
<p>FIG. 1. <i>Isotrypa hexagona</i>, sp. nov.....</p> <p style="padding-left: 2em;">Reverse face of frond, showing sinuous carina on branches, and dissepiments stronger than branches.</p> <p style="padding-left: 2em;">Holotype No. 10467 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 17.</p>	252
<p>FIG. 2. <i>Isotrypa hexagona</i>, sp. nov.....</p> <p style="padding-left: 2em;">Section cut oblique to plane of frond, showing superstructure, very thin carinae on obverse branches, and arrangement of zoecia in branches.</p> <p style="padding-left: 2em;">Holotype No. 10467 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 17.</p>	252
<p>FIG. 3. <i>Isotrypa vibrata</i>, sp. nov.....</p> <p style="padding-left: 2em;">Obverse face of frond, showing coarsely granulose appearance and regularity of superstructure.</p> <p style="padding-left: 2em;">Holotype No. 10466 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 17.</p>	253
<p>FIG. 4. <i>Isotrypa vibrata</i>, sp. nov.....</p> <p style="padding-left: 2em;">Section cut oblique to plane of frond, showing structure of superstructure and anastomosed reverse branches.</p> <p style="padding-left: 2em;">Holotype No. 10466 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 17.</p>	253
<p>FIG. 5. <i>Isotrypa vibrata</i>, sp. nov.....</p> <p style="padding-left: 2em;">Reverse face of frond, showing anastomosed parts of branches stronger than plane of normal branches and raised above them.</p> <p style="padding-left: 2em;">Holotype No. 10466 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 17.</p>	253
<p>FIG. 6. <i>Isotrypa oxytropis</i>, sp. nov.....</p> <p style="padding-left: 2em;">Obverse face of frond, showing sharply carinated superstructure.</p> <p style="padding-left: 2em;">Holotype No. 10465 U.M.</p> <p style="padding-left: 2em;">Bell Shale, Location 31.</p>	254
<p>FIG. 7. <i>Isotrypa oxytropis</i>, sp. nov.....</p> <p style="padding-left: 2em;">Reverse face of frond, showing large pores upon anastomosed parts of branches. Raised margins of pores give to branches a nodose appearance on first examination.</p> <p style="padding-left: 2em;">Holotype No. 10465 U.M.</p> <p style="padding-left: 2em;">Bell Shale, Location 31.</p>	254

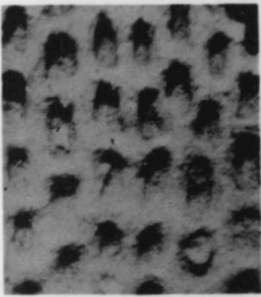
PLATE VII



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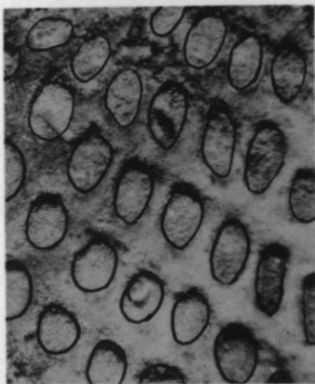
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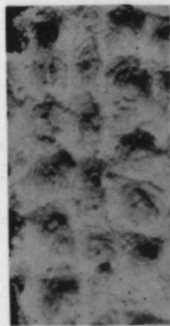
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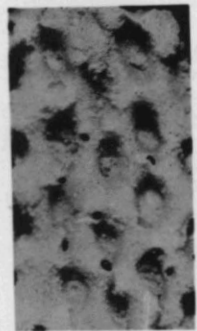
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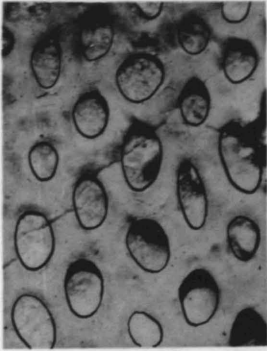
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EXPLANATION OF PLATE VIII

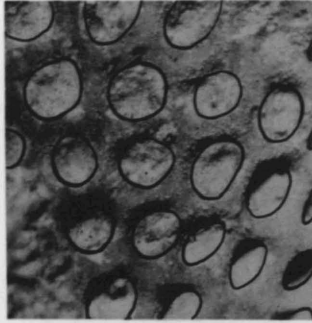
All specimens magnified 12 diameters

	PAGE
FIG. 1. <i>Isotrypa gigantea</i> , sp. nov.....	254
Obverse face of frond, showing zigzag appearance of expanded summits of carinae forming superstructure.	
Holotype No. 10500 U.M.	
Zone 8, Location 40.	
FIG. 2. <i>Isotrypa gigantea</i> , sp. nov.....	254
Reverse face of frond, showing granulose appearance of branches and dissepiments.	
Holotype No. 10500 U.M.	
Zone 8, Location 40.	
FIG. 3. <i>Isotrypa isopeda</i> , sp. nov.....	255
Obverse face of frond, showing irregular appearance of carinae on surface of superstructure.	
Holotype No. 10464 U.M.	
Location 47.	
FIG. 4. <i>Isotrypa isopeda</i> , sp. nov.....	255
Section cut nearly parallel to plane of frond, showing superstructure.	
Holotype No. 10464 U.M.	
Location 47.	
FIG. 5. <i>Isotrypa isopeda</i> , sp. nov.....	255
Section cut oblique to plane of frond, showing carinae below superstructure.	
Holotype No. 10464 U.M.	
Location 47.	
FIG. 6. <i>Phyllopora aequirobundata</i> , sp. nov.....	256
Reverse face of frond, showing large, subcircular fenestrules and anastomosed branches.	
Holotype No. 10499 U.M.	
Zone 1, Location 17.	
FIG. 7. <i>Phyllopora aequirobundata</i> , sp. nov.....	256
Section cut oblique to plane of frond, showing minutely granulose appearance of reverse branches and arrangement of apertures upon obverse branches.	
Holotype No. 10499 U.M.	
Zone 1, Location 17.	

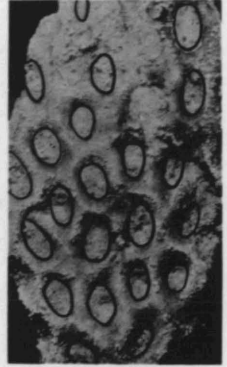
PLATE VIII



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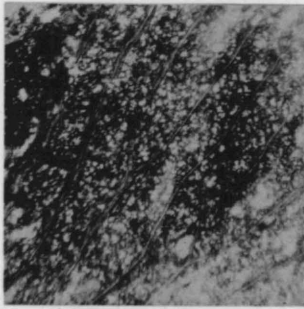
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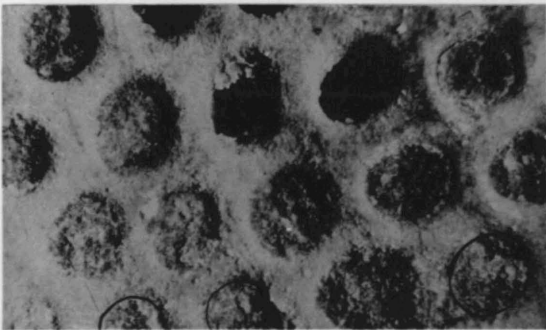
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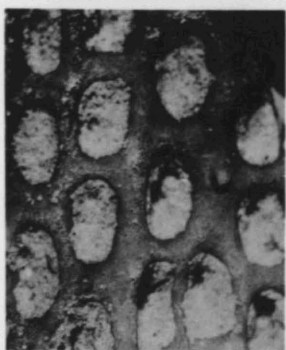
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EXPLANATION OF PLATE IX

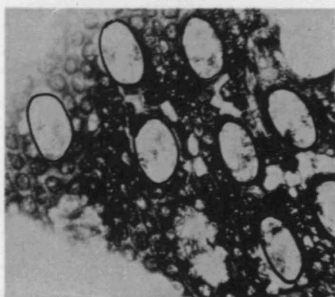
All specimens magnified 12 diameters

	PAGE
<p>FIG. 1. <i>Polypora ambiplana</i>, sp. nov.</p> <p style="padding-left: 2em;">Reverse face of frond, showing rounded branches with granular nodes occasionally disposed at junction of branches and dissepiments.</p> <p style="padding-left: 2em;">Holotype No. 10463 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 49.</p>	256
<p>FIG. 2. <i>Polypora ambiplana</i>, sp. nov.</p> <p style="padding-left: 2em;">Section cut slightly oblique to plane of frond, showing arrangement of apertures upon branches and regularity of size and shape of fenestrules on obverse face.</p> <p style="padding-left: 2em;">Holotype No. 10463 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 49.</p>	256
<p>FIG. 3. <i>Polypora finitima</i>, sp. nov.</p> <p style="padding-left: 2em;">Obverse and reverse face of frond. Surface of obverse face removed, showing arrangement of zoecia in branches. Reverse face shows gently rounded branches and regularity of size and shape of fenestrules.</p> <p style="padding-left: 2em;">Holotype No. 10506 U.M.</p> <p style="padding-left: 2em;">Bell Shale, Location 31.</p>	257
<p>FIG. 4. <i>Polypora amorpha</i>, sp. nov.</p> <p style="padding-left: 2em;">Reverse face of frond, showing both dissepiments and anastomosed portions of branches and variation in shape of fenestrules from circular to oval to subquadrangular.</p> <p style="padding-left: 2em;">Holotype No. 10460 U.M.</p> <p style="padding-left: 2em;">Zone 6, Location 29.</p>	257
<p>FIG. 5. <i>Polypora amorpha</i>, sp. nov.</p> <p style="padding-left: 2em;">Section cut nearly parallel to plane of frond, showing two dissepiments with apertures disposed upon them and distribution of ranges of apertures upon branches.</p> <p style="padding-left: 2em;">Holotype No. 10460 U.M.</p> <p style="padding-left: 2em;">Zone 6, Location 29.</p>	257
<p>FIG. 6. <i>Polypora magnifica</i>, sp. nov.</p> <p style="padding-left: 2em;">Reverse face of frond, showing branches and dissepiments faintly carinated and minutely granulose.</p> <p style="padding-left: 2em;">Holotype No. 10495 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 49.</p>	258

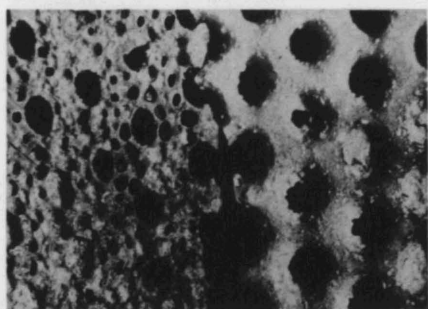
PLATE IX



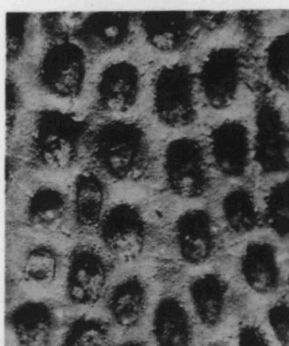
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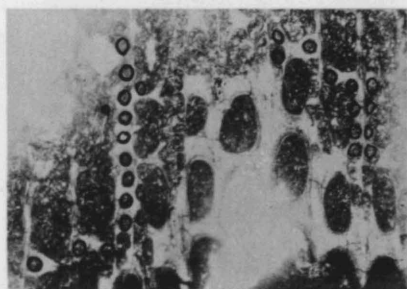
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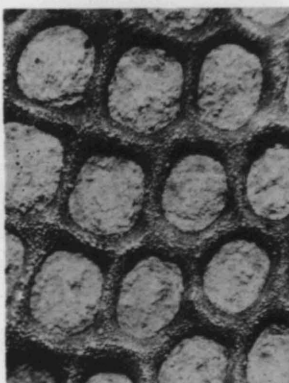
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EXPLANATION OF PLATE X

All specimens magnified 12 diameters

	PAGE
<p>FIG. 1. <i>Polypora magnifica</i>, sp. nov.....</p> <p style="padding-left: 2em;">Section cut oblique to plane of frond, showing arrangement of apertures on branches and structure of granules and carinae on reverse branches and dissepiments.</p> <p style="padding-left: 2em;">Holotype No. 10495 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 49.</p>	258
<p>FIG. 2. <i>Polypora brevissima</i>, sp. nov.....</p> <p style="padding-left: 2em;">Reverse face of frond, showing great variation in width of branches and strong dissepiments.</p> <p style="padding-left: 2em;">Holotype No. 10494 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 49.</p>	259
<p>FIG. 3. <i>Polypora brevissima</i>, sp. nov.....</p> <p style="padding-left: 2em;">Section cut nearly parallel to plane of frond, showing broad, flatly rounded and much depressed dissepiments.</p> <p style="padding-left: 2em;">Holotype No. 10494 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 49.</p>	259
<p>FIG. 4. <i>Polypora pyramidata</i>, sp. nov.....</p> <p style="padding-left: 2em;">Reverse face of frond, showing angular branches and dissepiments.</p> <p style="padding-left: 2em;">Holotype No. 10493 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 49.</p>	259
<p>FIG. 5. <i>Polypora pyramidata</i>, sp. nov.....</p> <p style="padding-left: 2em;">Section cut slightly oblique to plane of frond, showing granu-lose structure of reverse branches.</p> <p style="padding-left: 2em;">Holotype No. 10493 U.M.</p> <p style="padding-left: 2em;">Zone 1, Location 49.</p>	259
<p>FIG. 6. <i>Polypora indentata</i>, sp. nov.....</p> <p style="padding-left: 2em;">Reverse face of frond, showing slender dissepiments broadly expanded at junction with branches, and striated appearance of worn parts of branches.</p> <p style="padding-left: 2em;">Holotype No. 10492 U.M.</p> <p style="padding-left: 2em;">Zone 6, Location 29.</p>	260
<p>FIG. 7. <i>Polypora indentata</i>, sp. nov.....</p> <p style="padding-left: 2em;">Section cut slightly oblique to plane of frond, showing angular, depressed dissepiments on obverse face.</p> <p style="padding-left: 2em;">Holotype No. 10492 U.M.</p> <p style="padding-left: 2em;">Zone 6, Location 29.</p>	260
<p>FIG. 8. <i>Polypora uniplana</i>, sp. nov.....</p> <p style="padding-left: 2em;">Reverse face of frond, showing coarsely striated appearance of branches. Specimen largely embedded in matrix.</p> <p style="padding-left: 2em;">Holotype No. 10491 U.M.</p> <p style="padding-left: 2em;">Middle shale zone, Location 14.</p>	260
<p>FIG. 9. <i>Polypora uniplana</i>, sp. nov.....</p> <p style="padding-left: 2em;">Section cut slightly oblique to plane of frond, showing regu-larity of size and shape of fenestrules.</p> <p style="padding-left: 2em;">Holotype No. 10491 U.M.</p> <p style="padding-left: 2em;">Middle shale zone, Location 14.</p>	260

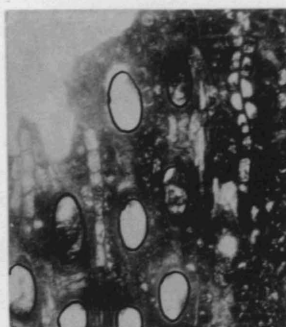
PLATE X



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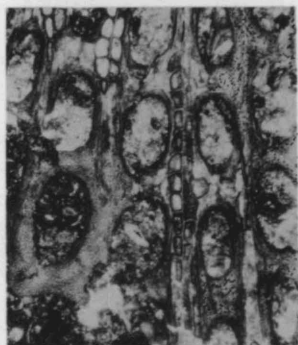
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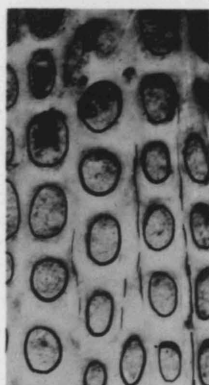
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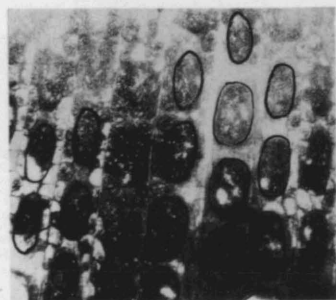
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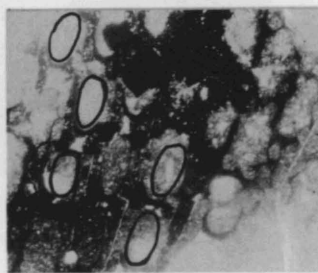
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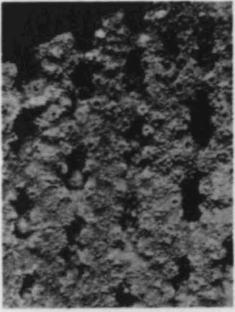
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EXPLANATION OF PLATE XI

All specimens magnified 12 diameters

	PAGE
FIG. 1. <i>Polypora minuta</i> , sp. nov.....	261
Obverse face of frond, showing peristomes of lateral ranges of apertures indenting borders of fenestrules.	
Holotype No. 10490 U.M.	
Bell Shale, Location 31.	
FIG. 2. <i>Polypora minuta</i> , sp. nov.....	261
Reverse face of frond, showing rounded branches and dissepiments and variation in shape of fenestrules.	
Holotype No. 10490 U.M.	
Bell Shale, Location 31.	
FIG. 3. <i>Polypora minuta</i> , sp. nov.....	261
Section cut oblique to plane of frond, showing minutely granulose structure of reverse branches and dissepiments depressed below plane of obverse branches.	
Holotype No. 10490 U.M.	
Bell Shale, Location 31.	
FIG. 4. <i>Polypora allelomorpha</i> , sp. nov.....	261
Obverse face of frond, showing disposal of apertures upon branches and anastomosis of branches.	
Holotype No. 10507 U.M.	
Bell Shale, Location 31.	
FIG. 5. <i>Polypora allelomorpha</i> , sp. nov.....	261
Reverse face of frond, showing sharply rounded branches and absence of dissepiments owing to anastomosis of branches.	
Holotype No. 10507 U.M.	
Bell Shale, Location 31.	
FIG. 6. <i>Polypora labellosa</i> , sp. nov.....	262
Obverse face of frond, showing sharp peristomes.	
Holotype No. 10462 U.M.	
Bell Shale, Location 31.	
FIG. 7. <i>Polypora labellosa</i> , sp. nov.....	262
Reverse face of frond, showing minute, granulose nodes disposed upon branches and dissepiments, and regular arrangement of fenestrules.	
Holotype No. 10462 U.M.	
Bell Shale, Location 31.	
FIG. 8. <i>Polypora tenuosa</i> , sp. nov.....	263
Obverse face of frond, showing apertures widely disposed, both longitudinally and transversely on branches.	
Holotype No. 10461 U.M.	
Zone 1, Location 49.	
FIG. 9. <i>Polypora tenuosa</i> , sp. nov.....	263
Reverse face of frond, showing dissepiments on same plane as branches, and small size of branches and fenestrules.	
Holotype No. 10461 U.M.	
Zone 1, Location 49.	

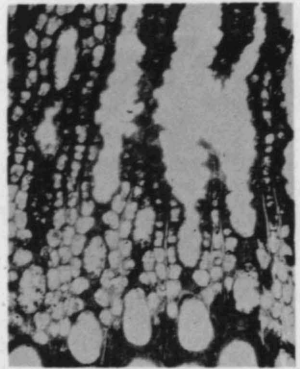
PLATE XI



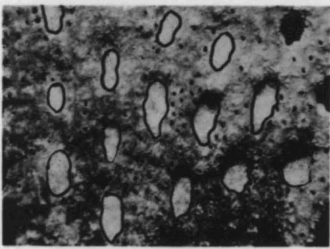
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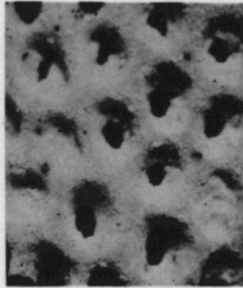
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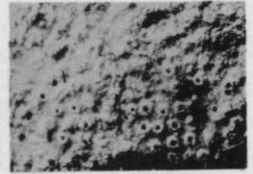
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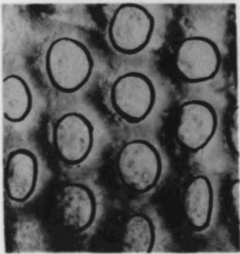
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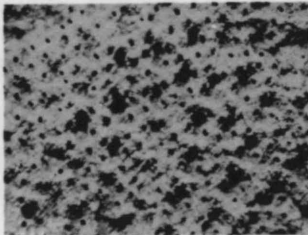
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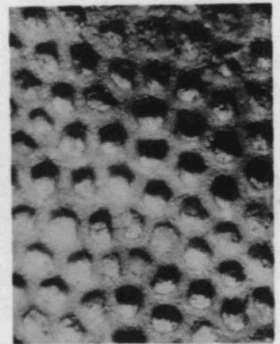
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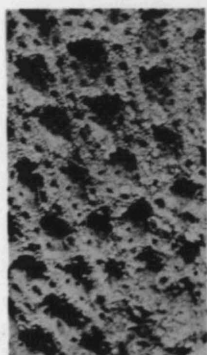
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EXPLANATION OF PLATE XII

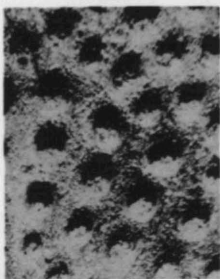
All specimens magnified 12 diameters

	PAGE
FIG. 1. <i>Polypora exemplaria</i> , sp. nov.....	263
Obverse face of frond, showing angularity of branches and absence of peristomes. Holotype No. 10489 U.M. Zone 1, Location 17.	
FIG. 2. <i>Polypora exemplaria</i> , sp. nov.....	263
Reverse face of frond, showing relationship of rounded branches and dissepiments. Holotype No. 10489 U.M. Zone 1, Location 17.	
FIG. 3. <i>Polypora exemplaria</i> , sp. nov.....	263
Section cut oblique to plane of frond, showing regularity in shape of fenestrules and in width of dissepiments. Holotype No. 10489 U.M. Zone 1, Location 17.	
FIG. 4. <i>Polypora muricula</i> , sp. nov.....	264
Obverse face of frond, showing distribution of apertures and irregularly disposed minute nodes. Holotype No. 10488 U.M. Zone 1, Location 17.	
FIG. 5. <i>Polypora muricula</i> , sp. nov.....	264
Section cut slightly oblique to plane of frond, showing granu- lose structure of reverse branches and subcircular fenestrules. Holotype No. 10488 U.M. Zone 1, Location 17.	
FIG. 6. <i>Polypora muricula</i> , sp. nov.....	264
Section cut nearly parallel to plane of frond, showing minute nodes disposed between ranges of apertures. Holotype No. 10488 U.M. Zone 1, Location 17.	
FIG. 7. <i>Polypora modesta</i> , sp. nov.....	264
Obverse face of frond, showing slender dissepiments depressed below plane of branches and peristomes with anterior edge more strongly developed. Holotype No. 10496 U.M. Shaly limestone, Location 35.	
FIG. 8. <i>Polypora modesta</i> , sp. nov.....	264
Section cut slightly oblique to plane of frond, showing carinae on reverse branches and dissepiments. Holotype No. 10496 U.M. Shaly limestone, Location 35.	
FIG. 9. <i>Ptiloporina jugosa</i> , sp. nov.....	265
Reverse face of frond, showing strong primary branch with secondary branches diverging laterally from it. Holotype No. 10487 U.M. Middle shale zone, Location 14.	

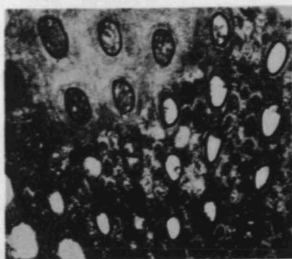
PLATE XII



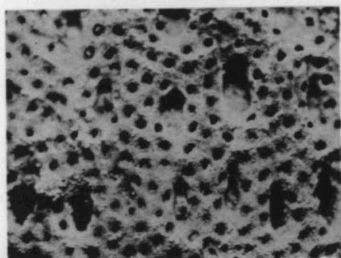
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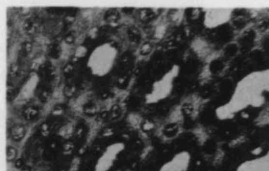
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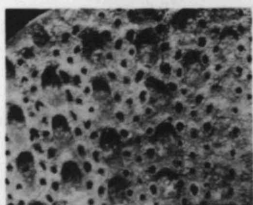
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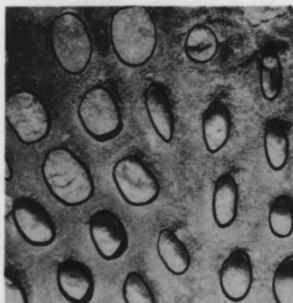
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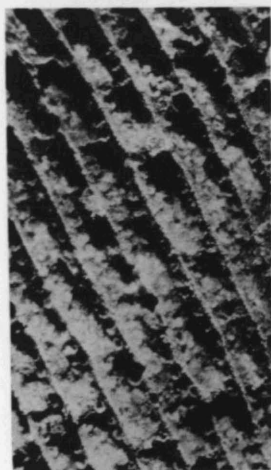
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EXPLANATION OF PLATE XIII

All specimens magnified 12 diameters

	PAGE
<p>FIG. 1. <i>Semicosinium rhombicum</i> Ulrich var. <i>obliquum</i>, var. nov.</p> <p style="padding-left: 2em;">Obverse face of frond, showing large accessory pores disposed upon a few dissepiments. Holotype No. 10486 U.M. Zone 1, Location 49.</p>	266
<p>FIG. 2. <i>Ptiloporina jugosa</i>, sp. nov.</p> <p style="padding-left: 2em;">Section cut oblique to plane of branch, showing arrangement of apertures upon branches and sharp conical nodes regularly disposed upon summits of obverse branches. Holotype No. 10487 U.M. Middle shale zone, Location 14.</p>	265
<p>FIG. 3. <i>Semicosinium rhombicum</i> Ulrich var. <i>obliquum</i>, var. nov.</p> <p style="padding-left: 2em;">Reverse face of frond, showing straight branches, comparatively strong dissepiments, and regularity in size and shape of fenestrules. Holotype No. 10486 U.M. Zone 1, Location 49.</p>	266
<p>FIG. 4. <i>Semicosinium thyene</i> Hall var. <i>michiganense</i>, var. nov.</p> <p style="padding-left: 2em;">Reverse face of frond, showing faintly carinated branches, with granulose nodes disposed upon them. Holotype No. 10485 U.M. Location 46.</p>	266
<p>FIG. 5. <i>Semicosinium rhombicum</i> Ulrich var. <i>obliquum</i>, var. nov.</p> <p style="padding-left: 2em;">Section cut oblique to plane of frond, showing anastomosis of branches and regularity in size of oval fenestrules on obverse face. Holotype No. 10486 U.M. Zone 1, Location 49.</p>	266
<p>FIG. 6. <i>Semicosinium thyene</i> Hall var. <i>michiganense</i>, var. nov.</p> <p style="padding-left: 2em;">Section cut oblique to plane of frond, showing slightly expanded summit of carina, apertures opening directly, and regularity of size and shape of reverse fenestrules. Holotype No. 10485 U.M. Location 46.</p>	266

PLATE XIII



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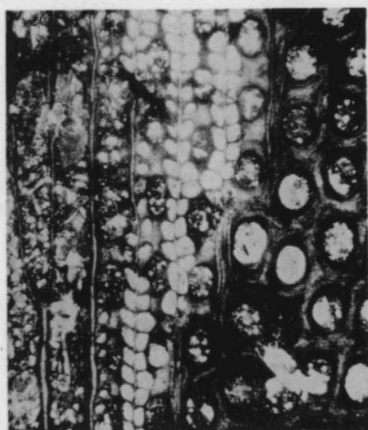
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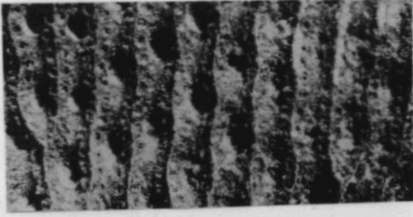
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EXPLANATION OF PLATE XIV

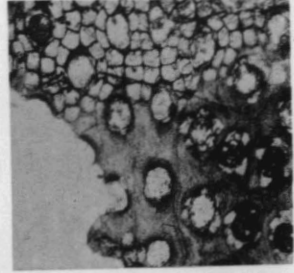
All specimens magnified 12 diameters

- | | PAGE |
|--|------|
| FIG. 1. <i>Semicosinium approximatum</i> , sp. nov..... | 267 |
| Obverse face of frond, showing low, thin, sinuous carinae separating apertures, which open directly, and small regularly oval fenestrules. | |
| Holotype No. 10484 U.M. | |
| Shaly limestone, Location 35. | |
| FIG. 2. <i>Semicosinium approximatum</i> , sp. nov..... | 267 |
| Section cut slightly oblique to plane of frond, showing faintly carinated reverse branches and circular fenestrules. | |
| Holotype No. 10484 U.M. | |
| Shaly limestone, Location 35. | |
| FIG. 3. <i>Semicosinium flexuosum</i> , sp. nov..... | 268 |
| Reverse face of frond, showing rounded, zigzag branches and variation in size of fenestrules in younger and older portions of frond. | |
| Holotype No. 10483 U.M. | |
| Zone 1, Location 17. | |
| FIG. 4. <i>Semicosinium flexuosum</i> , sp. nov..... | 268 |
| Section cut slightly oblique to plane of frond, showing flexuous carinae with slightly expanded summits. | |
| Holotype No. 10483 U.M. | |
| Zone 1, Location 17. | |

PLATE XIV



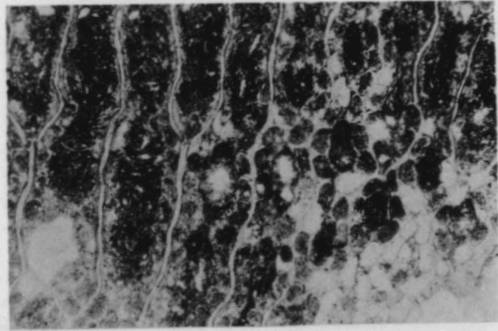
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(Continued from inside of front cover)

9. Arthrodiran Remains from the Devonian of Michigan, by E. C. Case. Pages 163-182, with 5 plates and 13 text figures. Price, \$.35.
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