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DESCRIPTIONS OF BRYOZOA AND CORALS

OF THE LOWER HELDERBERG GROUP.

By JAMES HALL.

[The title of this paper (and also one upon the Bryozoa and corals of the upper Helderberg and Hamilton groups) was announced in the 20th Report on the State Cabinet of Natural History, the manuscript having been prepared sometime previously. Owing to imperative duties connected with the affairs of the museum, and the rearrangement of collections, these papers together with others, the titles of which were at that time or had been previously announced, have been postponed from time to time, until in some cases the occasion for their publication has passed.

The present paper was again communicated with the Report of 1872 (in January, 1873), but its publication has been delayed by the State Printer till 1874. Some of the papers which have been previously announced in the 18th, 19th and 20th Reports will appear in this and subsequent Reports of the State Museum of Natural History.]

Genus FENESTELLA *Lonsdale*.

FENESTELLA NERVIA *n. sp.*

Bryozoum forming funnel-shaped bodies, which are attached by their bases to foreign substances, often to the branches of ramose Bryozoans. Near the base the cup expands at an angle of about seventy degrees, spreading more rapidly above and becoming undulated or folded. Branches slender, approximate, about five in one-tenth of an inch, frequently bifurcating; sharply carinate on the outside, with a row of pores on each side of the carina, inside smooth or slightly granulose, not striate; dissepiments thickened, rounded, widening at their junction with the branches; surface on the same plane with the branches on the inner side of the frond, deeply sunken on the outer side. Fenestrules elongate, quadrangular on the outer

surface, rounded or sub-oval within, the length but little exceeding the breadth; appearing longer on the outer side, from the thickening of the dissepiment on the inner.

Pores rounded, three or four on each side of the fenestrule, distance from each other equal to or greater than their own diameter; in well preserved specimens they have a slightly upward direction, with the outer margin projecting. This feature is, however, seldom preserved, and the cells appear as slight protuberances with a central perforation.

This is an abundant form on weathered slabs of the shaly limestone of the Helderberg group, two miles north of Clarksville, Albany county, New York.

FENESTELLA PRÆCURSOR *n. sp.*

Bryozoum forming narrow, deep, funnel-form bodies, attached by their bases to foreign substances. Near the base the cup expands at an angle of not more than forty degrees, spreading more rapidly above. Branches slender, with few bifurcations below, the number increasing above. Outer surface with a series of cell pores on each side of a narrow, elevated carina, which widens above, forming another branch parallel with the principal one, and having a sharp crest with a line of obtuse nodes on each side, giving the appearance of a second range of cell pores. Inner surface of the branch rounded, marked by numerous small pustules which, when worn away, show openings into the interior tube, presenting the characters of the poriferous surface of Polypora. Dissepiments somewhat thickened, rounded, spreading at their junction with the branch, on the same plane in the inner side and not extending above the range of pores on the outside. Fenestrules varying from subquadrangular to elongate oval, about as wide as the breadth of the branches. Pores circular, three or four to each fenestrule, opening outwardly and slightly upwards, forming lobes on the sides of the branches. The obtuse nodes are arranged somewhat more closely than the pores, five nodes occupying a space equal to four pores. In much weathered specimens the nodes are often worn away so as to exhibit a small perforation, and in this condition they might be mistaken for another range of pores. In one specimen the wearing of the carina has left a groove between the ranges of pores.

Formation and locality.—On decomposed surfaces of the shaly limestone of the Lower Helderberg group, near Catskill, New York.

FENESTELLA CREBRIPORA *n. sp.*

Bryozoom forming frond-like expansions on the surface of weathered slabs, undulated or folded from the rapid increase of the branches from bifurcation; base not known. Branches slender, rounded and smooth on the non-poriferous side, not perceptibly striate: poriferous side of the branch carinate with a range of large, closely approximate pores on each side. Dissepiments slender, distant, widening at their junction with the branch, carinate on the poriferous side, and rounded on the opposite. Fenestrules elongate, quadrangular, wider than the branch, and their length often double their width. Pores large, often appearing polygonal on the surface but rounded within, from three to four in the length of a fenestrule: the partition walls narrow, often sharp on the outer edge, that on the inner side dividing the two ranges and forming the carina frequently tortuous. At the junction of the dissepiment with the branch, there is commonly a cell pore within the dissepiment and out of the line of the regular range; sometimes one in each axil, and in these cases the pores are triangular at the surface. Branches from three to four in a tenth of an inch: dissepiments one and a half to two in the same space.

This species is a somewhat coarser form than either of the preceding, with slender and more distant branches and dissepiments; and pores differing from those in size and position.

Formation and locality.—On weathered slabs of Lower Helderberg Limestone; Albany county, New York.

FENESTELLA IDALIA *n. sp.*

Bryozoom forming broadly spreading cup-shaped bodies, attached by the base to other substances; celluliferous on the inside. Branches slender, very closely arranged, frequently bifurcating, longitudinally striate on the outer surface, striæ granulose, from three to five or six on each branch; inner surface of branches densely crowded with small slightly oval pores in two ranges, except for a short distance below each bifurcation, where the branch gradually widens and an intermediate range appears which divides at the bifurcation; a slight ridge often separates the rows of pores, but this is often obsolete. Dissepiments slender, striated on the inner surface; their distance from each other equal to or greater than the width of the branch; about four in the space of one-tenth of an inch. Fenestrules small, elongate elliptical, appearing quadrangular on the

outside. Pores circular or a little elongate, their margins elevated, projecting on the upper side into a slight roof-like covering over the pore. Branches about six in one-tenth of an inch.

This species is distinguished by the compact and closely arranged branches even when the striæ or asperate character of pores are removed. It is a much more delicate species than any of the preceding.

Formation and locality.—In shaly limestones of the Lower Helderberg group, at Schoharie, New York.

FENESTELLA SYLVIA *n. sp.*

Bryozoum forming large funnel-shaped fronds, with a small attached base, rapidly spreading and becoming much folded toward the outer margin. Branches very slender and closely approximate. Outer or non-poriferous side of the frond in well preserved specimens distinctly striated longitudinally. Dissepiments closely arranged, rounded, appearing nearly as strong as the branch on the outer side of the frond, angular on the opposite side. Fenestrules small, quadrangular on the surface, round or oval within, a little longer than wide. Pores minute, round, slightly elevated, three in the length of the fenestrule. About seven branches in the space of one-tenth of an inch, where there are no bifurcations; at the bifurcations sometimes ten in the same space; five to seven dissepiments in the space of one-tenth of an inch. The edge of the carina, between the ranges of pores, when well preserved, is slightly rugose or asperated.

This species resembles *F. nervia*, but has more slender and closely arranged branches, more frequent dissepiments and consequently smaller fenestrules and fewer pores.

Formation and locality.—In upper layers of the shaly limestones of the Lower Helderberg group, on Slingerland's farm, near Clarksville, New York.

Genus POLYPORA *McCoy.*

POLYPORA LILIA *n. sp.*

Bryozoum forming small fan-like fronds (not cup-shaped), attached by the base to foreign bodies. Branches small, irregular, anastomosing, connected at unequal distances by the dissepiments, poriferous on one side and obscurely striate on the other. Dissepiments very short, comparatively distant, widening at their junction with the branches. Fenestrules elongate-oval or elliptical, their length often

twice or more than twice their width. Pores distinct, rounded, their margins very slightly elevated, scattered on the wider but forming rows in the narrower parts of the branch; two, three or four in the breadth of the branch. On the dissepiment, near its junction with the branch, a single pore is often visible, but the dissepiments have not a poriferous character.

This beautiful species is the only true *Polypora* yet known in the Silurian strata of New York. It is easily distinguished from the associated *Fenestella* by the irregular mode in which the branches multiply, and by the greater number of pores, without dividing ridges. The poriferous side, as seen in the rock, has somewhat the appearance of *Retepora asperato-striata* of the Niagara limestone, except that it has a finer and more delicate structure, fewer pores, and the dissepiments are destitute of cells except at the extremity.

Formation and locality.—On weathered slabs of the Lower Helderberg limestone, at Schoharie and near Clarksville, New York.

POLYORA ELEGANS (?) *n. sp.*

Bryozoum growing in small, irregular and duplicating fan-shaped overlapping fronds, attached by the base to foreign substances. Branchlets slender, rounded, frequently and irregularly bifurcating and rapidly diverging. Dissepiments strong, two-thirds as thick as the branches and placed at irregular distances. Fenestrules a little longer than wide. Pores small, round or ovate, comparatively distant, with distinctly elevated margins; arranged in two series only, and alternating, one on each side of the branch, leaving a smooth or striated space between; the distance between the two ranges equal or nearly equal to the diameter of the pore with its margin. Surface between the pores, and also the dissepiments, striated with tortuous striæ. Opposite side not known.

This species is remarkable as having only two ranges of pores, although with all the other essential features of the genus *Polypora*.

Formation and locality.—In shaly limestones of the Lower Helderberg group, near Clarksville, Albany county, New York.

Genus HEMITRYPA *Phillips.*

The genus HEMITRYPA of Phillips was established for a group of Fenestelloid bryozoans, which have unusually high ridges dividing the ranges of pores on the exterior of the frond, and the crests of the ridges connected by a series of dissepiments which are not unfrequently so much thickened laterally as to leave only small round

pores, which open into a series of radiating galleries formed by this covering between the branches; these galleries also communicate with the interior of the cup by the fenestrules of the inner layer. The cell pores are situated on the branches in the same relative position as in true FENESTELLA, and open into the galleries, or tubes. The inner portion of these bodies, if denuded of the exterior layer together with a portion of the ridges, would be in every respect like a true Fenestella.

There is but one species of this type yet known in the Lower Helderberg rocks of New York; and none in any of the older formations; others occur in the Hamilton group, and several in the precarboniferous rocks of the western States, one of which has been described by Dr. H. A. Prout as *Fenestella hemitrypa*, Trans. Acad. Nat. Sci. St. Louis, Vol. 1, p. 444, pl. 17, f. 4.

From FENESTELLA of the ordinary type, there is a somewhat regular gradation, through those with highly elevated intercellular ridges, to the type of HEMITRYPA; and in *F. præcursor*, herein described, we have a form so nearly intermediate that it is difficult to say to which genus it belongs. The highly elevated crests have along their sides a row of small pustules which if prolonged and continued across the spaces would form the characters of HEMITRYPA.

HEMITRYPA PRIMA *n. sp.*

Bryozoum forming narrow funnel-shaped bodies, the sides diverging at an angle of from thirty-five to forty-five degrees. Branches slender, round, contiguous, about five in the space of one-tenth of an inch; dissepiments frequent, two-thirds as wide as the branch and expanding at their junction. Fenestrules small, oval or ovate. Pores small, round, with elevated margins, about three to each fenestrule: distance between the inner and outer layers about equal to that between the branches. Outer surface of the cup divided into small rhomboidal openings by small slender filaments connecting the edges of the branches; usually a little depressed in the middle; about four to each fenestrule, nine or ten in the length of one-tenth of an inch.

Formation and locality.—On slabs of the Lower Helderberg limestone, Schoharie, New York.

Genus ICHTHYORACHIS *McCoy*.

ICHTHYORACHIS NEREIS *n. sp.*

Bryozoum plumose, slender, slightly flexuose; midrib flattened on the exterior surface, longitudinally striate, with a groove along the center; lateral branches short, rigid, obtusely pointed at the extremity, distance from each other equal to the width of the mid-

rib. Pores moderately large, in two ranges on the lateral branches, with three or more on the midrib (not fully determined).

Length of the longest specimen seven-tenths of an inch, imperfect at both extremities; width, including lateral branches, one-tenth of an inch, four of them in length equal to the entire width of the frond.

Formation and locality.—On limestone surfaces of the Lower Helderberg group, at Schoharie, New York.

Genus *ESCHAROPORA* Hall. 1847.

(Not *ESCHARIPORA* D'Orb. 1851.)

ESCHAROPORA TENUIS n. sp.

Bryozoom growing in thin, elongate, narrow stipes, with parallel margins, and celluliferous on both sides. Cells arranged in longitudinal rows (eighteen rows counted in one specimen), the marginal rows largest; the cells of the outer row situated a little in advance of the next within it, and so on to the central row, where the order is reversed, so that the transverse rows of cells run obliquely downwards to the center from both margins. Cell apertures rhomboidal or obscurely hexagonal and opening upwards; the partitions between them sharp on their outer edges. The cells from the opposite sides of the stipe reach to the thin dividing epitheca in the center, and are inclined to the axis at a very low angle; the whole thickness of the stipe is seldom more than two-hundredths of an inch; breadth one-sixth of an inch. The longest stipe which we have seen is nearly three inches, gradually narrowing from the middle upward.

This species differs from all others of the type yet seen, in its great tenuity, differing extremely from those of the Trenton limestones which are often nearly as thick as wide.

Formation and locality.—In shaly limestones of the Lower Helderberg group; Albany and Schoharie counties, New York.

ESCHAROPORA NEBULOSA n. sp.

Bryozoom forming thin, flat, elongate expansions, celluliferous on both sides. Cell apertures quadrangular, length scarcely exceeding the width, in parallel rows of contiguous ranges slightly alternating with each other; longitudinal partition walls thin, rounded on the edges, transverse partitions more slender and usually not elevated to the same plane, rising from the central epitheca and gradually curv-

ing upwards and outwards. The surface of the frond is marked with distant, elevated spots or nebulae, formed of cells which are a very little larger than the rest. Thickness of frond four-hundredths of an inch, width nearly half an inch; eleven of the longitudinal ranges of cells in the width of one-tenth of an inch and about eight pores in the same length.

This species differs from *E. tenuis* in its greater breadth, its nebulous surface and the proportionally shorter cell apertures, as well as in its more robust appearance.

Formation and locality.—In weathered blocks of the Lower Helderberg group, at Catskill creek, New York.

ESCHAROPORA LIRATA *n. sp.*

Bryozoum forming small ensiform bodies, gradually enlarging upwards from an obtusely pointed base; sides of the stipe convex, giving a lenticular transverse section. Cells in longitudinal parallel rows increasing in size with the width of the stipe: longitudinal partitions elevated (giving a lirate aspect to the surface), transverse partitions thin, deeply depressed. Cell apertures quadrangular, longer than wide. Length of stipe from half to three-fourths of an inch, greatest width about one-sixteenth of an inch, containing about eight rows of pores.

These forms may perhaps be only the bases, or young, of *E. tenuis*, the bases of that species having not been found with the specimens; but the objection to such a supposition is that these forms are not known to occur in the same strata where the others are most abundant, and are most common in beds from a higher level. They resemble the *E. (Phænopora) ensiformis* of the Clinton group.

Formation and locality.—In the upper, shaly portions of the shaly limestones of the Lower Helderberg group, near Clarksville, New York.

Genus CALLOPORA *Hall.*

CALLOPORA HYALE *n. sp.*

Bryozoum growing in irregular foliate expansions, or incrusting other bodies. Surface marked by comparatively large, distant and irregularly disposed, circular or slightly oval cells with elevated margins. The intercellular spaces marked by very small, shallow, angular pits or depressions, sometimes three or four between adjacent cells; sometimes considerable areas destitute of these depressions, when the specimen presents much the appearance of a Trematopora.

In general appearance this species closely resembles *C. elegantula* of the Niagara group; but the cells are smaller and much more distant, while the cell margins of *C. elegantula* are never elevated; also the intermediate pits are larger and more distinct. It resembles in some degree *C. perelegans*, but the cells are less circular, the margins more strongly elevated, and the intercellular pits less distinct.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, at Schoharie, New York.

CALLOPORA MACROPORA *n. sp.*

Bryozoum forming slender, solid branches, with distant, widely diverging bifurcations; the branches seldom wider than a twentieth of an inch. Surface marked by comparatively large, elongate-oval or slightly angular cells. Intercellular spaces narrow, often only a narrow ridge, intercellular pits few, small and angular, never more than a single series so far as observed, and no spines have been seen on the cell margins.

This is a very distinct and well marked species, characterized by the large cells and slender branches. A single branch, apparently belonging to the same species, has been found in the Niagara group at Lockport.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, at Catskill creek, Greene county; near Clarksville, Albany county, and at Schoharie, New York.

CALLOPORA VENUSTA *n. sp.*

Bryozoum consisting of hollow branches, usually occurring flattened upon the surface of slabs; varying in width from a sixteenth to more than a fourth of an inch; their surfaces often nodose or tortuous. Inner surface of the tubes longitudinally striate and marked by strong concentric wrinkles. Cells small, longitudinally elliptical, not contiguous, their margins not distinctly elevated, though showing in some instances a well defined border. In well preserved specimens the cell margins are marked by short, obtuse spines, generally situated one on each side at the point of greatest diameter; occasionally there is also one at the upper or lower side. Intercellular spaces marked by one or more series of angular depressions or pits, which are sometimes almost as large as the true cells.

This species has much the general aspect of *C. elegantula* of the Niagara group, but the cells are much smaller, elongate instead of circular, and in the whole appearance is of a finer texture.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, on Catskill creek, New York.

CALLOPORA UNISPINA *n. sp.*

Bryozoum forming slender, solid branches, with distant bifurcations; the branches seldom more than a sixteenth of an inch in diameter. Cells small, somewhat crowded, usually triangular except at or near the bifurcation, where they become distorted; distant from each other about two-thirds of their own diameter. The intercellular space marked by small angular pits, with the ridges between sharply elevated, and rising into a short triangular spine at the basal margin of the true cells; giving to the branches under a magnifier a sharply asperate appearance.

The distinguishing feature of this species is the triangular cells with the single spine at the base of each.

Formation and locality.—In the shaly limestone of the Lower Helderberg group at Catskill creek, Greene county, and near Clarksville, Albany county, New York.

CALLOPORA PERELEGANS *n. sp.*

Bryozoum growing in strong, solid, tortuous branches, three-sixteenths of an inch, or more, in diameter. Cell apertures large, circular, with slightly elevated margins, somewhat irregularly disposed, distant from each other usually a little less than their own diameter. Intermediate spaces marked by comparatively large, polygonal pits, which frequently extend from cell to cell, making their length much greater than their breadth; the partition walls between the pits vertical, slightly flattened on the top. In a transverse section, the partitions across the intercellular spaces are strong and distant. Cell tubes smooth.

This exquisite species of Callopora is not equaled in beauty even by the *C. elegantula* of the Niagara group; it differs from that in the form of the intercellular pits, which in the *C. elegantula* are smaller, more numerous, and more equal in size.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, near Clarksville, Albany county, New York.

CALLOPORA HETEROPORA *n. sp.*

Bryozoum forming solid, comparatively slender branches, with numerous irregular bifurcations. Cell apertures small, elongate-oval, with frequent constrictions, which, in well preserved specimens, give

the border a somewhat lobed appearance; cells arranged irregularly and at distances varying from one-half to nearly twice their own length. Intercellular spaces marked by minute shallow pits, which are easily worn away, giving to the branches the appearance of Trematopora. In well preserved individual branches the intercellular pits are distinct, and the borders of the cells have small, short spines.

This is a common and variable species, occurring in branches of from three-hundredths of an inch to a line or more in diameter; the pores also vary in size and contiguity.

Formation and locality.—In the shaly limestone of the Lower Helderberg group, near Clarksville, Albany county, New York.

CALLOPORA PONDEROSA *n. sp.*

Bryozoum growing in heavy, dense, irregular masses, formed by numerous accretions of growth; or in smaller masses, incrusting shells and other substances. Surface crowded with medium-sized circular cells, distant from each other about half their own diameter, margins not elevated above the surrounding surface. Intercellular spaces crowded with minute, deep, polygonal pits, in one, two, or sometimes three ranges; the small triangular spaces at the angles, between the cells and pits, are elevated and form short triangular spines.

This species somewhat resembles in surface characters the *C. elegans* of the Niagara limestone, but it is of finer texture, and the cells have not the tendency to form rows, so common in that species. It differs from *C. perelegans* in the smaller size of the pores, the more numerous and smaller intercellular pits, and in its mode of growth, which is always incrusting or in large irregular masses.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, at Schoharie, New York.

Genus TREMATOPORA *Hall.*

TREMATOPORA RHOMBIFERA *n. sp.*

Bryozoum forming slender solid branches, with distant diverging ramifications; their surface marked by densely crowded, rhombic pores with narrow partition walls, carinate on their edges. Cells generally equal-sided, and arranged spirally around the branch, their vertical greater than their transverse diameter. The branches vary

in diameter from two-hundredths of an inch, to, rarely, a sixteenth of an inch.

In some well preserved examples of evenly weathered specimens a narrow groove or channel is seen passing from the upper and lower angle of the cells on to the surface, nearly uniting with that from the cells above and below, which may sometimes pass entirely over, leaving a double carina between the lines of pores; but this feature has been seldom observed.

This species is closely allied in some points to *T. regularis*, with which it is often associated, but differs essentially in the arrangement of the pores; that species having pores in longitudinal lines with an elevated ridge between, while in this species they are always spirally arranged; in worn specimens the difference is less distinctly seen.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, near Clarksville, Albany county, and at Schoharie, New York.

TREMATOPORA SIGNATUS *n. sp.*

Bryozoum forming slender, tortuous branches, seldom more than four-hundredths of an inch in diameter; bifurcations frequent, widely divergent. Surface marked by comparatively large polygonal pores, rather longer than wide, with partition walls carinate on the surface in unworn specimens, but frequently flattened from weathering or other causes, and in this condition the pores appear circular. In the angles formed by the junction of three or more pores are often seen minute pits, similar in appearance to the intercellular pits in *Calopora*, but which are probably the commencement of additional pores.

This is a clearly distinct and easily recognized species. It has much the appearance of a minute species of *Striatopora* and the form of cell apertures, their upward direction, radiating from the center of the branch, their angular outline and large size, would seem to ally it with that genus; but no trace of the characteristic striæ can be seen. It is closely allied to *T. constricta* from which it can be distinguished by the larger and angular pores as well as by the numerous intercellular pits of that species.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, at Schoharie, New York.

TREMATOPORA CONSTRICTA *n. sp.*

Bryozoum forming hollow bifurcating branches, generally about an eighth of an inch in diameter, rarely nearly twice these dimen-

sions: surface of branches smooth, having a worn appearance. Cell apertures small, round or slightly elongate, distant from each other once and a half to twice their own diameter; with a narrow depressed space surrounding the aperture; intercellular spaces smooth or but slightly channeled. On smooth silicified specimens the dermatic film, covering the intercellular spaces, is often thin and translucent, with the appearance of opercula caused by the refraction of light from the small cavities beneath. Inner surface of the branch-tubes transversely wrinkled and obscurely striated longitudinally by the recumbent portion of the cell tubes.

Formation and locality.—On weathered surfaces of the shaly limestones of the Lower Helderberg group, near Clarksville, Albany county, New York. (Rather abundant.)

TREMATOPORA CORTICOSA *n. sp.*

Bryozoum growing in long, irregular, solid branches, with distant ramifications, which are often more than an inch apart, and diverging at an angle of about ninety degrees; diameter of branches one-eighth of an inch or less. Cells numerous, elongate-ovate, sometimes elongate-hexagonal, deeply impressed. Intercellular spaces strongly elevated, forming roughened ridges between the cells, like the miniature roughened bark of a tree.

This species is easily recognized by the rough surface and distant, widely-diverging branches. It is not very abundant.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, near Clarksville, Albany county, New York.

TREMATOPORA Densa *n. sp.*

Bryozoum growing in solid, ramose branches, an eighth of an inch or less in diameter; their surface closely covered by small polygonal cells, with narrow, flattened interspaces. Cells rising from the center of the branch and rapidly diverging to the exterior; cell apertures various in size and irregular in position. Intercellular spaces solid on the exterior, cellulose within; the surface at the angles between the adjacent cells elevated, rising into small node-like tubercles.

In general aspect this species has the appearance of a small finely marked *Chaetetes*; but where broken so as to show the hollow tubes and cellulose intertubular space, its character as a *Trematopora* is clearly marked. In size and general appearance it has some resemblance to *T. corticosa*, but is easily distinguished by the smaller and less elongate cells, and less elevated intercellular substance.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, at Catskill creek, Greene county, New York.

TREMATOPORA PONDEROSA *n. sp.*

Bryozoum growing in heavy masses, consisting of lamellar accretions; surface structure consisting of comparatively large pores, distant from each other about their own diameter; margins of pores elevated, often extending over and constricting their apertures, especially on the posterior margin, and forming elevated hood-like projections. Intercellular area depressed or channeled, but destitute of pits or other markings. Under-surface of the lamellæ with radiating striæ, and marked by strong concentric wrinkles. In vertical section the intercellular substance is seen to be strongly vesicular, the partitions dome-shaped, and the cell tubes with frequent constrictions.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, at Catskill creek, Greene county, New York.

TREMATOPORA MACULOSA *n. sp.*

Bryozoum growing in irregular foliate or incrusting masses; cells approximate with depressed spaces between; apertures hooded in some stages of growth. Surface of frond studded with numerous comparatively large maculæ on which the cells are more sparsely arranged. Intercellular tissue strongly vesiculose seen in a vertical section. Under surface of frond strongly corrugated.

This species differs from *T. ponderosa* in the spots on the surface, in the mode of growth (in distorted or explanate fronds), and in the more strongly corrugated epithelial crust of the inferior surface.

Formation and locality.—In shaly limestone of the Lower Helderberg group, on Catskill creek, Greene county; and near Hudson, New York.

TREMATOPORA REGULARIS *n. sp.*

Bryozoum forming very slender, solid branches, with frequent, widely-diverging bifurcations; diameter of branches seldom more than three-hundredths of an inch. Cells elongate-oval, in longitudinal rows and in quincunx order, between the rows of cells the space is often elevated into a longitudinal ridge, with finely serrated crest in well-preserved specimens.

This species is often abundant on the surface of weathered slabs. The slender branches and regular arrangement of cells distinguish it; while the ridges are frequently worn away leaving a smooth

surface between the rows of cells. Well preserved specimens from Catskill creek show a short spine at the lower end of the cell aperture; a feature not observed in other localities.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, near Clarksville, Albany county, New York.

PALESCHARA *Nov. Gen.*

Bryozoum parasitic, or free, forming incrustations upon the surfaces of other fossils, or in independent frondose expansions. Surface with polygonal cellules, separated by thin solid walls; without evidence of rays or transverse septa.

The mode of growth is not dissimilar from that of a recent *Flustra* in its earlier stages, but the cells are less regularly arranged and the whole has a stronger and firmer aspect.

PALESCHARA INCRUSTANS *n. sp.*

Bryozoum growing in *flustra*-like expansions, incrusting shells and other bodies; sometimes more than an eighth of an inch in thickness from additions of growth. Cell apertures moderately large, polygonal; five to seven in the space of one-tenth of an inch; walls thick, their margins elevated at the angles of the cell apertures into obtuse projections, which are not sufficiently long to be characterized as spines. Sometimes the surface exhibits maculæ of larger cells; but this feature is obscure.

The general expression of this Bryozoan is that of a *Flustra*; the cells are very similar to some forms of *Chætetes*; but no transverse partitions have been discovered.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, near Clarksville, Albany county, New York.

PALESCHARA BIFOLIATA *n. sp.*

Bryozoum growing in broad, spreading fronds, or thin expansions, celluliferous on one or both sides, with an epithelial crust forming the base of the cells. The same or similar epithelial expansions may be found incrusting other substances. Surface of the frond covered with small, closely arranged, slightly elevated maculæ, formed of larger cells, with thicker walls than those dividing the ordinary cells. Cells polygonal, often slightly-elongated hexagons, in undulating or tortuous lines or irregularly disposed; cells rectangular to the plane of the frond or slightly inclined; without transverse plates, walls thin.

Maculæ distant from each other two to three times their own diameter. Thickness of the frond two to three-hundredths of an inch when single; width in one specimen more than an inch and a half. Seven to nine cells in one-tenth of an inch between the maculæ.

This species resembles some of the so-called Chætetes of the Hudson river formation of Cincinnati, Ohio. In the cell arrangement and the maculæ it may be compared with *C. pavonia* of D'Orb.; but the expansions are never so thick as in that one, though sometimes occurring double.

Formation and locality.—In the shaly limestone of the Lower Helderberg group, Schoharie, New York.

Genus CERAMOPORA Hall.

CERAMOPORA MACULATA *n. sp.*

Bryozoum growing in thin disc-like expansions, incrusting shells and other bodies, or free; with a wrinkled epithelial crust beneath; flat or depressed on the upper side. Disc covered with larger and smaller polygonal pores, the larger ones forming maculæ at irregular distances, and often formed by the union of two or three smaller cells. The cells radiate from the center, their apertures directed towards the margin of the disc, a little elongate, with the walls slightly elevated at the angles, forming angular projections. In small specimens the apertures are more elongate; and in the very young condition, where the cells are just forming on surfaces, they are extremely elongate with the posterior portion of the aperture hooded, and having an indistinct radiation from each of the maculæ. This character becomes obscured in older specimens from the bending upwards of the cells in the process of growth.

Discs from one-fourth of an inch to one inch and a half, or more, in diameter; the thickness in larger specimens an eighth of an inch. Between the maculæ about five cells occupy a tenth of an inch.

This species resembles *C. imbricata* of the Niagara limestone, but differs in the less distinctly hooded apertures, the maculæ more obscure and less strongly divided and radiate, and it also grows much larger.

Formation and locality.—In shaly limestones of the Lower Helderberg group, near Clarksville, Albany county, and at Schoharie, New York.

CERAMOPORA (BERENICEA) MAXIMA *n. sp.*

Bryozoum of a depressed convex form, composed of cells which radiate from the center of the disc, and open laterally, inclined at an angle of about forty-five degrees to the plane of the disc near the center, and becoming more prone as they approach the margin. Cell apertures irregularly hexagonal, somewhat elongated from the projection of the anterior or lower margin; diameter of the opening about one-twentieth of an inch; cell walls thick, obscurely striate inside, their margins at the angles of the cells prolonged in a spine-like process. Under surface unknown.

The single specimen found, measures nearly three-fourths of an inch in diameter. It has the general features of those Palæozoic species usually referred to Berenicea, but is much larger than the usual size of those. It resembles a Michelina with very small pores; but on examination its characters are more of a Bryozoan, especially the projections at the angles of the cell walls.

Formation and locality.—In the shaly limestone of the Lower Helderberg group, at Schoharie, New York.

VERMIPORA *Nov. Gen.*

Bryozoum growing in ramose branches, which are composed of small cell tubes, growing upon each other side by side, without intertubular or cellulose substance, and destitute of rays, or transverse partitions within the tubes. Tubes rising from the center of the branch, gradually diverging, and opening upwards on the exterior surface; each tube forming the apex of the branch at the time of its origin, and giving place to succeeding cells in its diverging outward.

The Bryozoans referred to this genus are ramose branches, formed by the union of serpula-like tubes, cemented upon each other, their apertures directed upwards and opening on the side of the branch, increasing in size with the increased diameter of the branch. There are no new cells formed by interstitial additions, the increased size of branch being dependent on the increased size of the tubes themselves. In a transverse section the appearance is of a bundle of compressed tubes, cemented together; the floor of the outer ones being formed by the exterior walls of the two just beneath it, and between which it has been formed. Of this peculiar type of Bryozoans we know yet of but two species, one of which is in the Upper Helderberg limestone.

VERMIPORA SERPULOIDES *n. sp.*

Bryozoum growing in strong ramose branches, with widely-diverging bifurcations: branches often one-fourth of an inch in diameter, rapidly decreasing in size at the bifurcations, composed of long, slender tubes, which gradually diverge from the axis to the exterior of the branch. Tubes flexuose, compressed, smooth on the exterior, or with corrugations of growth; gradually increasing in size upward. Apertures opening rectangularly to the axis (when entire), their greatest diameter about three hundredths of an inch, and with about an eighth of an inch of their length exposed, on branches which are one-fourth of an inch in diameter.

Formation and locality.—In limestone of the Lower Helderberg group, at Schoharie, New York.

Genus AULOPORA. *Goldf.*AULOPORA SCHOHARÆ *n. sp.*

Cells tubular, elongate, cylindrical or gradually enlarging to the aperture, frequently budding in a direct line, including an angle of about eighty degrees, varying somewhat in different specimens: apertures large, circular, opening upward, or directed slightly forward; walls thin, not striate within; exterior of the tubes smooth or with transverse wrinkles of growth. Length of cell tubes about one-fourth of an inch; diameter of aperture five-hundredths of an inch; greatest diameter of tube one-third greater than that of the cell apertures; diameter of the posterior extremity of tube equal to one-half that of the aperture.

This species is much smaller than that in the Hamilton group referred to *A. tubæformis* Gold.; it corresponds more nearly in size to *A. serpens* var. *minor* Gold., in *Petref. Germ.*, p. 82, pl. 29, f. 1 b.; but is larger than the figure; the extremities of the tubes are more unequal, and the mode of growth and bifurcation differ.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, at Schoharie, New York.

Genus CHÆTETES *Fischer.*CHÆTETES HELDERBERGÆ *n. sp.*

Bryozoum growing in strong, ramose branches, or palmate fronds; the diameter of the branches sometimes five-eighths of an inch, and

the fronds several inches in length. Cell tubes polygonal, very long and slender, rising from the center of the branch and gradually curving outward to the surface; increased by interstitial additions; diameter of the cells at the surface of the branch about a hundredth of an inch. Transverse floors or partitions distant in the lower part of the tube, becoming more numerous towards the outer end, and near the surface the distance from each other is less than the diameter of the tube.

In well preserved silicified specimens the cell walls on the surface are comparatively thick, the margins slightly elevated at the junction of cells, but not spine-like, the young cells appearing in the angles; in the interior of the branches the cell walls are obliquely corrugated. No maculæ have been seen on the branches.

This is a beautiful and not uncommon species.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, at Catskill creek, near Clarksville, and at Schoharie, New York.

CHÆTETES SPHÆRICA *n. sp.*

Bryozoum growing in large convex or hemispherical masses, composed of cell tubes radiating from within and diverging more rapidly as they approach the surface of the mass. Tubes small, polygonal, increased by interstitial additions; transverse partitions three, four or more times the diameter of the tube; cell walls very thin and corrugated. The surface of the mass is marked by maculæ, situated about a fourth of an inch from centre to centre, composed of cells which are about twice the size of the intermediate cells; the addition of new cells mostly takes place within the maculæ. About eight of the intermediate cells occupy the space of a tenth of an inch.

This species grows in very convex masses of sometimes four or more inches in diameter. On cursory observation it has the appearance of *Favosites conica*, with which it is associated, but it is composed of smaller tubes which are destitute of intercommunicating pores, and the transverse plates are more distinct, while also the maculated surface distinguishes the species.

Formation and locality.—In shaly limestones of the Lower Helderberg group, near Clarksville, and on Catskill creek.

Genus FAVOSITES *Lam.*

FAVOSITES HELDERBERGIÆ *n. sp.*

Corallum growing in large, lenticular, depressed-convex or hemispherical masses, with a wrinkled epithelial surface on the under side

when perfect. Cell tubes averaging one-twentieth of an inch, polygonal, their inner surface showing evidence of a few strong longitudinal striæ; the walls rather thin, but greatly increasing by silicification; the sides perforated by a single row of medium sized pores communicating with the adjacent cells; transverse partitions numerous, one, two, or sometimes three in a space equal to the diameter of the tube, the margins bent downwards at the junction with the cell-walls, and often perforated in one of the depressions.

In many specimens, a few of the cell-tubes are larger than those surrounding them, measuring about one-sixteenth of an inch, with thicker walls, and being less angular. A single specimen from Coeymans' Landing has slightly larger tubes on one portion, while in all the rest the cells have the ordinary characters.

The longitudinal striæ seen on some silicified specimens are not constant, and are not seen on calcareous specimens, and may be a feature produced in the process of silicification.

This species differs from the Upper Helderberg form known as *F. basaltica* in the smaller tubes and more closely arranged partitions.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, near Clarksville, Albany county. It is here found weathered out from the rock and silicified, frequently in masses of a foot or more in diameter. Smaller specimens of what appear to be the same or a closely allied form occur at Cole's quarry, in Herkimer county, New York.

FAVOSITES CONICA *n. sp.*

Coral forming conical masses, flattened at the base, composed of moderately large, strongly diverging, polygonal cells, curving more abruptly towards the surface of the mass; dividing walls thin, perforated by large, round, intercellular pores in one, two, or sometimes three series: those series which consist of a single range have the pores vertical one above the other; in the series of two ranges, they generally alternate with each other; where there are a greater number, the pores are irregularly disposed: margins of pores are usually slightly thickened. Transverse partitions closely arranged, two or three in a distance equal to the diameter of the tube. Tubes very variable in size and shape, some being not more than four-hundredths of an inch in diameter, while many are an eighth of an inch; the larger cells are six or more sided, the smaller cells four or five sided, or triangular, a feature not common in Favosites; but the triangular cells are usually small and near the base and soon become pentagonal from the truncation of two of the angles.

The conical form of the specimens, and the inequality of the cells, distinguish this species from every other known Favosites. The specimens are usually from one inch to nearly three inches in diameter.

Formation and locality.—In the shaly limestone of the Lower Helderberg group, near Clarksville, Albany county, New York.

FAVOSITES? MINIMA *n. sp.*

Coral forming globose or compressed globose bodies, composed of minute radiating cells, about two-hundredths of an inch in diameter; having comparatively thick walls which are perforated at regular distances by large pores, distant from each other less than the diameter of the tube, a single series on each face of the tube. Transverse plates rather closely arranged.

From the globular form of this small species and where the external characters are obscured by shale, it may be mistaken for the species of *Astylospongia* found in the same rocks. From the extreme tenuity of the tubes it presents the appearance of *Chaetetes*, but partially decomposed specimens from Catskill creek show very beautifully the casts of the intercellular pores connecting the different tubes. The original cells were probably formed upon some foreign substance, but from their rapid growth and curvature they soon close around and form spherical bodies generally a little distorted. Specimens an inch and a half or less in diameter.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, near Clarksville, Albany county; and Catskill creek, Greene county, New York.

Genus MICHELINA *De Koninck.*

MICHELINA LENTICULARIS *n. sp.*

Coral forming small lenticular bodies, the lower surface the less convex, and covered with a strongly wrinkled epitheca; cells large and few, broadly campanulate, with narrow partition walls strongly marked by granulose or denticulate longitudinal striæ, the number varying with the size of the cell.

In a specimen of little more than three-fourths of an inch in diameter, there are about twelve cells, the larger ones somewhat more than three-tenths of an inch in diameter: the whole height of the specimen is about the same.

This is a very small species, seldom attaining a diameter of more than one inch. This character, with the large cells and their strongly granulose striæ, are distinctive features.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, near Clarksville, Albany county; and at Schoharie, New York.

Genus STRIATOPORA *Hall.*

STRIATOPORA ISSA *n. sp.*

Coral growing in strong ramose branches, with distant bifurcations; branches three-eighths of an inch or more in diameter. Cells rising from the center of the branch, rapidly increasing in size, and curving outward to the surface; apertures very unequal, polygonal, strongly striated on the inside, the number of striæ increasing with the size of the aperture; walls not very thick, perforated by large, round pores situated between the striæ, and increasing in number with the increase of striæ. The larger cell-apertures somewhat more than a tenth of an inch in diameter.

This is the most robust species of this genus yet noticed, and the cells are large in proportion. It is not a very common form, and is generally found in detached pieces on the weathered surfaces of blocks of limestone.

Formation and locality.—In limestones of the Lower Helderberg group.

Genus STREPTELASMA *Hall.*

STREPTELASMA (PETRAIA) STRICTA *n. sp.*

Cup narrowly turbinate, very gradually and regularly enlarging at an angle of about thirty degrees, straight or slightly curved except the small apex which is sometimes more abruptly bent. Exterior surface strongly and distinctly ribbed longitudinally, and marked with concentric, unequal undulations of growth: longitudinal ribs rounded, from forty-five to fifty-five on specimens, at a point where the diameter is half an inch; the increase of ribs or rays taking place usually at three distinct points, but sometimes only at two points. Interior of cup broad and deep, with thin sharp margin; the lamellæ not projecting into the cup until near the bottom, but forming low, rounded rays, a little stronger than those on the exterior.

In a slightly flattened specimen which is one inch by three-fourths of an inch in diameter at the margin, with length which has been about one inch and seven-eighths, the number of rays at the margin is fifty-five; about half of these reach to the center, the other half project only a little beyond the walls at the base of the cup.

The primary lamellæ are smooth on the edge, and strongly granu-lose on the sides below, and sometimes more or less twisted in their direction to the center, although generally direct; uniting and coalescing near the middle, forming an indistinct plate or vesiculose core, from an eighth to three-sixteenths of an inch in diameter; and in vertical section, sometimes showing an indistinctly defined vertical wall.

The secondary lamellæ strongly denticulate on the edge below the surface of the other lamellæ. Fosset obscure or obsolete.

This species is distinguished by the rigid straightness of its form, the strongly ribbed exterior, and the deep wide cup with undeveloped rays or ribs: and in these characters differs from both those of the Niagara group and also from those in the higher formations.

Formation and locality.—In the shaly limestones of the Lower Helderberg group, at Catskill creek, Greene county; near Clarks-ville, Albany county; at Schoharie, and at numerous other localities in New York.