384. *Primitia centralis Ulrich. Southgate.
385. *Primitia cincinnatiensis (Miller). Richmond.
386. *Primitia impressa Ulrich. Arnheim and Waynesville.
387. Tetradella quadrilirata (Hall and Whitfield). Lower Richmond.
388. *Tetradella quadrilirata simplex Ulrich. Richmond.

CIRRIPEDIA.

389. *Lepidocoleus jamesi (Meek). Southgate, Waynesville.

PART IV. PALEONTOLOGY.

Under this heading we consider the points of special interest of the more important genera and species. The major part of our study has been devoted to the Bryozoa, on account of their abundance, their value as zone markers, and the fascinating interest they lend to paleobiology. The Bryozoa of the Cincinnatian exceed all other groups in number of species and individuals.

No attempt has been made in this paper to differentiate the smaller subdivisions of many old species, as has recently been done by Foerste, as it suits our present purpose better to retain the long-used names.

CORALS.

Protarea vetusta (Hall). This coral makes its first appearance, in the Cincinnatian, in the middle of the Waynesville. In the upper 17 feet of this division and in the upper Liberty it occurs abundantly, and rarely in the Saluda and Whitewater. Foerste calls this species *Protarea richmondensis.*

BRACHIOPODA.

Dalmanella meeki (Miller) (=*Dalmanella jugosa* (James)), makes its first appearance in the Fairmount. This is the form recognized by Foerste as *Dalmanella fairmountensis. D meeki,* the typical form, comes in in the Corryville and increases in abundance to the base of the Waynesville. In this formation it is the dominant fossil. It disappears at the base of the Liberty.

Dalmanella multisecta (Meek). This form ranges throughout the Eden and up into the Fairmount. It is the characteristic brachiopod of the Eden.

Dinorthis retrorsa (Salter) (= *D carleyi* (Hall)), occurs apparently in a single layer near the top of the Arnheim at the top of Cut 11. The variety *D. carleyi insolens* Foerste, which occurs

in some places at the top of the Waynesville, was not obtained from our section.

Hebertella sinuata (Hall) occurs rather commonly in the Bellevue and rarely in the Fairmount It also occurs in the Waynesville, increasing in abundance from bottom to top, and in the lower Liberty. The Richmond form is somewhat smaller than the typical Maysville species and does not have the dorsal fold so strongly developed.

Leptaena rhomboidalis (Wilckens). This species begins, in the present section, in the Arnheim, where it is very rare, and increases in abundance to the top of the Waynesville, where some of the thin limestone layers are largely made up of fragments of the shells of this species.

Platystrophia lynx (Eichwald). The gerontic form is common in a single thick layer at an elevation of 730 feet, in Cut 10, but it is not nearly so abundant as in Ohio, where it ranges through a considerable thickness of rock. This layer corresponds to the Mt. Auburn. We also found a few specimens of the typical form in the Fairmount, but none in the Bellevue. This is rather remarkable in view of the fact that at most localities the Bellevue is replete with specimens of this species.

Platystrophia acutilirata (Conrad) is fairly common in the middle and upper Waynesville. It occurs sparingly above and is absent below this horizon in the present section.

Platystrophia laticosta (Meek) first appears in the middle of the McMicken, and continues to the top of the section. It is most common at the top of the Waynesville, but is also a common and characteristic fossil of the Fairmount and Bellevue.

Plectambonites sericeus (Sowerby) is another long-lived species. It persists with little change throughout the Cincinatian, and reaches its culmination in the base of the Liberty, where several layers are made up almost entirely of this shell.

Plectorthis plicatella (Hall), which is characteristic of the Fairmount, first appears in the upper 15 feet of the McMicken. We include under this name all of the commonly recognized varieties of this species.

Raflnesquina alternata (Emmons) is one of the most conspicuous and omnipresent species of the Cincinnatian, second in this respect only to *Zygospira modesta*. It occurs throughout the section, in several places making up the bulk of the rock. From the base of the Maysville to the top of the Liberty it is very abundant. The

variety *fracta* occurs in immense numbers in the Bellevue, Corryville and Arnheim. The variety *loxorhytis* is common from the Corryville to the top of the Waynesville. The variety *ponderosa* appears abundantly in the Bellevue, and a similar though probably distinct form in the middle Waynesville. It is possible to find all intermediate forms between the species and varieties, and one cannot be certain what variety he is dealing with unless the form is well marked.

Rhynchotrema capax (Conrad) is found first at about the middle of the Waynesville and extends up into the Whitewater. It occurs in large numbers in the lower Liberty.

Rhynchotrema dentatum (Hall) which is characteristic of the Whitewater at Richmond, appears to be lacking in this division on Tanner's Creek. It occurs rather commonly in the middle Waynesville.

Strophomena planoconvexa (Hall) is restricted to the Fairmount. Though occurring in small numbers it is characteristic of the Fairmount, and its first appearance marks the base of that division, as ordinarily defined.

Strophomena planumbona (Hall) first appears in the Waynes- and reaches its culmination in the Liberty, which it characterizes.

Zygospira modesta (Hall) occurs throughout the Cincinnatian. It is especially abundant in the Arnheim, Waynesville and Liberty. Our collections from the Saluda and Whitewater do not contain any specimens of this species, but it is found in these beds at Richmond.

Bryozoa.

Amplexopora cingulata Ulrich. We found several specimens of this species, which appear to be perfectly typical, in the Arnheim, in Cut 11.

Amplexopora filiosa (American authors). This species occurs, in our section, in the Bellevue and at the top of the Arnheim, but it is rare and the zoaria are smaller than the typical form. It seems quite probable that this species is a lineal descendant of *Amplexopora petasiformis* (Nicholson) from the Eden, which it resembles very closely.

Amplexopora septosa Ulrich. This species is quite abundant throughout the McMicken and Mt. Hope-Fairmount. The inflections of the zooecial walls by the acanthopores scarcely ever show at the surface, so that sections are necessary to distinguish the species from the variety *multispinosa*. The variety *minima* is the

simplest form, and the one from which the species and the other varieties were probably derived. In the variety *maculosa* the maculæ are quite different from the maculæ of *A. septosa,* as pointed out in the description.

Our study of maculæ and monticules has shown that they are of considerable importance in classification, and has thrown much light on their probable function. Our studies have also shown that curved diaphragms, which are quite common in species with numerous diaphragms, have little or no classificatory significance. These results, and other studies on morphology, will be brought out in detail in a succeeding paper.

There are three well-marked groups within the genus *Amplexopora.* The simplest type is the *filiosa* group, consisting of *A. filiosa, A. petasiformis, and A. Welchi.* A second group is the *pustulosa* type, consisting of *A. ampla, A. Columbiana, A. cylindracea, A. granulosa, A. pustulosa, A. pumila,* and *A. robusta.* A third group is the *cingulata* type, consisting of *A. cingulata, A. persimilis,* and *A. septosa* and its varieties. In this third group might appropriately be placed *Batostoma variabile, Batostoma minnesotense,* and *Batostoma winchelli.* It will probably be found advisable to redistribute most of these species among other genera and reserve *Amplexopora* for the *cingulata* type above.

Batostoma implicatum (Nicholson) and *Batostoma jamesi* (Nicholson) are characteristic of the Eden. *B. implicatum* extends up into the Fairmount also.

Batostoma varians (James) appears in the Arnheim and fails at the top of the Waynesville. It shows close relationship with *B. implicatum* of the Eden. The acanthopores and wall structure of the three species, *B. implicatum, B. jamesi* and *B. varians* (and probably *B. maysvillensis* Nickles, from the Mt. Hope at Maysville, Ky.), belong to a single type which is quite different from the acanthopores and wall structure of all the other species now referred to the genus *Batostoma.* We are of the opinion that it might be advisable to restrict the genus *Batostoma* to the *implicatum* type, and redistrbute the other species among *Amplexopora* and other genera. In this way we believe the natural relationships would be better shown.

Batostoma variabile Ulrich is restricted to the Whitewater. In Cut 18, near Weisburg, it is very abundant, but it is found only rarely at most other localities. At Ballstown, Ind., it is abundant in the Whitewater, and is beautifully preserved. This species was

evidently not derived from any Cincinnatian *Batostoma*. It bears a remarkably close resemblance to *Amplexopora cingulata* and was either derived from that species, or more probably, migrated from the northwest and is the descendant of *Batostoma minnesotense* or some of its congeners in the Trenton.

Batostoma prosseri Cumings and Galloway, which occurs commonly in the upper Waynesville, has no near relative in the Cincinnatian rocks. The similarity between it and *Batostoma varium* Ulrich, from the Black River of Minnesota, would indicate that it may have been derived from that form and came into the Cincinnati area during the Waynesville invasion from the north. It is found also in the Richmond of northern Illinois.

The species of the genus *Bythopora,* which occur in the Cincinnatian strata, fall into two groups, the *B. arctipora* group, consisting of *B. arctipora, B. dendrina, B. parvula* and *B. striata,* characterized by their delicate zoaria, rather large zooecia, and scarcity of diaphragms and acanthopores; and the *B. gracilis* group, consisting of *B. delicatula, B. gracilis* and *B. meeki,* characterized by their much larger zoaria and conspicuous acanthopores. There is considerable variation in the latter group, especially in the size and number of acanthopores and number of diaphragms. Some of these variants may later be recognized as distinct varieties, but they will be of little value in stratigraphic determination.

Bythopora delicatula (Nicholson) ranges from the Corryville to the Whitewater. In the latter formation it occurs in immense numbers.

Bythopora gracilis (Nicholson) is restricted to the Maysville, occurring most abundantly from the Bellevue to the Arnheim.

Bythopora meeki (James) occurs throughout the Richmond in considerable numbers.

Chiloporella flabellata (Ulrich) occurs commonly in a layer in the Corryville at an elevation of 60 feet above the railroad in Cut 8, and sparingly above and below this horizon. It is of considerable value as a zone marker, being characteristic of the Corryville.

The genus *Dekayia,* as we conceive of it, consists of *Dekayia appressa* Ulrich, *Dekayia aspera* E. and H., *Dekayia maculata* James, *Dekayia magna* Cumings, *Dekayia multispinosa* Ulrich, and *Dekayia obscura* (Ulrich). These species may be distinguished from all other species which have heretofore been placed in the genera *Dekayella* and *Heterotrypa* (which we refer to the single

genus *Heterotrypa*) by fewer diaphragms, fewer mesopores, and by their peculiar type of wall structure, seen typically in *Dekayia aspera*. We have near completion a re-study of all the species of *Dekayia* and *Heterotrypa*, the results of which will be published in the near future. In that paper we shall show the evolution of these genera, and endeavor to demonstrate that they constitute two well-defined natural groups.

Dekayia aspera E. and H. occurs abundantly in Cut 5 at the base of the Maysville. A form scarcely distinguishable from it, probably a variety, occurs in the Arnheim. A form of *Dekayia* very similar to *D. obscura* occurs in the Corryville-Arnheim. The *Dekayias* appear in the McMicken and become extinct at the middle of the Arnheim. They are especially characteristic of the Maysville.

Eridotrypa simulatrix (Ulrich), the only species of this genus found in the Cincinnatian, ranges from the Corryville to the base of the Liberty. It is most abundant in the upper Waynesville.

The genus *Hallopora* (formerly *Callopora*) is represented in the Cincinnatian by ten species, all of which are abundant at their respective horizons.

Hallopora dalei (E. and H.) characterizes the Mt. Hope-Fairmount. It also occurs sparingly in the McMicken.

Hallopora oncalli communis (James) is found sparingly in the Southgate and very abundantly in the McMicken, which formation it characterizes.

Hallopora ramosa (d'Orbigny) is very common throughout the Maysville, and is most abundant in the Bellevue and Corryville. A form scarcely distinguishable, perhaps the same species, occurs in the Waynesville and Liberty.

Hallopora subnodosa (Ulrich) extends from the Arnheim to the top of the Richmond.

Hallopora ramosa rugosa (E. and H.) is found throughout the middle and upper Maysville, and a form probably referable to this species occurs in the Waynesville. It reaches its maximum development in the Arnheim. The rugose phase is not confined to *H. ramosa*. It appears occasionally on all monticulose *Halloporas*.

Heterotrypa frondosa (d'Orbigny) occurs commonly throughout the Maysville. It reaches its culmination in the Bellevue. Occasionally specimens show inflected walls, as in *H. singularis*.

Heterotrypa prolifica Ulrich occurs only in the Waynesville, where it is very common. All the Waynesville species of *Hetero-*

TABLE I.

TABLE OF SPECIFIC CHARACTERS OF THE GENUS DEKAYIA.

Species.	Zoarium.	Surface.			Zooecia in 2 mm.	Shape of Zooecia.	Tangential Section.				
		Mesopores.	Monticules.	Maculae.			Mesopores.	Acanthopores. No. in 10 Zooecia.	Acanthopores. Size.	Thickness of Walls.	Cingulum.
Dekayia appressa	Ramose, flattened, 1-3 in. high; 7-10 mm. in diam.	Very few	None	Of large cells and mesopores.	10	Polygonal (oval).	Few to none.	4	2	Thin	Very thin or none.
Dekayia aspera	Ramose, 6-10 mm. thick; 3-6 cm. long.	None	None	Of large cells and mesopores.	10	Polygonal	None	4	3, 4	Thin. Thicker than in *appressa*.	Very thin or none.
Dekayia maculata	Ramose, 3-6 mm. thick; 3-6 cm. long.	Few, restricted to maculae.	None	Of mesopores.	8	Oval	Few, except in maculae.	4–8	1, 2, 3	Thick	Very thin.
Dekayia magna	Massive, large, ramose; 2 or more cm. thick.	None	None	Of large zooecia.	8	Polygonal	None	1	1	Very thin	None.
Dekayia multispinosa.	Ramose, flattened; 8–15 mm. in diameter.	Few or none	None	Of large Zooecia and mesopores.	10	Oval or polygonal.	Few, many in maculae.	4–10	2 (1, 3)	Medium	None.
Dekayia obscura	Ramose, slender, 4-6 mm. thick.	Moderate number.	None	Of large zooecia and mesopores.	9	Oval	Moderate number, angular.	3–6	1, 2, 3	Thick	Thin.

TABLE 1—Continued.

TABLE OF SPECIFIC CHARACTERS OF THE GENUS DEKAYIA.—Continued.

Species.	Longitudinal Section.				Range.	Remarks.
	Diaphragms in Axial Region.	Diaphragms in Periphery.	Acanthopores.	Diaphragms in Mesopores.		
Dekayia appressa	None	5 to 10	Not conspicuous	Closer than in zooecia.	Upper Maysville	Surface sometimes covered with a pellicle.
Dekayia aspera	None	None (2 to 4)	From axial region to periphery.	None	McMicken to Fairmount.	Walls crinkled. Acanthopores large at surface. Communication pores sometimes present.
Dekayia maculata	None	2 to 4	From axial region to periphery.	None	McMicken (Maysville).	Walls crinkled, much thickened at surface. Acanthopores large at surface.
Dekayia magna	None	None	Rarely a large one in axial region.	None	Fairmount to Arnheim.	Walls crinkled, not thickened in periphery.
Dekayia multispinosa	None	None (1 or 2)	Common in axial region	None	Mt. Hope to Fairmount	Walls crinkled, not abruptly thickened in periphery. Sometimes covered with pellicle.
Dekayia obscura	None	2-4	Common from axis to periphery.	Closer than in zooecia	Upper Eden to lower Maysville.	Walls crinkled. Mature region shallow. Surface often with pellicle.

TABLE 2.

TABLE OF SPECIFIC CHARACTERS OF THE GENUS HETEROTRYPA.

Species.	Zoarium.	Surface.			Zooecia in 2 mm.	Shape of Zooecia.	Tangential Section.				
		Mesopores.	Monticules.	Maculae.			Mesopores.	Acanthopores. No. in 10 Zooecia.	Acanthopores. Size.	Thickness of Walls.	Cingulum.
Heterotrypa affinis	Irregularly ramose, 15 mm. thick.	Only in maculae	Very low	Of large zooecia and mesopores.	7–8	Polygonal	Few to none	20	1	Thin	None.
Heterotrypa frondosa	Frondescent, 5-10mm. thick.	Numerous or few	Low, round	Of large zooecia and mesopores.	7–8	Oval or polygonal.	Numerous to few.	3–4	*1, 2	Medium	None.
Heterotrypa inflecta	Flabellate, 3-5 mm. thick.	Numerous	None	Of large zooecia and mesopores.	8	Round	Numerous	5–7	†1, 2	Thick	Thick, perfect.
Heterotrypa paupera	Ramose or subramose, 4-8 mm. in diameter.	Only in maculae	None	Of large zooecia and mesopores.	8	Polygonal	Very few	4–5	1	Very thin	None.
Heterotrypa pelliculata.	Large, subramose, 16-20 mm. thick.	Few to none	None	Of large zooecia and mesopores.	7–8	Polygonal	Few	4	1, 2	Very thin	None.
Heterotrypa solitaria	Frondescent, 2-4 mm. thick.	Very few or none	None or very low.	Of large zooecia and mesopores.	7–8	Polygonal	Very few	6–10	1	Thin	None.
Heterotrypa subfrondosa.	Frondescent, large, 8-10 mm. thick.	Few to numerous.	Low, round	Of large zooecia and mesopores.	7–8	Round	Few to numerous.	10	‡1, 2, 3, 4	Thin	None.
Heterotrypa subpulchella.	Large, subramosa, 10-15 mm. in diameter.	Few, except in the maculae.	Very low	Of mesopores, surrounded by zooecia.	7–8	Round	Numerous	6	1, 2, (3)	Medium	None.
Heterotrypa ulrichi.	Ramose, 5-10 mm. in diameter.	Abundant	None (or low).	Of mesopores, surrounded by zooecia.	7–8	Round	Abundant	4–10	2, (3)	Medium to thick.	Thick, perfect.
Heterotrypa ulrichi lobata.	Subramose to frondescent, 3-5 mm. thick.	Abundant	None (or low).	Of large zooecia and mesopores.	7–8	Round	Numerous	4	1, 2, 3	Thin	None.
Heterotrypa ulrichi robusta.	Ramose, 10 mm. in diameter.	Numerous	Small, conical.	Of large zooecia and mesopores.	7–8	Polygonal (Round).	Numerous	6	1, 2, 3	Medium	None or thin.
Heterotrypa microstigma.	Ramose, 10 mm. or more in diameter.	None	None	Very small, of small mesopores.	9	Subcircular	None	20–25	1	Thick	Thick, perfect.
Heterotrypa prolifica	Frondescent, large, 8-15 mm. thick.	Few	Low, large, round.	Large, of large zooecia and mesopores.	8–9	Subcircular	Few	20	1	Thick	Thick, perfect.
Heterotrypa singularis.	Subramose, 7-10 mm. in diameter.	Abundant	Low, large, round.	Large, of large zooecia and mesopores.	8–9	Subcircular	Abundant	20	1	Thick	Thick, perfect.
Heterotrypa subramosa.	Ramose, 8-10 mm. in diameter.	Few or none (sometimes numerous).	None or low.	Large, of large zooecia and mesopores.	8–9	Subcircular	Few to numerous.	10–15	1, 2	Thick	Thick, perfect.

*Very regular. ‡Very variable. †Regular.

TABLE 2—Continued.

TABLE OF SPECIFIC CHARACTERS OF THE GENUS HETEROTRYPA—Continued.

Species.	Longitudinal Section.				Range.	Remarks.
	Diaphragms in axial Region.	Diaphragms in Periphery.	Acanthopores.	Diaphragms in Mesopores.		
Heterotrypa affinis	Numerous, 1-3 tube diameters apart.	½-1 tube diameters apart.	Small	Numerous, close-set (beaded).	Waynesville	Acanthopores slightly inflect the walls.
Heterotrypa frondosa	None	1 tube diameter apart.	Rarely a large one in axial region.	Numerous, close-set (beaded).	Mt. Hope to Arnheim	Very variable in all characters.
Heterotrypa inflecta	None	1 tube diameter apart.	Inconspicuous	Numerous, close-set (beaded).	Mt. Hope to Corryville.	Acanthopores inflect walls; conspicuous at surface.
Heterotrypa paupera	None	1-2 tube diameters apart.	Inconspicuous	Numerous, close-set (beaded).	Fairmount to Corryville	
Heterotrypa pelliculata	None	½-1 tube diameters apart.	No. 2 common	Numerous, close-set (beaded).	Fairmount and Bellevue	Surface sometimes covered with a pellicle.
Heterotrypa solitaria	None	½-1 tube diameters apart.	Inconspicuous	Numerous, close-set (beaded).	Fairmount to Arnheim.	
Heterotrypa subfrondosa	None	½-1 tube diameters apart.	Sometimes a large one in axial region.	Numerous, close-set (beaded).	Mt. Hope to Fairmount	
Heterotrypa subpulchella	None	1-2 tube diameters apart.	Sizes 2, 3 in submature region.	Numerous, close-set (beaded).	McMicken to Fairmount	
Heterotrypa ulrichi	None	½-2 tube diameters apart.	Sizes 2, 3 in submature region.	Numerous, close-set (beaded).	Southgate to Fairmount	Characteristic of the middle McMicken.
Heterotrypa ulrichi lobata.	None	½-2 tube diameters apart.	No. 3, rare	Numerous, close-set (beaded).	McMicken to Fairmount	
Heterotrypa ulrichi robusta.	None	½-2 tube diameters apart.	Nos. 2, 3 in submature region.	Numerous, close-set (beaded).	McMicken to Fairmount	
Heterotrypa microstigma	Numerous, 1-3 tube diameters apart.	1 tube diameter apart.	Small	Close-set	Waynesville	Zooecia sometimes inflected.
Heterotrypa prolifica	Numerous, 1-3 tube diameters apart.	½-1 tube diameters apart.	Small	Close-set	Waynesville	Zooecia sometimes inflected. Communication pores and infundibular diaphragms common.
Heterotrypa singularis	Numerous, 1-3 tube diameters apart.	½-1 tube diameters apart.	Small	Close-set	Waynesville	Zooecia much inflected.
Heterotrypa subramosa	Numerous, 1-3 tube diameters apart.	½-1 tube diameters apart.	Small	Close-set	Waynesville to Whitewater.	

trypa may be easily distinguished from the Maysville species of the genus by the presence of numerous diaphragms in the axial region of the Richmond forms. In the Maysville representatives of this genus diaphragms are almost always entirely lacking in the axial region. Communication pores and infundibular diaphragms are very beautifully developed in most species of *Heterotrypa*, especially in *H. prolifica* and its allies.

Heterotrypa ulrichi (Nicholson) ranges throughout the Eden and up into the Fairmount. It reaches its culmination in the middle of the McMicken.

The genus *Homotrypa* is represented in the Cincinnatian of Indiana by twenty-five species.

Homotrypa austini Bassler and *Homotrypa communis* Bassler, two closely related species, occur commonly in the Waynesville and Liberty, and occasionally in the Whitewater..

Homotrypa flabellaris Ulrich occurs rarely in the Arnheim and commonly in the Waynesville. The variety *H. flabellaris spinifera* Bassler occurs in the Fairmount and in the upper Waynesville. It it doubtful, however, if the Waynesville form is identical with the Fairmount form. Bassler does not say from which formation his type comes.

Homotrya frondosa Bassler occurs from within the Corryville to the top of the Waynesville. That this species is not a variety of *H. flabellaris* is shown by the absence of diaphragms in the axial region of *frondosa*, the large round monticules, and other minor differences.

In the Whitewater occurs a group of species, the *Homotrypa ramulosa* group, consisting of *Homotrypa constellariformis* Cumings, *Homotrypa nicklesi* Bassler, *Homotrypa nitida* Bassler and *Homotrypa ramulosa* Bassler, which are very closely related to each other, and distinguished from all other species of *Homotrypa* (except *H. gelasinosa* Ulrich, which probably belongs in the same group) by the peculiar, irregular maculæ.

Homotrypa pulchra Bassler is characteristic of the Corryville-Arnheim. The ease of identification of this species in the field makes it valuable for stratigraphic determination.

Homotrypa wortheni (James) occurs quite abundantly in the Whitewater, which it characterizes. It is not confined to this formation, however, but is found sparingly in the upper Waynesville and Liberty.

Homotrypella hospitalis (Nicholson) is characteristic of the Waynesville, increasing in abundance from the bottom to the top of this formation. It also occurs in the Liberty and rarely in the Whitewater.

Homotrypella rustica Ulrich occurs rarely in the Waynesville and Liberty. We have no specimens from the Whitewater of the Tanner's Creek section, although it occurs abundantly in that formation at Richmond, Laurel and Versailles.

Peronopora pavonia (d'Orbigny) is a common fossil, occurring from the top of the Fairmount to the middle of the Liberty. There is considerable variation in the characters of this species. The acanthopores vary considerably in size and number. There is also much variation in the size of the zoaria, number of mesopores, diaphragms and cystiphragms. Some of these variants may sometime be recognized as varieties or even distinct species. *P. pavonia* may always be distinguished from *Peronopora vera* by the much smaller zoœcia of the former.

Peronopora vera Nickles occurs in the Southgate and McMicken, and is particularly abundant in the Mt. Hope-Fairmount. There is also considerable variation in the characters of this species, variations which would at once be considered of sufficient importance to cause the erection of new species and varieties if they occurred in some other genera. However, it seems that no useful purpose would be served by recognizing these variants as new species or varieties at the present time.

The genus *Stigmatella* is represented by ten species in the Cincinnatian of Tanner's Creek. None of these species occur abundantly and they are consequently of little importance in stratigraphic work.

Scale of Sizes of Acanthopores.

We have found in our study of acanthopores that instead of there being two recognizable sizes, heretofore designated as "large" and "small," there are at least seven easily recognizable sizes, ranging from the extremely minute ones like those found in *Homotrypa grandis* Bassler to the extraordinarily large ones of *Lioclema spineum* Bassler.

We have taken as the unit of measurement 1/20 of a mm., so that when a tangential section is magnified 20 diameters, No. 1 acanthopores will be 1 mm. in diameter, No. 2, 2 mm. in diameter,

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 *Homotrypella hospitalis* (Nicholson).

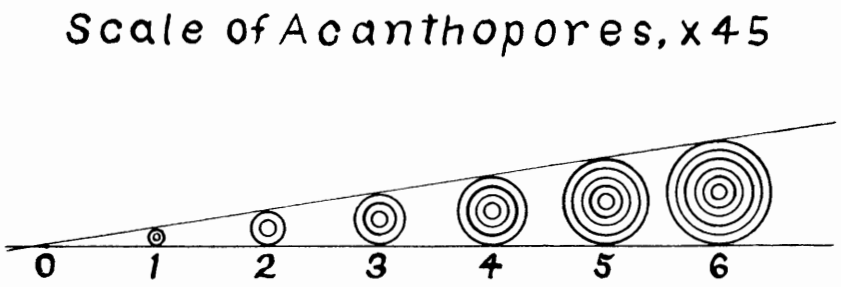
No. 3. *Homotrypa nodulosa* Bassler, and *Dekayia aspera* Edwards and Haime.

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

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. *Lioclema 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.



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 maculæ consisting of smaller