AMERICAN PALÆOZOIC BRYOZOA.

By E. O. Ulrich.

[*Continued from Vol.* 5, *p.* 257.]

Amplexopora robusta, n. sp. (Pl. I., figs. 1, 1*a*, 1*b*.)

Zoarium ramose, consisting of cylindrical, oftener of flattened branches, dividing dichotomously at rather frequent but irregular intervals, and usually varying in diameter from .4 inch to .7 inch. A very large specimen in my cabinet has a length of 4.3 inches; the central stem is flattened, and varies in diameter from 1.1 inches to 1.7 inches. The bases of two branches are on one side, and three on the other, the mean diameter of which is about .6 inch. Monticules are not developed. The cells are moderately thin-walled, polygonal, and consist of one kind only (*i.e.*, the interstitial cells are wanting); their arrangement is quite regular, and, when well preserved, show at their angles of junction the elevated points of the spiniform tubuli (Pl. I., fig. 1). At intervals of about .15 inch the surface exhibits conspicuous clusters of cells larger than the average, with a mean diameter of $\frac{1}{60}$th of an inch. The smaller or ordinary cells have a diameter varying from $\frac{1}{100}$th to $\frac{1}{90}$th of an inch.

Tangential sections (Pl. I., fig. 1*a*) show that the cell-walls are comparatively thin and polygonal, and that their cavities are only occasionally rounded by a secondary deposit of sclerenchyma; and further that the original line of separation between adjoining cells is always more or less distinctly marked. The spiniform tubuli do not constitute a conspicuous feature in sections of this species, and unless carefully examined might be overlooked. With an occasional exception they always occupy the angles of junction of the cells. (Their appearance is very well represented by the figure.) Lastly, in many sections some of the cell-cavities inclose a small circular ring, that is due to the peculiar funnel-shaped diaphragms seen in longitudinal sections.

In longitudinal sections (Pl. I., fig. 1*b*) the tubes in the "immature" region are thin-walled, and crossed by straight diaphragms from two to four tube-diameters apart. The nearly equal curve of the tubes, from the axis of the branch to the peripheral portion, constitutes a characteristic feature of the species. As they enter the peripheral or "mature" region their walls are considerably thickened, and the diaphragms become much more numerous, being from less than one half to

one tube-diameter distant from each other. The funnel-shaped, diaphragms noticed in the preceding species (*A. cingulata*), are much more numerous in this species. Not infrequently two or three open into each other in such a manner that by the coalescence of the contracted parts of the superimposed funnels, a smaller irregular tube is formed within the proper tube-cavity. As is shown in fig. 1*b*, these diaphragms in their normal condition are represented in the section by two thin converging lines, springing from the walls of the tubes, and nearly meeting near the center of the tube cavity. Frequently, however, one of these lines is missing. In this case the diaphragm extends from one wall nearly across the tube toward the opposite wall.

Superficially, the species above described resembles the type of the genus, though not nearly enough to be confounded with it by one experienced in the determination of this group of fossils. The cell-walls are thinner, and the groups of large cells more conspicuous in *A. robusta* than in *A. cingulata*. Internally, the comparatively thin cell-walls and numerous funnel-shaped diaphragms, and the small number of spiniform tubuli of *A. robusta* will further distinguish it from that species. Care must be taken in separating the species from *Monotrypella æqualis*, Ulrich, which the smaller specimens of *A. robusta* strongly resemble. The former, however, is restricted to the lower 150 feet of the strata exposed at Cincinnati, O., while the latter is limited to a few feet of strata at least 225 feet higher in the series.

Formation and locality : Cincinnati Group. Rather rare near the tops of the hills about Cincinnati, O.

Heterotrypa, Nicholson.

Of the seventeen species placed under *Heterotrypa* by Nicholson ("The Genus Monticulipora" 1881), but two are, according to my opinion, congeneric, viz. : the type species, *H. frondosa*, D'Orb. (*H. mammulata*, Nich.), and *H. subpulchella*, Nich. Of the remaining fifteen, *H. andrewsi*, Nich., *H. nodulosa*, Nich., *H. sigillaroidea*, Nich., *H. ramosa*, D'Orb., and *H. dalei*, Ed. & H., must be referred to *Callopora*, Hall ; *H. barrandi*, Nich., and *H. moniliformis*, Nich., to *Amplexopora*, Ulrich; *H. dawsoni*, Nich., to *Homotrypa*, Ulrich ; *H. girvanensis*, Nich., *H. implicata*, Nich., and *H. jamesi*, Nich., to *Batostoma*, Ulrich; *H. gracilis*, Nich., and *H. tumida*, Phill., to *Batostomella*, Ulrich ; and *H. trentonensis*, Nich., to *Monotrypella*, Ulrich.

The type species of *Heterotrypa* is a common, easily recognized, and well known fossil of the Cincinnati group, and its characters have

been excellently described by Dr. Nicholson under the name of *H. mammulata.* As I have shown in the first part of my memoir, this is not the *Monticulipora mammulata*, of D'Orbigny, but his *M. frondosa. Heterotrypa subpulchella*, Nich., in its typical form, *i. e.*, flattened branches, is a rather rare species at a height of from 300 to 350 feet above low water mark in the Ohio river, on the hills surrounding Cincinnati, O. This is also about the range of the typical *H. frondosa.* Associated with them is a common intermediate form having a frondescent zoarium like the last species, from which, on the other hand, it differs in having distinct "maculæ," such as characterize *H. subpulchella.* Furthermore, in this intermediate form, the interstitial cells are not approximately restricted to the "maculæ," as is the case in *H. subpulchella*, but a greater or less number are distributed indiscriminately over the entire surface. The form under consideration clearly demonstrates the close relationship existing between *H. subpulchella* and *H. frondosa,* but, as a majority of its characters also pertain to the more typical examples of the latter, it should be regarded as a variety of that species. The Cincinnati group furnishes beside the two species mentioned in the preceding sentence, at least four and probably five other forms that are fully as distinct from *H. frondosa*, as is *H. subpulchella.* These, if I can command the space, I propose to describe in the next number of this publication. The two species next described (*H. vaupeli* and *H. solitaria*) show the extremes of the genus so far as observed. The first is a most peculiar and beautiful species, and has more interstitial tubes than any other species of the genus known to me. The latter is characterized by the almost total absence of interstitial cells, thus making a near approach to *Dekayia*, Ed. and H. In fact I have found it an exceedingly difficult matter to draw the line between *Heterotrypa* and *Dekayia.* Taking the types of the two genera, the differences are of course strongly marked. In *H. frondosa* we have a more or less broadly *frondescent* zoarium, the interstitial cells are *quite numerous*, and the spiniform tubuli are small, and sometimes very numerous. In *Dekayia aspera*, Ed. and H. (the type of the genus), the zoarium is irregularly branched, the branches subcylindrical or flattened, and the interstitial cells are *very few or wanting*, while the spiniform tubuli are *few, but remarkably developed.* Compare, however, such a species as *H. subpulchella* with a certain new speices of *Dekayia*, differing in much the same manner from *D. aspera*, as *H. subpulchella* does from *H. frondosa*, and the generic differences are not so striking.

The species of *Dekayia* alluded to, has flattened branches and distinct maculæ of smaller cells, and the only well marked feature, shown in thin sections, wherein it differs from *H. subpulchella*, is found in the larger size and smaller number of the spiniform tubuli. Precisely the same difference distinguishes *H. solitaria* from another undescribed species of *Dekayia*. Despite the close resemblance between several species of the two genera, I believe that they should be held separate and distinct. I have been strengthened in this belief, after a careful examination of all the species of the two genera known to me, by finding a character that pertains in a more or less marked manner to all the species of *Dekayia*, but which I have sought for in vain in species of *Heterotrypa*: namely in species of *Dekayia*, at certain periods in the growth of the zoarium, a thin pellicle is drawn over greater or smaller patches of the surface, while other portions of the surface have the cell-apertures open. This covering being thin and delicate, is of course only to be observed in well preserved specimens. I have no doubt that the pellicle was developed at the close of the existence of the zooids of each layer of cells, so as to form the floor of the succeeding layers, and ultimately the diaphragms which cross the tubes.

As a summary of the preceding remarks, it may not be out of place to subjoin a description of HETEROTRYPA, based upon the aggregate of characters shown by the different species known to me.

Zoarium growing from an expanded base, attached to foreign objects, upward into simple, often undulated or irregularly inosculated fronds, and occasionally into flattened branches. Cell-apertures varying in shape from polygonal to circular. They are separated from each other by walls or interspaces, which may be comparatively thin (*H. solitaria*), or nearly as thick as their own diameter (*H. vaupeli*). Interstitial cells from few to very numerous, always angular or subangular. Spiniform tubuli small, usually numerous (sometimes excessively so, as in *H. vaupeli*), occasionally inflecting the walls, and giving the cell-apertures an irregularly petaloid appearance. Internally we find that the walls of the tubes are more or less thickened as they enter the "mature" region, and apparently amalgamated with one another. The diaphragms are straight, of one kind only, more numerous in the interstitial tubes than in the proper zooecia, and always more crowded in the "mature" regions than in the "immature" or axial region.

HETEROTRYPA VAUPELI, n. sp. (Pl. I., figs. 2, 2*a*, and 2*b*.)

Zoarium very irregular in its growth, forming twisted, and always more

or less inosculated loose masses, several inches in diameter, consisting of convoluted fronds, varying in thickness from .15 inch, to .3 inch. This irregularity of growth, which is very characteristic of the species, is caused by the frequent elevation of the face of a frond into a secondary frondescent growth, which eventually anastomoses with other similar divisions of the zoarium. The surface is sometimes nearly smooth, but usually is studded with small, rounded or conical monticules, the summits of which are subsolid, each being occupied by a small "macula" of interstitial cells. The arrangement of the monticules and maculæ, in conformity with that of the cells, is very regular. Measuring from center to center, seven may be counted in the space of .5 inch. The cell-apertures are circular, and regularly arranged in decussating series, which are more or less curved around the monticules. One or two rows of cells immediately surrounding each of the small "maculæ," are conspicuously larger than the ordinary cells, their *apertures* having a diameter varying from 1-150th to 1-100th of an inch, while the diameter of the cell-apertures in the interspaces is about 1-200th of an inch. Measuring along one of the series, twelve cells may be counted in the length of .1 inch. On an example of this species the cell-interspaces are comparatively thick, and may show, according to the stage of development and state of preservation, either all, or one or two, of three different appearances. In the first (probably due to attrition), the interspaces are smooth and apparently solid. In the second, they carry numerous small pits, representing the orifices of the interstitial cells. In the third (Pl. I., fig. 2), the apertures of the interstitial cells are obscured by an exceedingly large number of small spines or granules. The last phase doubtlessly represents the zoarium in its perfect and fully matured stage.

Tangential sections, according to the depth at which the zoarium is divided, may show one or both of two distinct phases. In the first (the one usually obtained on account of the unusual brevity of the "matured" portion of the tubes) the cells have moderately thin walls, are subangular or nearly circular, and in contact at limited points, the intervening spaces being occupied by smaller and angular interstitial cells. The spiniform tubuli, if any at all can be detected, are small and inconspicuous. In the second phase, which is obtained by cutting the cells of a fully matured specimen just below the surface, the interstitial cells appear to be almost entirely suppressed by the remarkably great development of spiniform tubuli, which are ranged in one or two closely crowded series around the cell cavities. Fig. 2*a*, Pl. I.,

represents a portion of a section somewhat intermediate between the two phases described.

Longitudinal sections (Pl. I., fig. 2*b*) show that the tubes in the axial region have very thin and somewhat flexuous walls; that they approach the surface gradually, that the peripheral or "mature" belt on each side of the frond is very narrow, and, as they enter the latter region, that their walls are thickened. In the proper zooecial tubes the diaphragms are usually wanting throughout the axial region, and they are never numerous even in the peripheral portion of the zoarium. In the interstitial tubes they are numerous, and generally very thick.

In its internal structure this species is very remarkable, and differs widely from *H. frondosa*. One peculiarity in its structure I can as yet not fully understand. That the interstitial cells are actually suppressed as the zoarium becomes fully matured, I must doubt. I would rather believe that the spiniform tubuli, which are developed in the spaces that in the earlier stages of the growth of the zoarium were occupied by interstitial cells, have sprung from the surface of diaphragms which covered the interstitial cells. I am upheld in this belief by finding, what appears to me to be, corroborative evidence: namely, on many diaphragms of the interstitial tubes, I can detect one or two, rather faintly delineated, hollow processes, extending upward from the diaphragm toward the one next succeeding. If this is not deceptive, then we have a curious analogy with such more recent Bryozoa as *Heteropora pelliculata*, Waters (a recent species), in which the orificed of the interstitial cells are closed by a *perforated* pellicle. The only difference (as regards this point) between such forms and *H. vaupeli*, being that in the latter the surface of the pellicle or diaphragm is elevated into a hollow spine, instead of being perforated by a simple foramen.

Examples of *H. vaupeli* are readily distinguished from all the frondescent *Monticuliporidæ* described from the Cincinnati group, by their peculiar growth, circular cell-apertures, and regular arrangement of the cells and monticules. When in a good state of preservation the most striking characteristic is found in the granular cell interspaces.

The name is given in honor of my esteemed friend, Mr. E. H. Vaupel, who is an enthusiastic student of Palæozoic fossils. He has not only gathered one of the best collections of the Cincinnati group Bryozoa, but he is also able to classify them.

Formation and locality: Cincinnati group. Not uncommon near the tops of the hills about Cincinnati, O. It is associated with, and apparently restricted to the same beds as *Amplexopora robusta*. I

have one specimen of a nearly allied species or variety, which was collected near Waynesville, O., about 250 feet higher in the series.

HETEROTRYPA SOLITARIA, n. sp. (Pl. I., figs. 3, 3*a*, 3*b*.)

Zoarium consisting of thin undulated, or somewhat palmated expansions, from one to two tenths of an inch in thickness, and one inch or more in height. The surface is not raised into monticules, but at intervals of .15 inch, one may observe, on careful examination, small clusters of cells which are slightly larger than the average. The cells are polygonal and thin-walled, and those of the ordinary size have a diameter of about 1-100th of an inch, while that of the cells in the clusters mentioned, varies from 1-70th to 1-80th of an inch. The interstitial cells are almost entirely absent, and it is only rarely that I have been able to detect them at the surface. Occasionally the elevated points of small spiniform tubuli may be observed at the angles of the cells.

Tangential sections (Pl. I., fig. 3*a*) show that the cells are angular, and rather unequal, with moderately thin walls. The interstitial cells are very few in number, being almost entirely absent in some sections. The figure of a tangential section referred to at the beginning of this paragraph represents more of these small cells than is usual. The spiniform tubuli are small, but quite numerous, and generally developed only at the angles of junction of the cells. The walls of adjoining tubes appear to be amalgamated one with another, as no distinct line of demarcation can be detected between them.

Longitudinal sections (Pl. I., fig. 3*b*) show that the walls of the tubes in the axial region are very thin, and that diaphragms are not developed in this portion of the zoarium, these structures appearing only near the surface, where they are about one half a tube-diameter apart. The curvature of the tubes from the axial into the peripheral region is not abrupt but gradual. In the latter portion of the zoarium the tube-walls are but slightly thickened, and occasionally show one of the spiniform tubuli. The interstitial tubes, on account of their rarity, are easily overlooked. Those noticed were crossed by diaphragms, a little more crowded than in the larger tubes.

This species might be confounded with *Peronopora uniformis*, Ulrich, a species in which also the cell walls are thin, and the interstitial cells few in numbers. However, even without the potent aid of thin sections they can readily be distinguished by one character: namely, *P. uniformis* belongs to the *double-leaved* species, and, by

examining the edge of the zoarium, the tubes are seen to proceed at nearly a right angle from the distinct median laminæ to each face of the expansion. On the other hand, *H. solitaria* is truly *frondescent* (as explained on page 123, vol. V., of this Journal), and there being no median lamina in such forms, the margin of the frond is uniformly occupied by the cell-apertures. When longitudinally fractured, the tubes are seen to approach the surface in precisely the same manner, as they do in any of the ramose *Monticuliporidæ*. The small, thin, and smooth frond, as well as the extreme paucity of interstitial tubes, will distinguish it from the species of *Heterotrypa* so far described.

Formation and locality: Cincinnati group. Rare near the tops of the hills west of Covington, Ky., at a height of about 300 feet above low water mark in the Ohio river.

(Dekayella obscura, n. gen. et. sp. (Pl. I., figs. 4, 4*a*, 4*b*.)

Gen. char., *ante* vol. V., p. 155.

Zoarium ramose, consisting of slender ramulets, .18 to .25 of an inch in diameter, dividing dichotomously at intervals of .4 inch or more. Monticules are not developed, the surface usually being smooth. Cells from 1-120th, to 1-110th of an inch in diameter, with moderately thick walls, and subangular apertures. When in a good state of perservation, the cell-orifices over large patches of the surface are entirely covered, or only partially, by a very thin pellicle or membrane. It is developed from the margin of the aperture inwardly, and when not fully completed, an irregular opening is left in the center (Pl. I., fig. 4). The boundary lines of the cells are now thin, and project but little above the pellicle. The interstitial cells are numerous, and vary much in shape and size, but are always more or less angular. At intervals of about .1 inch, they are usually aggregated into unequal clusters. The spiniform tubuli are of two kinds, large and small, the former may be observed very readily at the surface, and they often show the minute orifice at their summits. About five may be counted in the space of .1 inch. The latter are smaller and much more numerous, and can not be detected except on perfectly preserved examples. They are developed in the cell-walls, and three or four surround each cell.

In tangential sections (Pl. I., fig. 4*a*) the proper cells are subcircular, and have thick walls. Each cell-cavity is encircled by a thin band or ring of dark sclerenchyma, the thinner original walls having a lighter color. The interstitial cells are numerous, unequal and angular, those

constituting the clusters or "maculæ" being separated from each other by rather thin walls. The large spiniform tubuli are distinct enough, but the smaller ones can not always be detected. Especially is this the case in examples taken from a shaly matrix. In other specimens they are more apparent.

Longitudinal sections (Pl. I., fig. 4*b*) show that diaphragms, with an occasional exception, are entirely absent in the axial region, where the walls of the tubes are also very thin. The tubes approach the surface in a gradual curve, and as they enter the peripheral regions, their walls are thickened, sometimes becoming slightly beaded. Very thin straight diaphragms are developed crossing the tubes at distances apart of from one to one third tube diameter. The interstitial cells are divided by diaphragms, only a little more crowded than those in the proper zooecia. The large spiniform tubuli make their first appearance in the axial region, and in their course to the surface, they frequently cross obliquely over the tubes (see figure). The smaller ones are first developed in the "mature" or peripheral region, and can always be seen when the section passes through the face of a tube. The figure on Plate I. represents two tubes so divided.

In transverse sections the tubes in the central portion of the branch are slightly larger than nearer the margin. The walls are excessively thin, and polygonal, often nearly circular. Numerous smaller and more angular cells (young) occupy the interspaces left between them. The margin of the section cuts the tubes longitudinally, where they have the same appearance as in the peripheral regions of a vertical section.

Dekayella is probably more nearly allied to *Dekayia* than to any other genus of the *Monticuliporidæ*. On the other hand the cell structure slightly resembles that of *Heterotrypa*. From the former the new genus is separated by having the tube-walls in the "mature" region of the zoarium thicker; in having numerous interstitial tubes, and instead of one, two distinct sets of spiniform tubuli. From *Heterotrypa*, *Dekayella* is distinguished by its ramose growth, and two sets of spiniform tubuli. The most peculiar character of the genus is found in the two sets of spiniform tubuli, differing from each other, both in the time of their development, and size. The larger set are precisely like those of *Dekayia*, and, as is likewise the case in that genus, they make their appearance already in the axial or "immature" region of the zoarium. This fact seems to point to a considerable difference in the functions of the two sets. The smaller spiniform tubuli are precisely

like those of *Heterotrypa*, *Amplexopora*, and other genera of the *Monticuliporidæ*, in which these structures exist, and in none of these do they appear before the zoarium has become fully matured.

Dekayella obscura is readily distinguised from all the slender ramose Bryozoa of the Cincinnati group, by the thin membranaceous covering of the cell apertures. When worn its cellular structure resembles that of *Dekayella ulrichi* (*Heterotrypa ulrichi*, Nicholson), but the larger size of the zoarium of that species will always serve to distinguish them.

Formation and locality: Cincinnati group. Not uncommon at Cincinnati, O., at an elevation of 150 feet above low water mark in the Ohio river. The best locality known to me is on Brown street, where the base of the hill has been graded for building purposes.

CALLOPORELLA HARRISI, n. gen. et. sp. (Pl. I., figs. 5, 5*a*, 5*b*, 5*c*.)

Gen. char., *ante* vol. V., p. 154.

Zoarium discoidal, consisting of a concavo-convex, thin, circular expansion, different examples varying in diameter from .3 of an inch to 1.0 inch, and in thickness from .02 to .05 of an inch. The upper or convex side is smooth, and covered by the cell-apertures, while the lower concave side is lined with an epithecal membrane, which is marked with faint concentric wrinkles, and sometimes with obscure radiating striæ. The height of a specimen having a diameter of .8 of an inch, is about .25 inch. The cell-apertures are circular, and arranged in regular decussating series, the continuity of which is sometimes interrupted by groups of cells slightly larger than the average. These clusters occur at intervals of .15 inch, and the diameter of the apertures of the cells composing them, varies from 1-125th to 1-100th of an inch. They are further distinguished from the ordinary cells, the diameter of whose apertures is about 1-160th of an inch, by being separated from one another by interstitial spaces wider than usual. Measuring along one of the series, eleven or twelve of the ordinary cells may be counted in the space of .1 inch. The interstitial spaces in most specimens, under an ordinary hand glass, appear to be solid. But when well preserved, and viewed under a higher magnifying power, they are seen to be occupied by a single, occasionally a double row of angular depressions, representing the apertures of the numerous interstitial cells. (Pl. I., fig. 5.)

In tangential or transverse sections (Pl. I., fig. 5*a*) the proper zooecia are suboval or circular, and their visceral cavities are enclosed

by a ring-like wall composed of a dark, and concentrically laminated sclerenchyma. Their walls are sometimes in contact at limited points, but usually they are separated from each other by one or two rows of angular, and very thin-walled interstitial tubes. The presence of a few very small spiniform tubuli constitutes an inconspicuous feature of these sections.

Vertical sections (Pl. I., fig. 5*b*) show that the tubes immediately after their development, proceed upward for a short distance in an oblique direction, forming an angle of about 45° with the epithecal membrane. Soon after their walls become thickened, and their direction is altered so that they proceed at a right angle to the upper surface. The larger tubes in their lower part are crossed by straight diaphragms, one tube-diameter or less distant from each other. Further up they are remote and placed on a level in nearly all the tubes. The interstitial tubes are developed very near the epitheca, and are provided with numerous straight diaphragms.

At this time the species above described is the only one certainly known to belong to the genus *Calloporella*. There are, however, certain Upper Silurian species, which further investigations will probably prove to be congeneric. The transverse section of *C. harrisi*, reminds one considerably of *Fistulipora*, but I know of no species of that genus in which the walls of the proper zooecia are so thick. The surface characters of the zoarium, such as the cell-apertures and walls, are however clearly such as characterize the *Monticuliporidæ*, and not the *Fistuliporidæ*, the cell orifices in the latter being always surrounded by a more or less developed rim or lip. The affinities indicated by the surface characters are fully substantiated by vertical sections, which show that the interstitial spaces are crossed by straight and complete diaphragms, instead of being occupied by a vesicular structure, such as is characteristic of all the *Fistuliporidæ*.

The Cincinnati group furnishes several species having a similar habit of growth, but they are all limited to the lower half of the group, while *C. harrisi* is found only in the upper part. In its internal structure it differs widely from them all.

Formation and locality: Cincinnati group. Rather common in the upper part of the group at Oxford, Blanchester, Westborough, and other localities in southwestern Ohio.

[TO BE CONTINUED.]

PLATE I.

Page.

Fig. 1. AMPLEXOPORA ROBUSTA, n. sp. The surface of a well-preserved example, 18 diameters, ... 82

1*a*. Tangential section, showing the spiniform tubuli at the angles of the cells, and, in many of the cells, the transversely divided funnel-shaped diaphragms, magnified 18 times.

1*b*. A longitudinal section of same, representing the tubes in the peripheral region of a branch.

Fig. 2. HETEROTRYPA VAUPELI, n. sp. The surface of a frond, enlarged 18 diameters, so as to show the small granules (spiniform tubuli) which surround each cell, ... 85

2*a*. Tangential section, showing the spiniform tubuli and interstitial tubes, enlarged 18 diameters.

2*b*. Longitudinal section of same, equally enlarged.

Fig. 3. HETRROTRYPA SOLITARIA, n. sp. The surface of a frond, enlarged 18 diameters, ... 88

3*a*. A tangential section, showing the small spiniforn tubuli, and very few interstitial tubes, magnified 18 times.

3*b*. A longitudinal section of same, similarly enlarged.

Fig. 4. DEKAYELLA OBSCURA, n. sp. The surface of one of the small branches, enlarged 18 diameters. The two sets of spiniform tubuli are readily recognized in well-preserved examples, while the cell-apertures are much obscured by the perforated surface pellicle, 89

4*a*. Tangential section, enlarged to 18 diameters.

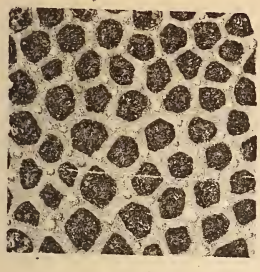
4*b*. Longitudinal section of same, showing one of the large spiniform tubuli, and several of the small ones, magnified 18 times.

Fig. 5. CALLOPORELLA HARRISI, n. sp. Surface of the discoidal zoarium, enlarged to 18 diameters, ... 91

5*a*. A tangential section, enlarged 35 diameters, showing the small spiniform tubuli, numerous interstitial tubes, and the ring like walls of the proper zooecia.

5*b*. A longitudinal section of same, enlarged 18 times.

5*c*. Represents a section of the natural size, through the center of the discoidal zoarium, and shows the relative thickness and diameter of a rather large example.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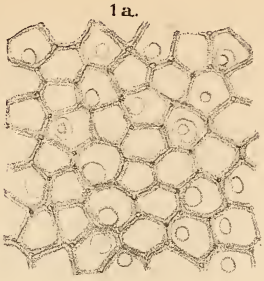
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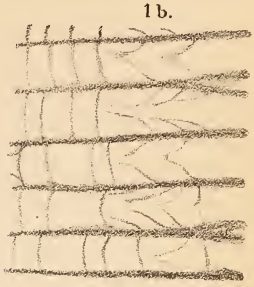
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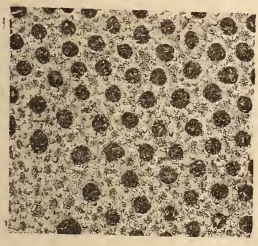
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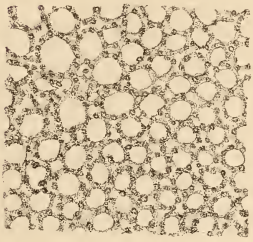
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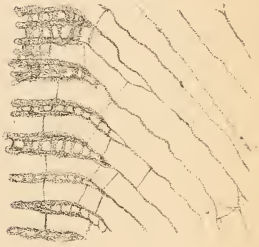
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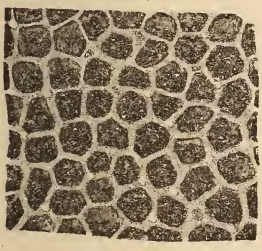
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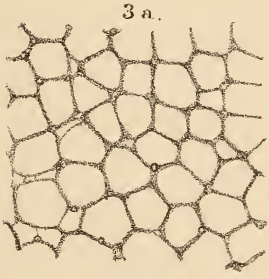
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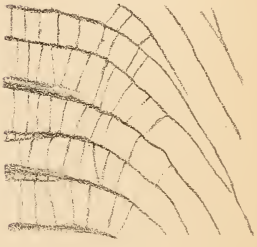
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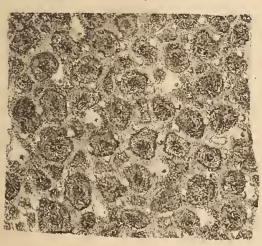
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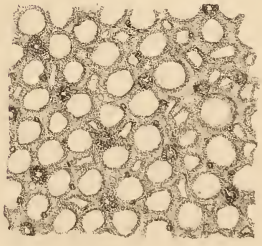
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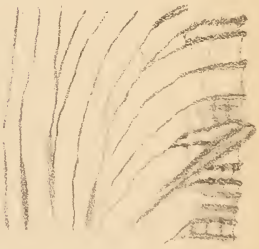
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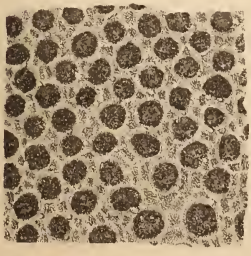
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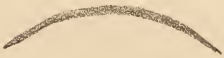
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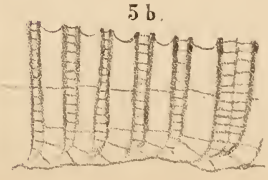
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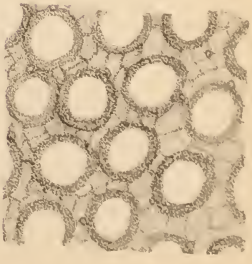
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E. O. ULRICH