DESCRIPTION OF SPECIES.

etc. This scale makes it possible, and frequently desirable, to recognize half sizes.

The following species exhibit typically the various sizes of acanthopores:

No. 0. *Homotrypa grandis* Bassler and *Homotrypa alta* n. sp. In this size there is no central lumen and the acanthopore presents an indistinct, "fuzzy" appearance.

No. 1. *Heterotrypa prolifica* Ulrich, and *Homotrypa communis* Bassler.

No. 2. *Heterotrypa affinis* (Ulrich), and *Homotreypella hospitalis* (Nicholson).

No. 3. *Homotrypa nodulosa* Bassler, and *Dekayia aspera* Edwards and Haine.

No. 4. *Homotrypa flabellaris spinifera* Bassler, and *Dekayia aspera* Edwards and Haine.

No. 5. This size is not typically developed in any species so far described, but acanthopores of this size are sometimes found in several species of *Dekayia*.

No. 6. *Lioclena spineum* Bassler. We have a specimen of *Dekayia*, probably a new species, which has all seven sizes, and all intermediate sizes.

Most species provided with acanthopores have two or three sizes. The size of most common occurrence is No. 1.

**Scale of Acanthopores, x45**

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**PART V. DESCRIPTION OF NEW SPECIES.**

**Amplexopora Granulosa n. sp.**

Plate I. Figs. 1-1c.

Zoarium ramose or subramose, 8 to 10 mm. in diameter, the branches short and irregular, sometimes anastomosing. Surface nearly smooth, with medium-sized maculae consisting of smaller
zoecia and mesopores surrounded by zoecia larger than the average; maculae very little elevated above the general surface, about 9 in one sq. cm.

Tangential sections show the zoecia to be subpolygonal to oval, moderately thick walled, each aperture surrounded by a thin, light-colored cingulum; about 8 zoecia in 2 mm. The zoecial walls are made up of a light-colored material in which are embedded numerous dark, fuzzy granules. These granules are commonly arranged in transverse rows. Under high magnification each granule shows a light-colored nucleus. In longitudinal sections the granules are seen to be in parallel, vertical rows. Acanthopores are apparently absent, none of our slides showing any. There are occasionally, however, indefinite structures which may be acanthopores. Mesopores are restricted to the Maculae. The mesopores have the same wall structure as the zoecia, and may be only young zoecia.

Longitudinal sections show that the zoecia in the axial region have thin, crinkled walls, and are crossed by diaphragms from one to two tube diameters apart. In the mature region the zoecial walls are considerably thickened, and exhibit the usual median, black line. Diaphragms are close-set in the mature region, many of them being curved and infundibuliform.

This species does not sufficiently resemble any described species to require comparison. The only associated species of the genus is *Amplexopora pumila* n. sp., from which it differs in having no acanthopores. It was probably derived from *Amplexopora robusta*, which occurs over 100 feet lower in the section.

**Occurrence:** Rather abundant in the lower 25 feet of the Liberty, in Cuts 16 and 17, on the Big Four Railroad, near Weisburg, Ind.

*Amplexopora Pumila* n. sp.
Plate 11, Figs. 1-1e.

Zoarium irregularly ramose, consisting of short, knotted branches from 3 to 8 mm. thick, and 3 or 4 cm. long. Surface nearly smooth, with slightly raised maculae composed of large zoecia and a few mesopores; about 8 maculae in 1 sq. cm. Zoecia polygonal, thin-walled at the surface; mesopores few, scattered among the ordinary zoecia as well as in the maculae.

In tangential sections the zoecia are seen to be subpolygonal in form, with medium thick walls, 7 or 8 in 2 mm. The double zoecial wall consists of two very light-colored rings of tissue separated by
a dark, granular line. These rings are not cingula, but parts of the true zoecial walls. The granules in the median line vary in number and size and are not arranged in transverse rows, as in *Amplexopora granulosa*. Mesopores are few in number and have the same wall structure as the zoecia; they are probably only young zoecia.

The acauthopores vary much in size and number, there being ordinarily about 3 in 10 zoecia. In size they range from No. 0 to 2, averaging about size 1. They are indefinite in outline and shape, fading out into the median line. The lumen is not clear and well-defined, but only somewhat lighter in color than the surrounding tissue.

The zoecia in the axial region have the usual thin, flexuous walls, and are crossed by diaphragms about their own diameter apart. As the mature region is reached the walls become considerably thickened, and the diaphragms about three times as numerous, many of them being curved.

The large, indistinct acauthopores are occasionally seen in longitudinal sections, but are never conspicuous. The dark line between adjacent zoecia is quite distinct, not straight and uniform, but irregularly crinkled and varied in thickness, and of a granular structure.

This species bears some resemblance to *Amplexopora pustulosa*, but may be distinguished by the small, irregular, smooth zoarium, the granulose intermural line, and larger and fewer acauthopores. The only associated species is *A. granulosa*, which differs from *A. pumila* in the absence of a cingulum, the wide intermural line with granules in transverse rows, and the absence of mesopores.

**Occurrence:** Rather abundant in the upper 15 feet of the Waynesville and lower 25 feet of the Liberty, in Cuts 14, 16 and 17, on the Big Four Railroad, near Weisburg, Indiana.

**Amplexopora Setosa Maculosa II. var.**

Plate III, Figs. 1-3.

Zoarium robust, ramose, about 10 mm. in diameter and 4 or 5 em. long, branching every 2 or 3 cm. Surface with elevated, subsolid, flat-topped maculae about 1 mm. in diameter, composed of mesopores or very small zoecia surrounded by zoecia considerably larger than the average; 12 maculae in 1 sq. em. These maculae constitute the main distinguishing characteristic between this va-
variety and *A. septosa* and its other varieties, all of which have maculae on a level with the general surface of the zoarium, and composed of larger zoecia and a few open mesopores.

Tangential sections show that the zoecia are thick-walled, although at the surface the walls are usually thin and the zoecia polygonal, and separated by a definite dark median line; 8 zoecia in 2 mm. There is usually no cingulum present in the zoecia, as is ordinarily the case with the variety *A. septosa multispinosa*. The acanthopores are numerous, 5 or 6 surrounding a zoecium about 2/3 the size of No. 1, that is 1/30 mm. in diameter, sometimes reflecting the zoecial walls. The outlines of the acanthopores are indistinct; the lumen is extremely small and seldom showing, but sometimes appearing clear and well-defined. The maculae are seen to be composed of mesopores either completely filled with secondary tissue or possessing a thick cingulum. Communication pores are sometimes present in large numbers.

The zoecia in the axial region have thin, irregularly crinkled walls and are usually without diaphragms, although an occasional very thin one is present. In the curve from the immature to the mature region the zoecial walls are considerably thickened and there begins a close-set series of diaphragms which become more and more crowded till a point about half way from the submature region to the surface is reached, at which point the diaphragms suddenly stop and only an occasional one is inserted from there on to the surface. In the type specimen there appears to have been a rejuvenation after maturity was reached and several diaphragms are again inserted. The median dark line is quite distinct, and nearly straight, as ordinarily seen. In good slides under a high power of the microscope (320 diameters) this median line is seen to be composed of curved, transverse rows of granules, and is not a double, or even single, plate separating adjacent zoecia and along which the walls tend to split. This variety agrees in all respects with *A. septosa multispinosa*, except the presence of the prominent, subsolid, elevated maculae.

**Occurrence:** Common in the upper 70 feet of the Eden and lower 50 feet of the Maysville, in Cuts 1, 2, 3, 4 and 5, on the Big Four Railroad, near Guilford, Indiana.

**Amplexopora Septosa Minima ii. var.**

Plate IV, Figs. 1-1d.

Zoarium small, ramose, 2-5 mm. in diameter and 3 or 4 cm. long, branching frequently. Surface smooth, with small, incon-
spicuous macula composed of large zoecia and a few mesopores, not raised above the general level of the surface.

In tangential sections the zoecia are seen to be thin-walled, with no cingulum, the dark median line showing quite plainly; 8 or 9 zoecia in 2 mm. Acanthopores are numerous, 5 or 6 surrounding a zoecium, about 1:3 the size of No. 1, that is, 1/60 mm. in diameter, with a clear, well-defined lumen. Mesopores few, scarcely more numerous in the maculae than elsewhere.

Diaphragms numerous in the submature region, absent in the mature, and absent or few in the axial region; walls crenulated. Walls somewhat thickened in the mature region.

This variety differs from A. septosa in having smaller zoaria, thinner walls and smaller acanthopores which do not inflect the zoecial walls.

**Occurrence:** Common in the upper 70 feet of the Eden and lower 50 feet of the Maysville, in Cuts 1, 2, 3, 4 and 5, on the Big Four Railroad, near Guilford, Ind.

**A'tactopora intermedia** n. sp.
Plate IV, Figs. 2, 2a; Plate V, Figs. 1-1d.

Zoarium parasitically attached to *Orthoceras*, no basal epitheca, about 20 sq. cm. in area and 1 mm. thick, and made up of superimposed layers. The surface presents prominently raised suboid monticules, which are slightly elongated in the direction of the longitudinal axis of the *Orthoceras* and in rows in the same direction, about 15 occupying the space of 1 sq cm. Zoecia floriform, thin-walled at the surface, indented by the small but conspicuous acanthopores.

Tangential sections show the zoecia to be very irregular in shape, indented by the numerous conspicuous acanthopores, about 9 zoecia in 2 mm. Each zoecium is surrounded by a very thin dark line, the interzoecial tissue consisting of irregular granular material, slightly lighter in color than the zoecial wall. Acanthopores very abundant, 4 or 5 surrounding each zoecium, No. 1 in size. The maculae are made up of irregularly concentric tissue, enclosing a few acanthopores. Mesopores are practically absent.

In the longitudinal section the zoecia are thick-walled, the acanthopores very conspicuous with a clear canal, which is somewhat irregular in size but not increasing in size as the surface is approached. Diaphragms numerous in the lower half of each zoecium, usually absent in the outer half. Cystoid diaphragms are pres-
ent in some of the tubes. The zooecia are at first prone, but soon turn at right angles, and then proceed direct to the surface. The maculae are composed of aborted zooecia and acanthopores, as described by Ulrich.*

This species presents several very interesting features. It is very similar to *Atactopora hirsuta*, except in possessing numerous diaphragms in the lower portion of the tubes. It resembles *Atactoporella* in possessing cystiphragms in some of the zooecia. We do not, however, attach even specific importance to the sporadic development of cystiphragms, inasmuch as we have found them in at least nine genera, exclusive of the Monticuliporidae. In a subsequent paper, now in preparation, we shall suggest an explanation of these structures.

This species also resembles very closely several species of *Spatiopora*, but the total absence of a lunarium would indicate that it is not a Ceramoporoid.

**Occurrence:** Rare in the McMicken division of the Eden, in Cut 3, on the Big Four Railroad, near Guilford, Ind.

*CERAMOPORELLA TRILIOBA* n. sp.

Plate VI, Figs. 1-1c.

Zoarium growing parasitically upon other bryozoans (*Heterotrypa ulrichi*), with no epitheca, forming large masses by superimposition of layers. Each layer is less than 1 mm. in thickness. The type specimen is 5 cm. long and about 2 cm. in diameter.

Surface nearly smooth, with maculae slightly raised or depressed. Maculae composed of smaller, distorted zooecia and mesopores. Zooecia irregularly trilobed, with a strongly arching lunarium. On unweathered surfaces minute acanthopores are discernable. Mesopores are numerous.

In tangential sections the zooecia are seen to be roughly trilobed, with moderately thin walls; 7 zooecia in 2 mm. Mesopores rather abundant, oval or irregular in shape. Structures exactly like the acanthopores in some Trepostomata, and which we consider to be true acanthopores, are common, though irregularly distributed among the zooecia. They are about half the size of No. 1, that is 1/40 mm. in diameter. Lunaria prominent, horseshoe shaped, occupying one-third of the zooecial circumference, the ends projecting slightly into the zooecial cavity. Opposite the lunarium is another very small crescent-shaped, light-colored structure very sim-

ilar to the lunarium but much smaller. These structures occur also in several other Ceramoporoids.

In longitudinal sections the walls are seen to be irregular in structure, rather thin, with no mural pores or large granules. Diaphragms thin, one or two in each tube. Acanthopores not conspicuous, but typically developed, with comparatively wide canals and thin walls.

This species is closely related to Ceramoporella distincta, but has fewer mesopores, differently shaped zoecia and more prominent lunaria. It resembles Crepipora in the distinct lunaria with projecting ends, but the mesopores are not collected into maculae, and the lunarium overarches more than in that genus. It is distinguished from Ceramoporella ohioensis by the prominent, horseshoe-shaped lunarium.

Occurrence: Rare in the McMicken member of the Eden, in Cut 3, on the Big Four Railroad, near Guilford, Ind.

Ceramoporella Tubulosa n. sp.
Plate VI, Figs. 2, 2a; Plate VII, Figs. 1-1c.

Zoarium parasitically attached to foreign bodies, in the type specimen to a species of Orthoceras, covering over 30 sq. cm. and having a thickness of about 1 mm. There is no epitheca.

Surface smooth, with maculae composed largely of irregular mesopores, neither elevated nor depressed and scarcely distinguishable. Zoecia oval, surrounded completely by irregular mesopores. Lunarium not elevated. Numerous minute acanthopores may be seen on unweathered surfaces.

Tangential sections present a bizarre appearance. The zoecia are regularly oval in shape, all orientated the same way, 1/4 mm. long and 1/6 mm. wide, about 6 in 2 mm., including mesopores. Walls of medium thickness. Lunarium pronounced, occupying a little less than one-half the zoecial circumference, the ends not projecting into the zoecial cavity. Mesopores abundant, very irregular in shape, separating the zoecia the distance of their shorter diameter and in the same direction; usually also separating the zoecia in the direction of their longer diameter. The most noticeable thing in tangential sections is the numerous acanthopores. They occupy for the most part the angles between the mesopores. They are sometimes much more abundant than in the section figured (Plate VII, Fig. 1), there being as many as ten or more to a
zoecium. They are about half the size of No. 1, or 1/40 mm. in diameter, though they vary somewhat in size.

Longitudinal sections show very few diaphragms, these structures averaging less than one to a tube. The acanthopores are perfectly typical, with wide canal and thin, laminated walls. Diaphragms occasionally cross the tube of the acanthopore.

This species most closely resembles Ceramoporella granulosa, but has fewer diaphragms, more mesopores, and absolutely lacks the large granules which are such a conspicuous feature of longitudinal sections of that species. The two species also occupy different horizons. We do not agree with Ulrich that the "small dark spots, precisely like acanthopores in tangential sections,"* are simply the cross-sections of granules, but hold that they are cross-sections of true acanthopores. Our specimens of Ceramoporella granulosa show these granules as well as acanthopores, from which they are easily distinguished by differences in structure.

*Ceramoporella tubulosa resembles Ceramoporella distincta externally, but tangential sections of the two are quite different.

Occurrence: Rare in the upper 25 feet of the Eden in Cut 3, on the Big Four Railroad, near Guilford, Ind.

Heterotrypa Microstigma H. sp.

Plate VIII, Figs. 1-1c.

Zoarium ramose or subramose, about 10 mm. thick and 6 cm. long. Surface nearly smooth, with very small, subsolid macula composed only of mesopores, surrounded by zoecia slightly larger than the average; 15 maculae in 1 sq. cm. Maculae averaging about 1 mm. in diameter, sometimes slightly elongated transversely to the zoarium. Zoecia medium thick walled, subpolygonal. No mesopores show at the surface except in the maculae. Acanthopores not showing at the surface.

Tangential sections show the zoecia to be subcircular, very thick walled, 9 zoecia in 2 mm. Mesopores absent, except in the maculae, where they are usually nearly closed by a secondary deposit of tissue. The zoecial aperture is surrounded by a thick ring of light-colored tissue. To this structure which is found in many species of Trepotostomata, we apply the name "cingulum." The cingulum is typically developed in Amplexopora cingulata Ulrich. Immediately surrounding the cingulum is a thin dark line, the true zoecial

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* Geol. Surv. Ill., VIII, p. 466.
wall. The intermural tissue is light-colored, and finely granular. Acanthopores small, No. 1 in size, and abundant, from 20 to 25 in 10 zooecia; sometimes slightly inflecting the zooecial walls. The zooecia and acanthopores are quite regular in size and arrangement.

In longitudinal sections the zooecia in the axial region are seen to be crossed by diaphragms averaging 3 tube diameters apart. In the mature region the zooecia are very thick walled and provided with diaphragms less than one tube diameter apart. Mesopores are rarely seen in these sections.

The character which distinguishes this species from associated species of Heterotrypa is the minute, subsolid maculae. Other differences are indicated on the chart, pages 417, 418.

Occurrence: Rather rare in the Waynesville, in Cut 13, on the Big Four Railroad, near Weisburg, Ind.

Homotrypa Alta n. sp.
Plate IX. Figs. 1-1c; Plate X. Figs. 1-1c.

Zoarium robust, ramose, or slightly compressed, 6 to 10 mm. in diameter and 4 or 5 cm. long, branching about every 2 cm. Surface perfectly smooth, with numerous subsolid, stellate maculae, which are neither raised nor depressed, composed of small mesopores surrounded by zooecia somewhat larger than the average. The maculae have a tendency to be drawn out in the direction of the longitudinal axis of the zoarium; 10 maculae in 1 sq. cm. At the surface the zooecia are polygonal to oval with medium thick walls, and the acanthopores rarely show.

As seen in tangential sections the zooecia are polygonal, medium thick walled, with oval apertures; 10 zooecia in 2 mm. The aperture is surrounded by a ring of dark tissue, succeeded by a lighter ring, and this is in turn surrounded by a second dark ring of granular tissue. Ordinarily there is a median line of light-colored tissue, but occasionally this is absent, in which case the median line is made up of the second, granular zooecial wall. Mesopores are practically absent, except in the maculae, but there are occasional small zooecia which might be mistaken for mesopores, but differ from mesopores in having walls exactly like the large zooecia. The maculae are composed of mesopores which have almost always been filled by a deposit of light-colored schlerenchyma. Acanthopores common, 4 in 10 zooecia, very minute, number 0 in size, with no central lumen. Communication pores are sometimes present.
In longitudinal sections the zoecia have wavy walls and no diaphragms in the axial region. The zoecia turn sharply outward in the submature region and proceed direct to the surface. Mature region deep, 1.5 to 2 mm. from the submature region to the surface. A series of 5 or 6 cystiphragms is developed in the bend of the submature region. A close-set series of diaphragms extends from the immature region to the surface. Cystiphragms are frequently interpolated near the surface, where the diaphragms are variously curved. Rarely in the submature region an acanthopore about number 1 in size appears, but never reaches the surface.

This species is most closely related to *Homotrypa grandis* Bassler, from the Lorraine of Tennessee, but differs in having only about a tenth as many acanthopores, and in wall structure. The specimen figured on Plate IX, Fig. 1c seems to be intermediate between these two species; the tangential section, however, is different (Plate X, 1c).

**Occurrence:** Common in the Mt. Hope-Fairmount in Cuts 2 and 4 on the Big Four Railroad, near Guilford, Ind.

**Homotrypa Glabra n. sp.**

Plate XI, Figs. 1-1d.

Zoarium small, ramose, 2 to 5 mm. in diameter and 2 or 3 cm. long. Surface smooth, with solid, stellate macule composed of mesopores which have been completely filled with schlerenchyma. Zoecia thick walled, their apertures oval.

In tangential sections the zoecia are seen to be thick walled, the zoecial apertures oval and largely filled with a secondary deposit of schlerenchyma, most of the thickening being on the upper side of the zoecium. Zoecial walls granular, much as in *Homotrypa cylindrica*, with a light streak of intermural tissue. Acanthopores rare, minute, number 0 in size, and indistinct. Mesopores absent. About 9 zoecia in 2 mm.

Longitudinal sections show the zoecia in the axial region to have thin, crinkled walls, and no diaphragms. Four or five cystiphragms appear in the submature region but there are none in the mature region. Occasionally a diaphragm or two is present in the mature region. Some of the zoecia are without cystiphragms. The zoecial walls are greatly thickened in the mature region, most of the thickening being on the upper side. The zoecia emerge obliquely to the surface. Acanthopores are almost
wanting in longitudinal sections, but occasionally one of about $\frac{1}{4}$ the size of number 1 is present in the submature region. These acanthopores do not appear to reach the surface.

This species is not sufficiently similar to any described species of *Homotrepa* to require comparison. The most nearly related form seems to be *Homotrepa axilis* Ulrich, from the lower third of the Trenton shales at Minneapolis, Minn.

**Occurrence:** Rare in the McMicken in Cut 2 on the Big Four Railroad, near Guilford, Ind.

**Homotrepa spinea** n. sp.

Plate XII, Figs. 1-1c; Plate XIII, Figs. 1-1d.

Zoarium subramose to subfrondescent, about 5 mm. thick, 10 mm. wide and 4 to 6 cm. long. Surface ordinarily smooth, with stellate macula of mesopores surrounded by zoecia larger than the average. Well-preserved surfaces show the projecting ends of the numerous large acanthopores; but in most of our specimens these are broken off. Zoecia polygonal, medium thick walled. Mesopores are usually absent except in the macula.

In tangential sections the zoecia are subpolygonal to oval, with thick walls; 9 zoecia in 2 mm. Each zoecial aperture is surrounded by a dark ring of tissue, then a lighter ring and finally by a second dark ring. The median line between adjacent zoecia is dark in some places, but ordinarily there is a line of light-colored tissue between the second set of dark rings. Mesopores are practically absent except in the macula. Deep sections, or sections from immature zooaria, show a considerable number of small mesopores. The acanthopores are rather large, from number 1 to 2 in size, 4 in 10 zoecia.

The zoecia in the axial region are without diaphragms, their walls thin and crinkled. A considerable number of large acanthopores appear in the axial region and proceed to the surface, bending with the zoecia, though sometimes they cut across the zoecia and maintain a straight course. The zoecia turn with an increasing curvature after they reach the immature region, and emerge at the surface almost at right angles. The walls become considerably thickened in the mature region. A close-set series of cystiphragms and diaphragms is developed from the immature region to the surface.

The internal characters of this species are quite constant. No associated species resembles it very closely in internal characters.
Homotrypa flabellaris spinifera Bassler resembles it zoaria, but
H. spicata is readily distinguished by the thicker walls, smaller
acanthopores and the absence of diaphragms in the axial region.

Occurrence: Rather common in the Mt. Hope-Fairmount in
Cuts. 2, 4, 5 and 7, on the Big Four Railroad, near Guilford, Ind.

MESOTRYPA ORBICULATA n. sp.
Plate XIV, Figs. 1-1b.

Zoarium discoidal or hemispherical, 10 to 15 mm. in diameter
and 2 to 5 mm. thick, with a concave base, growing parasitically
upon brachiopod shells; there is no basal epitheca. The zoarium
is made up of two or three superimposed layers or successive
rejuvenations with thickening of the walls and maximum develop­
ment of acanthopores, exactly as found in the genus Stigmatella.
We do not attach even varietal significance to this feature, which
is merely due to rejuvenation and is common to all genera of
Trepostomata.

The surface is smooth, with the ordinary maculae of large
zoecia and mesopores. The zoecia are subcircular, 7 in 2 mm.
and separated from each other by angular mesopores. Conspicuous
acanthopores occur between adjacent zoecia. They are regular­
ly of size number 1, 20 in 10 zoecia. Several diaphragms are
developed in the young part of each zoecium, some of them being
curved, but are practically absent in the mature part of the zoeciu,m.
The mesopores are provided with a close-set series of dia­
phragms throughout their length.

This species most nearly resembles Mesotrypa patella (Ulrich),
which is also found in the Richmond. It may, however, be dis­
distinguished by the larger acanthopores of M. orbiculata. Mesotrypa (?) spinosa Ulrich, from the Black River of Minnesota, is
also a closely related form, but has many more cystiphragms and
diaphragms, and no mesopores at the surface.

Occurrence: Common in the middle of the Arnheim, in Cut
10 on the Big Four Railroad, near Harmon's station, Ind.

NICOLSONELLA PECULIARIS n. sp.
Plate XIII, Fig. 2: Plate XIV, Fig. 2, 2a.

Zoarium irregularly frondescent, 3 mm. thick, about 2 cm. wide
and 4 cm. long. Surface smooth, having maculae which are slight­
ly depressed, composed of 6 or 8 large zoecia separated from each
other by large, irregular mesopores. Maculae 2 or 3 mm. in dia­
mater, about 10 in 1 sq. cm. The zoecia are circular, medium thick-walled, the angles between them occupied by mesopores.

Tangential sections present a pretty appearance. The zoecial apertures are nearly circular and surrounded by a cingulum of light-colored tissue; 8 or 9 zoecia in 2 mm. The true zoecial wall is an irregular, dark line, enclosing numerous, very minute acanthopores. These acanthopores are number 0 in size and rarely show the central canal; 8 or 10 surround a zoecium. Communication pores are occasionally present.

Irregular mesopores occupy the angles between the ordinary zoecia. The zoecia of the maeulae have no cingula, consequently their apertures are larger than the average. They are more or less completely separated by large, extremely irregular mesopores. The mesopores are not hazy or indefinite, but clear-cut, as if they were merely spaces between the zoecia. The mesopores, rather than the zoecia, are strongly inflected by the acanthopores. The structure of the walls, as well as the arrangement of zoecia, mesopores and acanthopores, is the most irregular of any species we have seen.

The zoecia in the axial region are without diaphragmus, their walls thin and wavy. They curve gradually till they reach the submature region, whence they proceed direct to the surface. One or two diaphragmus are developed in the mature region. The mesopores have a chain-like appearance, very similar to those of *Stigmella calceolata* n. sp.

This species, which has all the generic characters of *Nicholsonella*, bears a close resemblance to *Stigmella*, and raises the question whether *Nicholsonella* should not be replaced in the family Heterotryptidae.

The irregular structure and arrangement of parts makes this species easy to recognize and to distinguish from other species of *Nicholsonella*.

**Occurrence:** Rare in the Arnheim, in Cut 11 on the Big Four Railroad, near Harmon's station, Ind.

**Peronoporella** new genus.

Compressed, flabellate Manticuliporidae, having a much abbreviated axial region but no median lamina. Zoecia oval or peta-lloid, commonly indented by the abundant, rather large acanthopores, which give to the surface a hirsute appearance. Mesopores numerous, crossed by numerous diaphragmus, sometimes
closed at the surface. No monticules, but inconspicuous maculae of larger zoecia and mesopores are present.

This genus is distinguished from *Homotrema* by its abundant mesopores, from *Peronopora* by the absence of a median limina, and from *Atactoporella* by its frondescent form. *Peronoporella* is distinguished from *Homotrema*, to which it is evidently most closely related, by the narrow axial region and the presence of cystiphragms all the way from the axial region to the surface. The longitudinal section is very similar to that of *Peronopora*, except that there is no median lamina, and there is a longer immature region in *Peronoporella*. The zoarium is also like that of *Peronopora*, with which it has probably been confused, but it can unusually be distinguished by the less regular arrangement of zoecia and mesopores and the conspicuous acanthopores of *Peronoporella*.

*Genotype: Peronoporella dubia* n. sp.

**Peronoporella Dubia** n. sp.

Plates XV, XVI and XVII.

Zoarium compressed, frondescent or laminar, 6 or 8 cm. long, 5 or 6 cm. broad and about 2 mm. thick. Surface smooth, no monticules, but about 9 inconspicuous maculae in 1 sq. cm. Maculae only slightly elevated above the general surface, composed of 5 or 6 zoecia slightly larger than the average and separated by large, irregular mesopores. The maculae are about 2 mm. in diameter and 3 mm. apart.

The zoecia at the surface are oval or irregularly petaloid, inflected by the numerous acanthopores, and usually separated more or less completely from each other by irregular mesopores. The conspicuous acanthopores give to the surface a granulose appearance. Sometimes the mesopores are closed at the surface, but in ordinary specimens and in weathered specimens they more or less completely surround the zoecia. The zoecial walls are thick at the surface.

Tangential sections near the surface show that the zoecia are oval or irregularly petaloid in shape, thick-walled, about 8 in 2 mm. Mesopores are few on account of their being closed by the thickening of the zoecial walls and the enlargement of the acanthopores. The zoecial walls are amalgamated, having no distinct boundary; and the intermural deposit is light-colored, corresponding in position to the mesopores deeper down (Plate XV, Fig. 1 b.)
In the typical tangential section (Plate XV, Figs. 1, 1c) the zoeceia are oval, indented by the acanthopores, and separated from each other at the angles by numerous oval mesopores. The crescentic edges of one or more cystiphragms occupy each zocecial aperture. The walls are of medium thickness, and consist of a dark ring next to the aperture, surrounded by lighter tissue. Occasionally there is a second, indistinct, interrupted dark line separating two zoeceia, but not comparable to the dark median line of the Integrata. Three or four acanthopores having a diameter of about one-fourth the zocecial aperture, or a little larger than number 1, surround a zoecium. In deeper sections they are slightly smaller and in shallower sections slightly larger than in ordinary sections. They have a central lucid canal surrounded by a very dark ring, which is in turn surrounded by successively lighter concentric rings. The outer limits of the acanthopores are not clearly defined, where they fade into the mural tissue. Deeper sections show thinner walls, more numerous and larger mesopores and somewhat smaller acanthopores (Plate XV, Fig. 1a). Communication pores, similar to those found in Homotrypa and many other genera, are occasionally present in tangential sections.

In longitudinal sections the immature region is seen to be about one-fifth as broad as the whole zoarium. The zoeceia are at first almost parallel to the surface, thin-walled and crossed by a few remote diaphragms. They gradually bend toward the surface till the submature region is reached, where they bend more abruptly outward and proceed in a straight line to the surface and emerge at right angles to the latter.

Numerous cystiphragms are developed in the immature region, on the upper or distal side of the zoecia, and extend almost to the surface in an increasingly crowded series. They also become smaller as they approach the surface. There are a few diaphragms in the immature region of the zoecia, but usually none in the mature region. The mesopores are provided with a close-set series of diaphragms from the immature region to the surface.

Acanthopores are numerous in the longitudinal section, of rather large size and with a clear central canal. They are ordinarily straight, beginning in the immature region and increasing slightly in size till they reach the surface. Sometimes, where they have been protected by an overgrowth, the acanthopores extend some distance (one or two zoecial diameters) above the general level of the surface. In this case they consist only of the central canal and the thin dark tube immediately surrounding it. We have
observed this same feature in many other species, and it throws much light on the structure and function of acanthopores. Ordinarily this tenuous tube is broken off near the surface, and we do not see the complete acanthopore.

A remarkable feature of the acanthopores of *Peronoporella* is their occasional irregularity as seen in longitudinal sections. Very frequently, instead of proceeding in a straight line, they are bent in the shape of a hook, or in other unusual forms (Plate XVI, Fig. 1a). Then they appear to be rejuvenated and proceed toward the surface, sometimes showing several successive dislocations. Almost every longitudinal section shows these hooked acanthopores. They indicate that as the zoarium grew these tubes, which extended above the surface, were sometimes accidentally broken off or bent and were immediately rejuvenated. So far these peculiarly shaped acanthopores have not been detected in any genus except *Peronoporella*. We do not, however, at present, consider this feature as constituting a generic or even a specific character.

This species resembles species of *Peronopora* very closely, both in zoarial habit and in longitudinal sections, but the absence of any median lamina in over 50 longitudinal and cross-sections examined convinces us that it is not a *Peronopora*. Figures of *Peronopora vera* for comparison are given on Plate XVII, Figs. 2, 2a.

**Occurrence:** Common in the Bellevue in the Borrow Cut and abundant in the Arnheim in Cuts 10 and 11, on the Big Four Railroad near Harmon's station, Ind.

**Stigmatella Alcicornis** h. sp.

Plate XVIII, Figs. 1-4c.

Zoarium compressed, frondescent or subramose, about 2 mm. thick, 2 or 3 cm. high and about the same distance in width. Around the margin there are short, subramose branches, giving to the zoarium the appearance of the antlers of the moose. The surface is nearly smooth, having about 10 slightly raised maculae in 1 sq. cm. The maculae are composed of larger cells and a few mesopores. The zoecia at the surface are thin-walled and polygonal.

The zoecia, in tangential sections, are thin-walled, polygonal and separated in some places by an interrupted dark line; 7 or 8 zoecia in 2 mm. Acanthopores are very small, between num-
her 0 and 1 in size, about 10 occurring in 10 zoezia. Mesopores are usually absent.

Longitudinal sections show that the zoezia have thin walls throughout, with very little thickening in the mature region. The zoezial walls are more or less wrinkled. Diaphragms are absent, except a single one occasionally in the young part of the zoezialium. The acaenopores are not conspicuous, but have a clear, sinuous canal; they are numerous in the periphery and rare in the axial region.

The only associated bryozoan with which this species might be confused is the very thin form of *Heterotrypa frondosa*, but the larger zoezia, thinner walls and absence of mesopores will distinguish *S. alcicornis*.

**Occurrence:** Rather common in the Fairmount, in the upper 15 feet of Cat 5 on the Big Four Railroad, near Guilford, Ind.

**Stigmatella Catenulata n. sp.**

Plate XIX, Figs. 1-4c.

Zoarium robust, subramose, 1.5 to 2 cm. in diameter and 5 or 6 cm. long. Surface nearly smooth, with low, round monticules or large maculae, composed of mesopores and large zoezia. Zoezia subcircular, with medium thin walls. Mesopores are usually restricted to the clusters, but sometimes, on immature branches, there may be a small area in which mesopores are numerous.

Tangential sections show the zoezia to be subpolygonal and thin walled, with a light-colored intermural line; 9 zoezia in 2 mm. Where there are mesopores the zoezia are smaller, but there is the same number in 2 mm., including mesopores. The acaenopores are small but conspicuous, about half the size of number 1, that is, 1/40 mm. in diameter, about 10 in 10 zoezia. They are situated at the angles of junction of the zoezia and never inflect the zoezial wall. Mesopores are usually few or absent in sections near the surface, but occasionally a section will show a region of numerous mesopores, especially if the section is deep or taken from an immature branch.

Diaphragms are absent in the axial region and there are only one or two in the mature region. The zoezial walls are only slightly thickened in the mature region, which is 2 or 3 mm. in depth. The chain-like mesopores are the noticeable feature of longitudinal sections. They begin in the submature region and ordinarily do not reach the surface. Where the diaphragms cross
the mesopores there is a constriction, giving to the mesopores the appearance of chains or strings of beads. The zoecial walls are nearly straight or only slightly flexuous.

This species is evidently most closely related to *Stigmatella interporosa* Ulrich and Bassler, which it resembles, but it may be distinguished from that species by its more robust habit of growth, thicker mature region and less numerous mesopores and greater development of chain-like mesopores.

**Occurrence:** Rather common in the Arneheim, in Cuts 10 and 11, on the Big Four Railroad near Harmon's station, Ind.

**Stigmatella incrustans** h. sp.

Plate XIX. Fig. 2; Plate XX. Figs. 1, 1a.

Zoarium incrustating foreign bodies, in the type specimen attached by an epitheca to a cast of *Orthoceras*; irregular in growth, 4 or 5 cm. long and 2 to 3 cm. wide, and from 1 to 5 mm. in thickness, and composed of several superimposed layers. The surface is strongly monticulated, 10 monticules in 1 sq. cm.

In tangential sections the zoecia are very thin-walled, polygonal, 8 in 2 mm. Mesopores are practically absent. Acanthopores are conspicuous, situated at the angles or in the walls between adjacent zoecia, sometimes strongly inflecting the zoecial walls; 10 acanthopores in 10 zoecia and in size ranging from number 0 to 1.

The zoecia are at first prone, but quickly assume an erect position and proceed in undulating curves to the surface. Diaphragms are almost absent, except in the successive mature regions, which makes the whole section appear to have numerous diaphragms.

This species differs from *Stigmatella nicklesi* Ulrich and Bassler, to which it seems to be most closely related, in zoarial habit, in possessing prominent conical monticules, and in having fewer acanthopores which vary considerably in size. It differs from *Stigmatella clavis* (Ulrich) in the same respects. This form also resembles *Cypholrypa wilmingtonensis* Ulrich and Bassler, but there is no doubt of its being a *Stigmatella* as the latter genus is at present defined.

**Occurrence:** Rare in the lower Liberty, in Cut 17 on the Big Four Railroad, near Weisburg, Ind.
DESCRIPTION OF SPECIES.

**Stigmatella Sessilis** n. sp.

Plate XIX, Fig. 3; Plate XX, Figs. 2-26.

Zoarium discoidal, about 15 mm. in diameter and 3 mm. thick in the center, growing parasitically upon foreign objects. There is no basal epitheca.

The zoecia, as shown by tangential sections, are polygonal, their apertures oval or circular, 10 zoecia in 2 mm. Surrounding the aperture is a ring of very light-colored schlerenchyma, which is in turn surrounded by a very thin dark ring. The median line is usually light in color, but is absent in some places, in which case the two dark rings constitute the median line. Mesopores are practically absent. Acanthopores are numerous, 10 in 10 zoecia, quite constant in size, about 2/3 the size of number 1, that is 1/30 mm. in diameter. The lumen is clear.

The zoecia at first are crossed by thin diaphragms, their own diameter or less apart. In this region there is also a considerable number of chain-like mesopores. In the remaining portion of the zoecia the diaphragms are twice their diameter apart. At several successive levels, 4 in the type specimen, the acanthopores and walls show the characters of maturity. At these levels there is one diaphragm, occasionally 2, in each tube, at the same height in adjacent zoecia. That these levels represent successive stages of maturity is proven by the specimen, for the growth is interrupted completely in one part of the zoarium at these four levels. This characteristic of rejuvenation and overgrowth is not confined to the genus *Stigmatella*. It is a common feature of a good many species of Trepostomata, and we consider it as an inadequate basis upon which to found a genus. We consider *Stigmatella* as a valid genus; but we rely chiefly upon the thin walls, small acanthopores, few diaphragms and the presence of mesopores for its recognition.

*Stigmatella sessilis* differs from *S. nicklesi* Ulrich and Bassler, which it closely resembles, in internal characters, in zoarial habit, and in having thicker walls and smaller acanthopores.

**Occurrence:** Rare in the Fairmount, in Cut 7, on the Big Four Railroad, near Manchester Station, Ind.